OVERVIEW OF THE ATASCADERO SUBBASIN OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the Atascadero Subbasin 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 Atascadero Subbasin.

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).

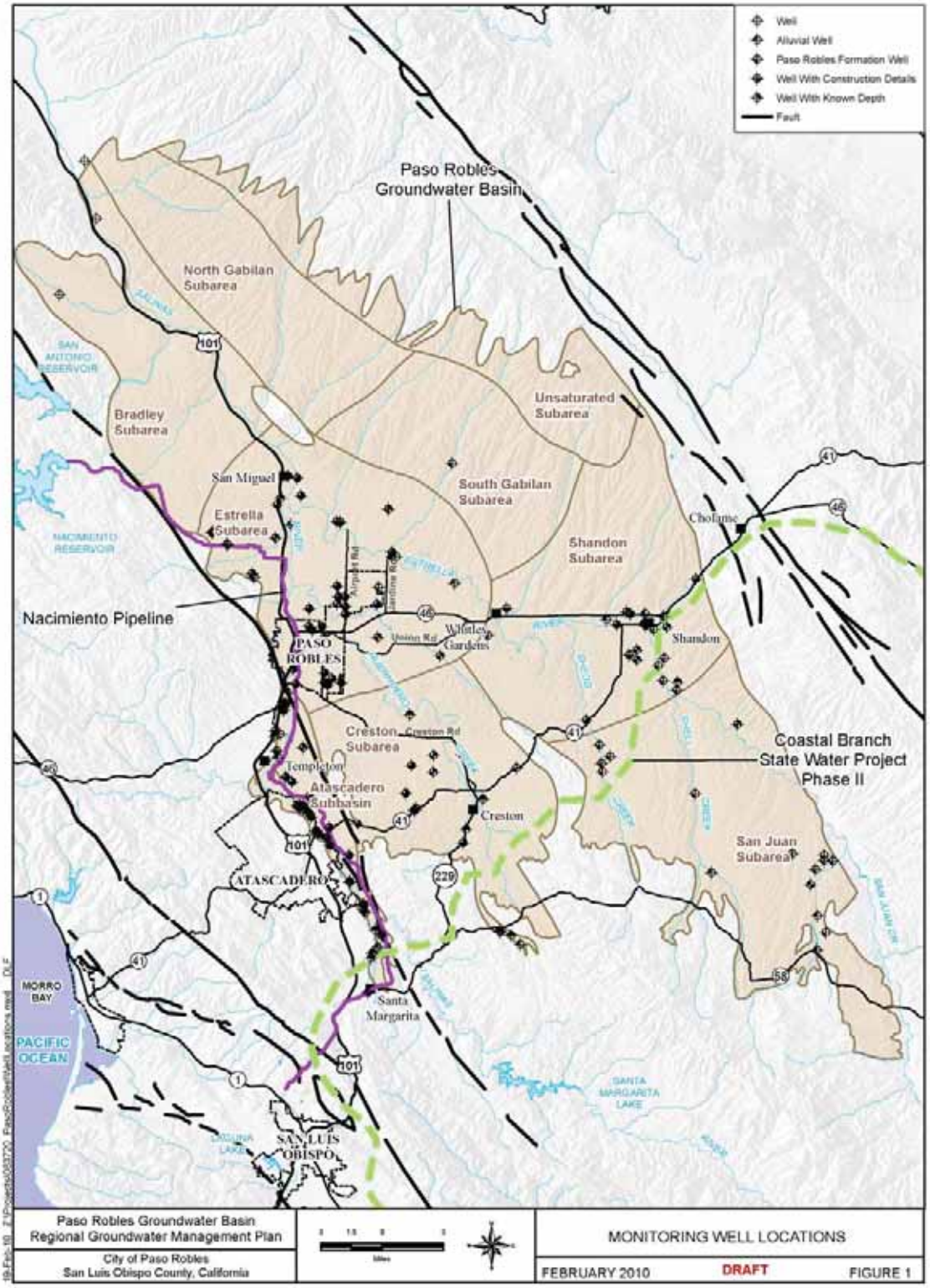

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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. The Atascadero MWC Station No. 34 is one of the gauges with a long, continuous period of record. The long-term average annual precipitation at this gauge is 17.6 inches per year for the 1916 to 2009 period.

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.

Atascadero Subbasin

The following information for the Atascadero Subbasin includes the recent land and water conditions and local groundwater conditions.

Land and Water Use

The Atascadero Subbasin is located in the western portion of the Paso Robles Groundwater Basin and has an area of approximately 14,577 acres, which makes up about three percent of the area of the Basin. The Rinconada fault separates the Atascadero Subbasin from the Paso Robles Basin. The Salinas River flows north roughly paralleling Highway 101 through the subbasin, entering the Estrella Subarea of the Basin near the City of Paso Robles.

This subarea includes the City of Paso Robles and the City of Atascadero, community of Templeton. The Atascadero Mutual Water Company (MWC) is the water purveyor to the City of Atascadero, but wastewater treatment is provided by the City of Atascadero. The Templeton Community Services District (CSD) provides potable water and wastewater treatment services to the community of Templeton.

The water use in 2006 totaled about 15,450 acre-feet representing about 17 percent of the water use in the Basin. The water users in the Atascadero Subbasin and their uses are shown in Table 1. In 2006, the entire demand was met with groundwater.

Beginning in 2010, Nacimiento Pipeline will begin delivering surface water to the Atascadero Mutual Water Company (up to 2,000 acre-feet per year) and the Templeton Community Services District (up to 250 acre-feet per year) to offset the municipal groundwater pumping.

Table 1. Total Estimated Pumping in the Atascadero Subbasin in 2006 (AF)

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
1,348	11,735	213	430	1,819	**15,454**
(9%)	(76%)	<1%)	(3%)	(12%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

The eastern boundary of the Atascadero Subbasin is the Rinconada fault. Because the fault displaces the Paso Robles Formation, the hydraulic connection between the aquifer across the Rinconada fault is sufficiently restricted to warrant the classification of the distinct Atascadero Subbasin. Outflow (primarily surface flow and Salinas River underflow) from this subbasin enters the Estrella Subarea.

In the Atascadero Subbasin, most production wells extract water from the Salinas River alluvium and the Paso Robles Formation. The alluvial aquifer associated with the Salinas River acts as a primary source of recharge to the Paso Robles Formation. Wells tapping the Salinas River alluvial aquifer tend to be less than 100 feet thick.

Wells in the Salinas River Alluvium - Wells perforated in the Salinas River Alluvium typically less than 100 feet total depth with 10 to 30 feet of well screens. Groundwater wells production ranges from < 100 to 700 gallons per minute.

Wells in Alluvium and Paso Robles Formation - Wells perforated in the Salinas River Alluvium and the Paso Robles Formation typically less than 100 feet total depth with 10 to 30 feet of well screens. Groundwater wells production ranges from 300 to 500 gallons per minute.

Wells in Paso Robles Formation – Wells perforated in the Salinas River Alluvium and the Paso Robles Formation typically less than 200 to 600 feet total depth with well screens ranging from 100 to 300 feet in length. Groundwater wells production ranges from 100 to 800 gallons per.

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 are currently about 33 wells located within Atascadero Subbasin that are included in the groundwater monitoring network.

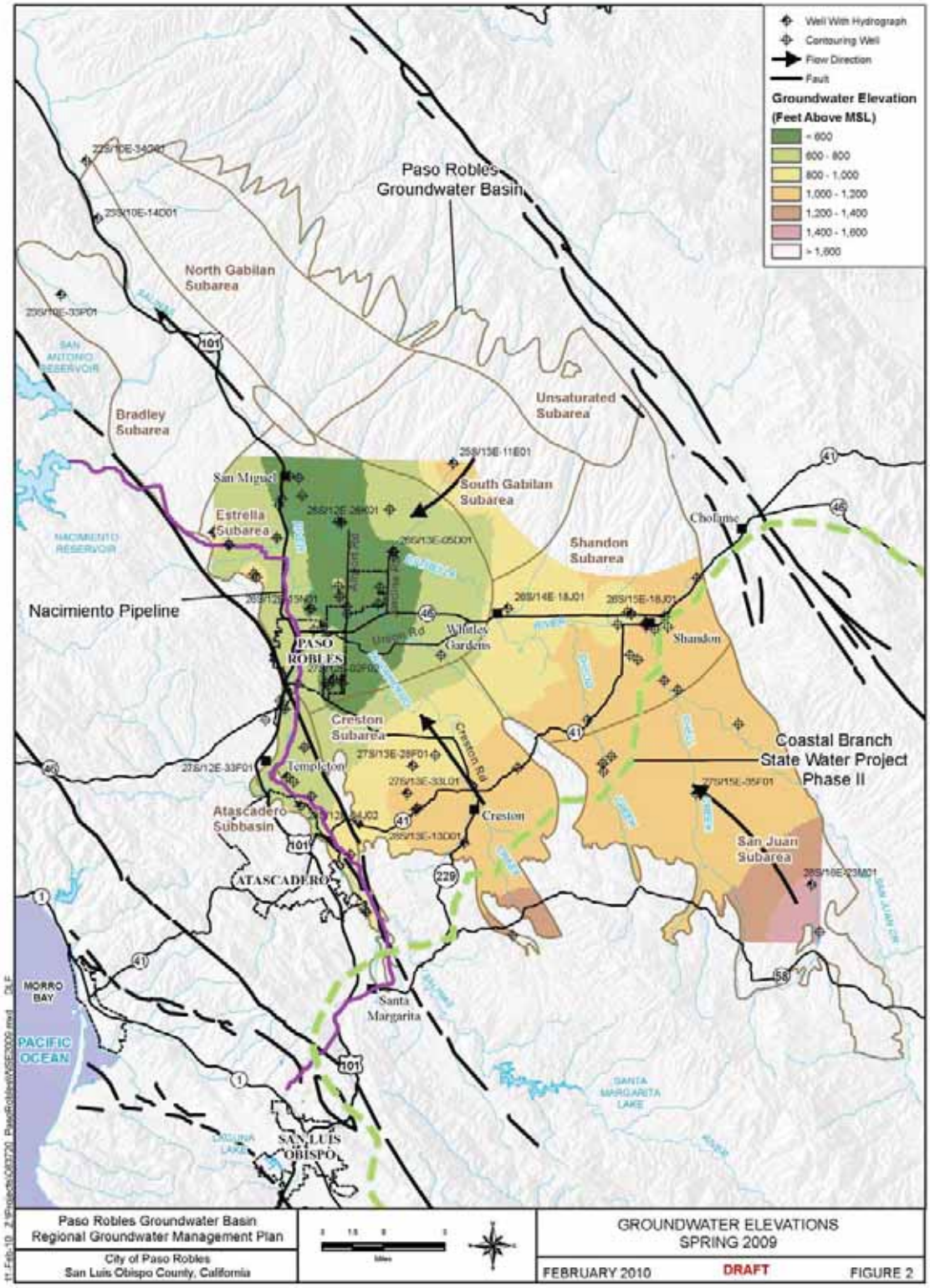

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

Two wells have been identified in the Atascadero Subbasin to demonstrate how groundwater levels have changed through time (well hydrographs) in the alluvial aquifer and the Paso Robles Formation. These wells were selected to represent a range of the conditions in the subarea through an extended period of record. Figures 3 and 4 show the groundwater level trends in key wells in the Atascadero Subbasin. The locations of these wells are shown on Figure 5. A brief discussion is provided for each well.

Well 28S/12E-4J02 – This well is identified as an alluvial well. It is located adjacent to the Salinas River in the City of Atascadero as shown on Figure 5. Over the 45-year period of record, spring groundwater levels in this well have remained relatively constant at about 780 feet above mean sea level. Fall groundwater levels in this well can be 20 to 40 feet below the spring levels. During the 1998 and 2009 period, spring groundwater levels have declined more than 20 feet. This corresponds to an average annual decline of about 1.5 feet per year. Groundwater levels in the alluvial aquifer are sustained by the percolation from the Salinas River.

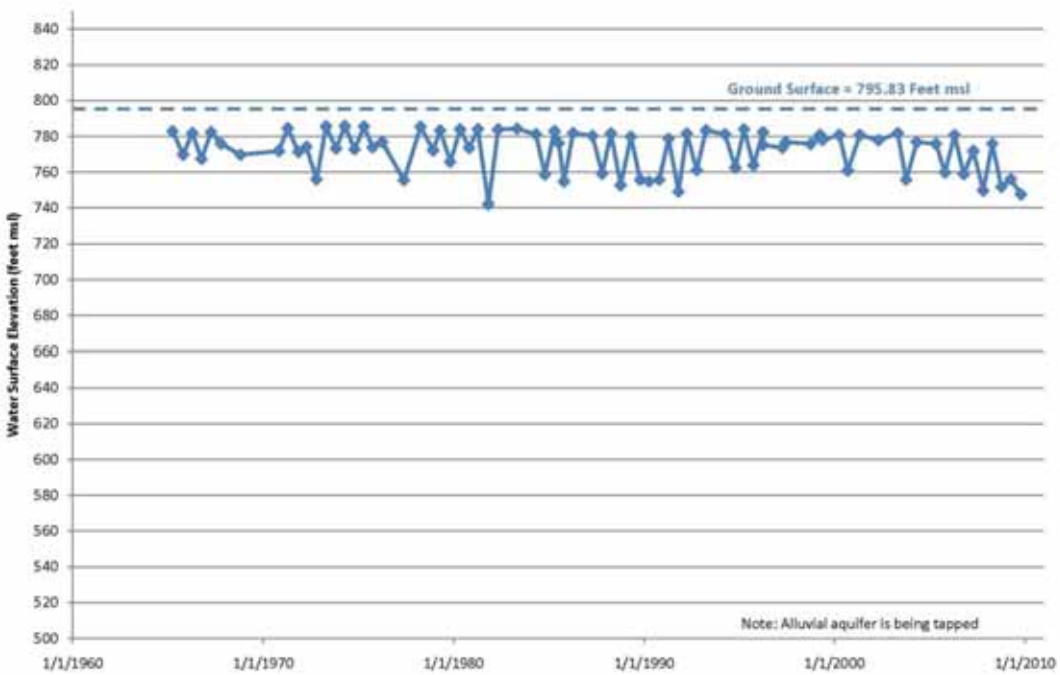

Figure 3. Hydrograph for Well 28S/12E-4J02

Paso Robles Formation Wells

Well 27S/12E-33F01 – This well is identified as extracting water from the Paso Robles Formation. It is located east to the Salinas River between the City of Atascadero and Templeton as shown on Figure 5. This well experienced considerable drawdown from about 1970 to 1995. Spring groundwater levels increase for several years, and have been fairly stable since about 1997. During the 12-year period from 1997 to 2009, spring groundwater levels have been very stable and only show a decline of less than 20 feet. This corresponds to an average annual decline rate of about 1.5 feet during this period. This well shows very little seasonal variation (difference between spring and fall observations) when groundwater levels are above 760 feet msl. When groundwater levels drop below this point, the seasonal variation increases to 20 to 40 feet.

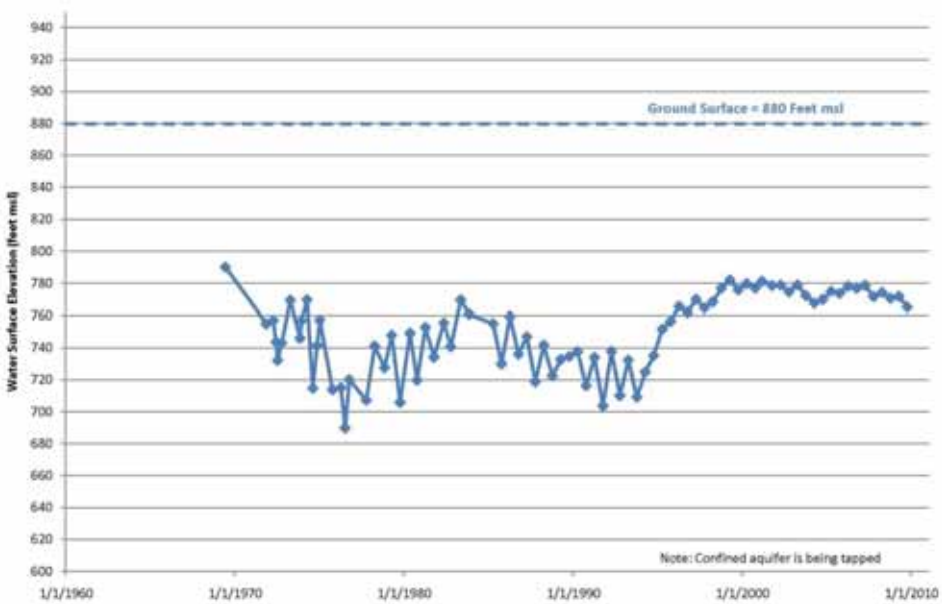

Figure 4. Hydrograph for Well 27S/12E-33F01

Change in Groundwater Storage

Groundwater levels in the alluvial aquifer system of the Salinas River (as represented by well 28S/12E-04J2 in this discussion) have maintained fairly constant groundwater levels with seasonal fluctuations of less than 20 feet. This occurs because groundwater is pumping from the alluvial aquifer system. It is replaced by infiltration from the Salinas River.

Groundwater levels in the Paso Robles Formation (as represented by well 27S/12E-33F01 in this discussion) shows a larger response to changes in groundwater pumping patterns with declines in groundwater levels during the early to mid-1970s, and again from the mid-1980s to mid-1990s with a period of increasing groundwater levels during the mid-1970s to the mid-1980s. Since the mid-1990s, groundwater levels have increased and remained relatively stable compared to the earlier trends.

Between 1997 and 2009 groundwater levels throughout much of the Atascadero Subbasin have decreased, with some wells near the north part of Atascadero declining by up to 40 feet as shown in Figure 5. A few wells in the northern part of the subbasin showing an increase in groundwater levels during this period.

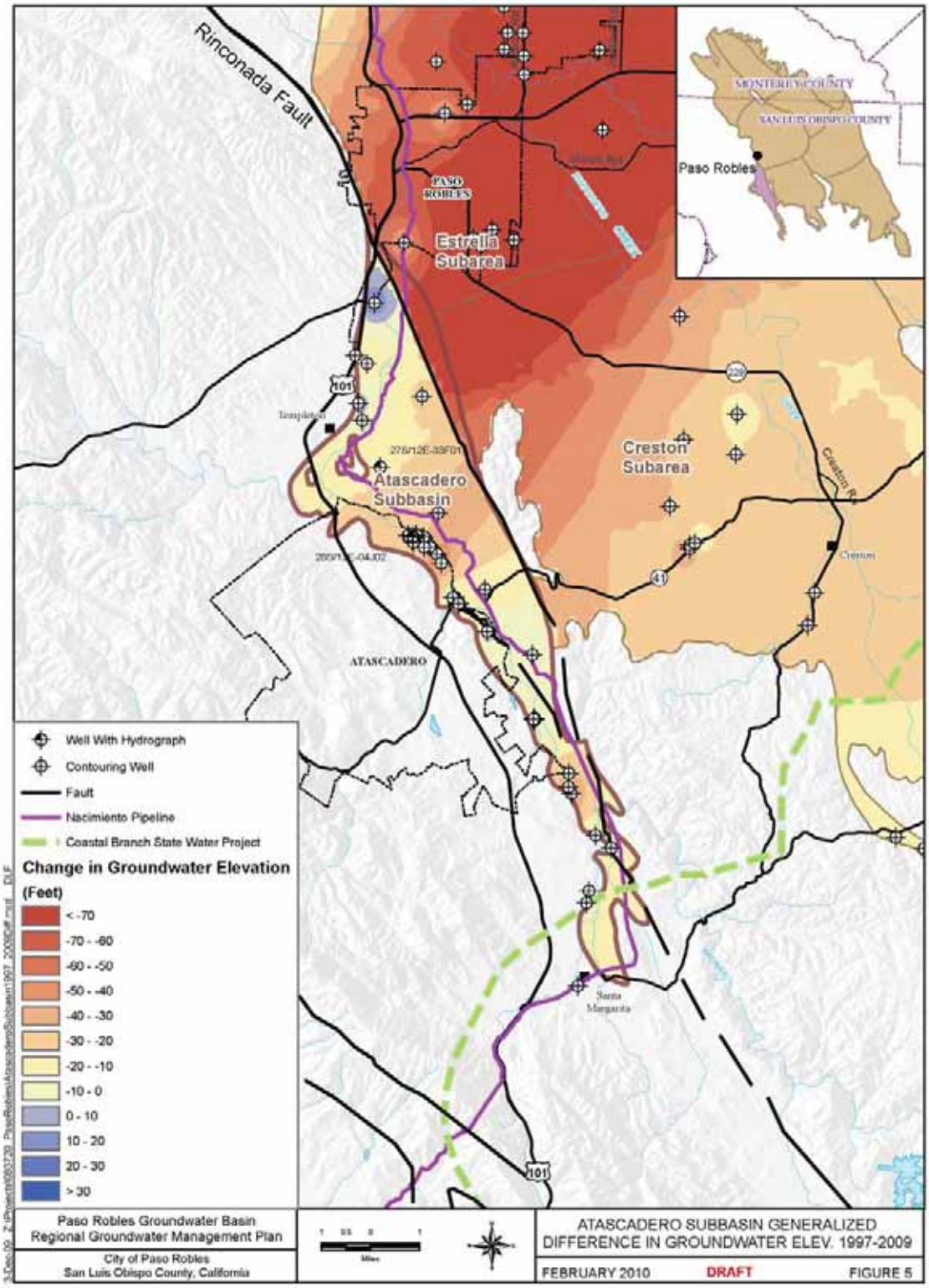

Figure 5. Change in Groundwater Levels in the Atascadero Subbasin for the 1997 to 2009 Period

Groundwater Quality Information

Groundwater quality in the subarea is generally good to moderate for municipal use. Total dissolved solids (TDS), a measurement of the salts in the water, is typically used to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can be usable up to 1,000 mg/l. TDS concentrations in local municipal supply wells, as reported in the 2008 Consumer Confidence Reports, ranged from 420 to 930 mg/l (averaging 665 mg/l) for Atascadero MWC, and ranged from 560 to 1,000 mg/l (averaging 755 mg/l) for Templeton CSD.

Groundwater quality in the subbasin is generally suitable for irrigation without restriction (Fugro and Cleath, 2002).

There is a possible influence of geothermal water on groundwater quality in the hills east of Templeton.

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

Summary of Basin Management Objective Workshop
For the Atascadero Subbasin

The draft Basin Management Objectives (BMOs) for groundwater levels in the Atascadero Subbasin were discussed and developed by stakeholders of Atascadero Subbasin at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Atascadero Subbasin that attended the Workshop are listed below:

Name	Affiliation
Della Barret	Resident (private well or AMCW)
Kathy Sweet	Resident (private well or AMCW)
Keith Larson	City of Paso Robles
Bob Roos	Resident (private well or AMCW)
Jackie Magill	Resident (private well or AMCW)
John Neil	Atascadero Mutual Water Company
John Hollenbeck	Resident (private well or AMCW)
Carrie Jones	Resident (private well or AMCW)
Jay Short	Templeton CSD
Susan Litteral	Resident (private well or AMCW)/NRCS

Jim Magill recorded the information discussed by the Atascadero Subarea Stakeholders. The Atascadero Subbasin Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Atascadero Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date. The changes in groundwater levels in the Atascadero Subbasin are currently recorded at 33 wells that are included in the groundwater monitoring network.

Summary of Basin Management Objective Workshop
For the Atascadero Subbasin

The draft Basin Management Objectives (BMOs) for groundwater levels in the Atascadero Subbasin were discussed and developed by stakeholders of Atascadero Subbasin at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Atascadero Subbasin that attended the Workshop are listed below:

Name	Affiliation
Della Barret	Resident (private well or AMCW)
Kathy Sweet	Resident (private well or AMCW)
Keith Larson	City of Paso Robles
Bob Roos	Resident (private well or AMCW)
Jackie Magill	Resident (private well or AMCW)
John Neil	Atascadero Mutual Water Company
John Hollenbeck	Resident (private well or AMCW)
Carrie Jones	Resident (private well or AMCW)
Jay Short	Templeton CSD
Susan Litteral	Resident (private well or AMCW)/NRCS

Jim Magill recorded the information discussed by the Atascadero Subarea Stakeholders. The Atascadero Subbasin Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Atascadero Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date. The changes in groundwater levels in the Atascadero Subbasin are currently recorded at 33 wells that are included in the groundwater monitoring network.

Groundwater Levels in the Atascadero Subbasin are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subbasin is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

Groundwater levels in the Atascadero Subbasin tend to have a greater range in annual response than other subareas, with average groundwater levels increasing or decreasing by up to 15 feet in single years. The overall trend of the average groundwater levels has remained relatively constant since the early 1980s with groundwater levels rising and falling in response to changing hydrologic conditions and increasing demands. The 2009 average groundwater levels are within ten feet of the 1981 levels as shown on Figure 1. Based on the pattern exhibited on this figure, a single wet year could return the average groundwater levels to the 1981 conditions. It is not clear how the increase in demands since the late 1990s likely contributes to the overall declining groundwater levels of about 30 feet during the 1997 to 2009 period.

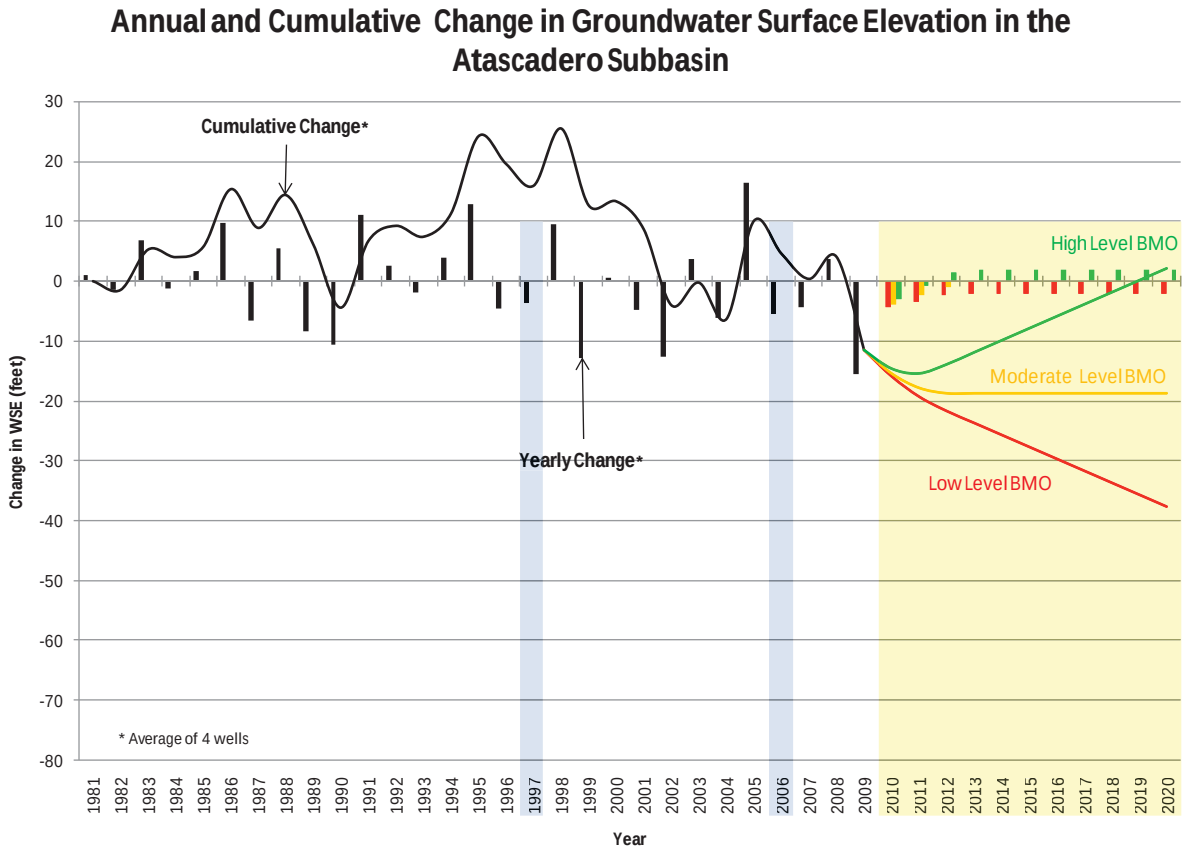

Figure 1. Composite Hydrograph of Four Selected Wells in the Atascadero Subbasin

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Atascadero Subarea met by groundwater increased by about 1,000 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period, likely contributed to the increased rate of groundwater level decline (about five feet per year) during this period.

Table 1. Estimated Water Demands in the Atascadero Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ATASCADERO SUBBASIN							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,348	11,735	0	430	2,032	15,545
Estimated 1997 Demand	(acre-feet)	1,023	11,376	0	300	1,800	14,499
Difference (2006 less 1997)	(acre-feet)	325	359	0	130	232	1,046

2006 Demand Assumptions: Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)

1997 Demand Assumptions: 1997 Demands form Paso Robles Groundwater Basin Study (Fugro, 2002)
Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.
1997 Municipal demand includes City of Paso Robles groundwater pumping from river wells(3,933 acre-feet)
Small community demands included in rural domestic demand

Draft Basin Management Objectives

The Atascadero Subbasin stakeholders determined that an acceptable draft BMO for groundwater levels in the Atascadero Subbasin would include stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells). This draft BMO had strong consensus among the participants.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Atascadero Subbasin Stakeholders to stabilize groundwater levels in the Atascadero Subbasin. The potential benefit from these GMAs has not been quantified for the Atascadero Subbasin (in terms of changes in groundwater

levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Atascadero Subbasin through the addition of new wells to the volunteer monitoring network.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis. Atascadero Mutual Water Company, City of Paso Robles and Templeton Community Services District collect water level data that is provided to the District for inclusion in the monitoring program.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users and impacts on groundwater level trends in the area. The effectiveness of this GMA will be evaluated on an annual basis.

This GMA had large consensus of the Atascadero Subbasin stakeholders. Some of the specific water conservation activities identified include:

- Municipal water purveyors have implemented some level of conservation to date. The effectiveness of these efforts can be tracked by the delivery volumes. Because municipal water demands compose the largest single demand type in the subbasin, there is the greatest opportunity for reduction in groundwater pumping. Based on 2006 municipal demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 880 acre-feet per year.
- Agricultural Water Conservation (opportunities for reductions in groundwater pumping resulting from agricultural conservation programs may be limited in the Atascadero Subbasin due to the comparatively small agricultural demand). Based on 2006 agricultural

demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 130 acre-feet per year.

- Rural Residential Water Conservation (opportunities for reductions in groundwater pumping resulting from rural residential conservation programs may be limited in the Atascadero Subbasin due to the comparatively small rural residential demand). Based on 2006 rural domestic demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 200 acre-feet per year. Water conservation programs in the rural residential sector may focus on the following:
    - Landscape Water Use
    - Consider controls on non-agricultural ponds
    - Development of conservation outreach and incentive programs implemented by San Luis Obispo County

Responsibility for implementing certain components of this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District. The Atascadero Mutual Water Company, City of Paso Robles, and Templeton Community Services District are responsible for implementing water conservation programs within their service areas.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of water demand in the subbasin. In areas outside the jurisdiction of the cities of Atascadero and Paso Robles, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. The cities have implemented land use policies that limit water use rates and promote water conservation, such as limiting turf in new development. In addition, higher water rates paid by city water customers encourage efficient water use. Any policies established in areas where San Luis Obispo County has jurisdiction would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- Discretionary lots splits would require meters on the new well and the existing well
- No net increase in water use resulting from additional rural residential development
- Promote greywater use
- Minimize turf areas
- Meter new wells
- Offset water use
- Explore opportunities for residential rainwater harvesting

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building and the cities of Atascadero and Paso Robles.

DRAFT

GMA 4: Maximize the amount of Nacimiento Project Water in the Subbasin: This GMA includes utilizing the existing Nacimiento Project Water already acquired for use in the subbasin, and explore opportunities to utilize unassigned Nacimiento Project Water.

The San Luis Obispo County Flood Control and Water Conservation District would be one of the lead agencies responsible for implementing this GMA. Local water purveyors would be responsible for developing and implementing projects to acquire supplies from the Nacimiento Water Project.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building, and City of Atascadero would likely be the lead agencies responsible for implementing this GMA.

DRAFT

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).

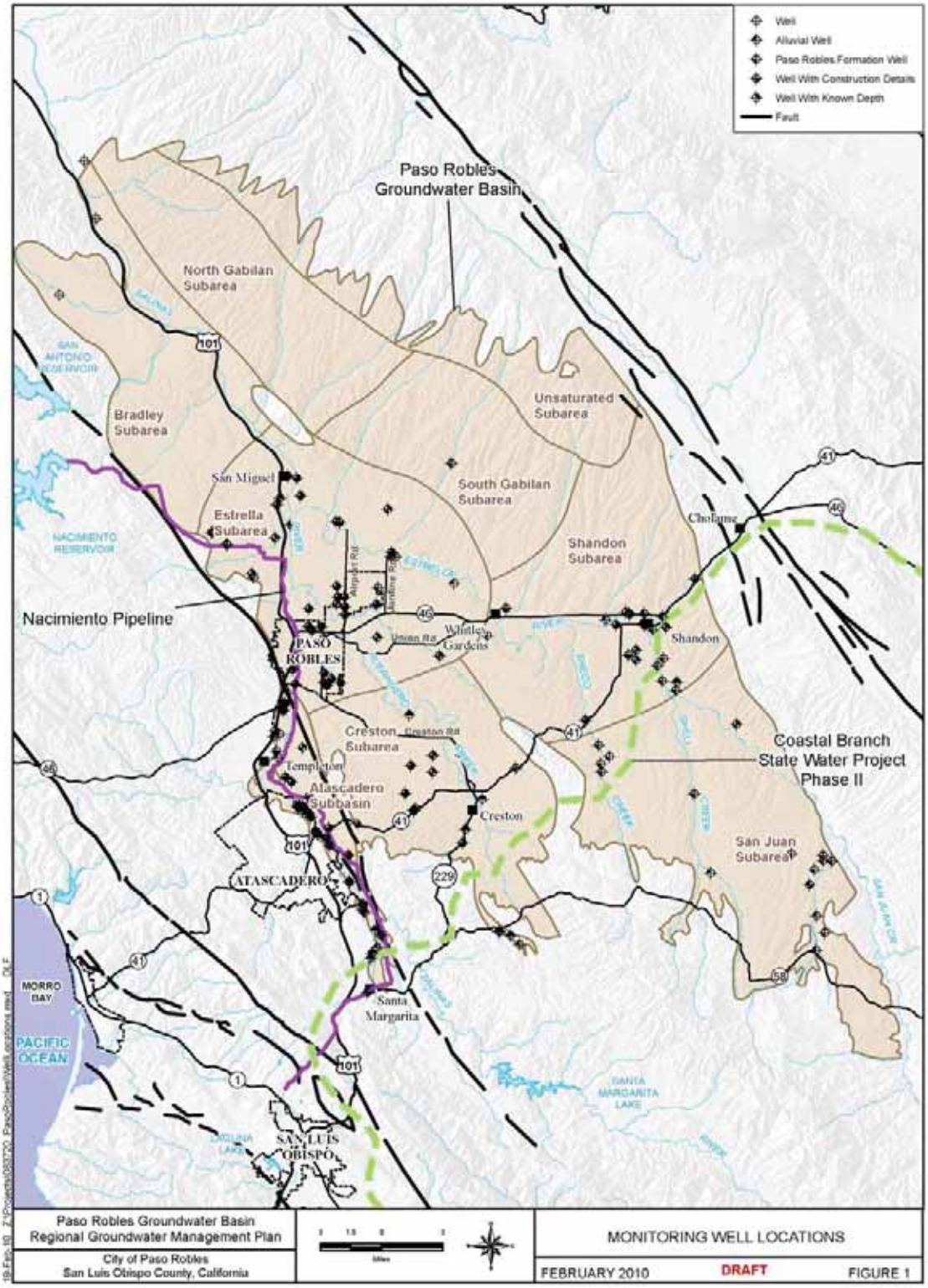

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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 11percent 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.

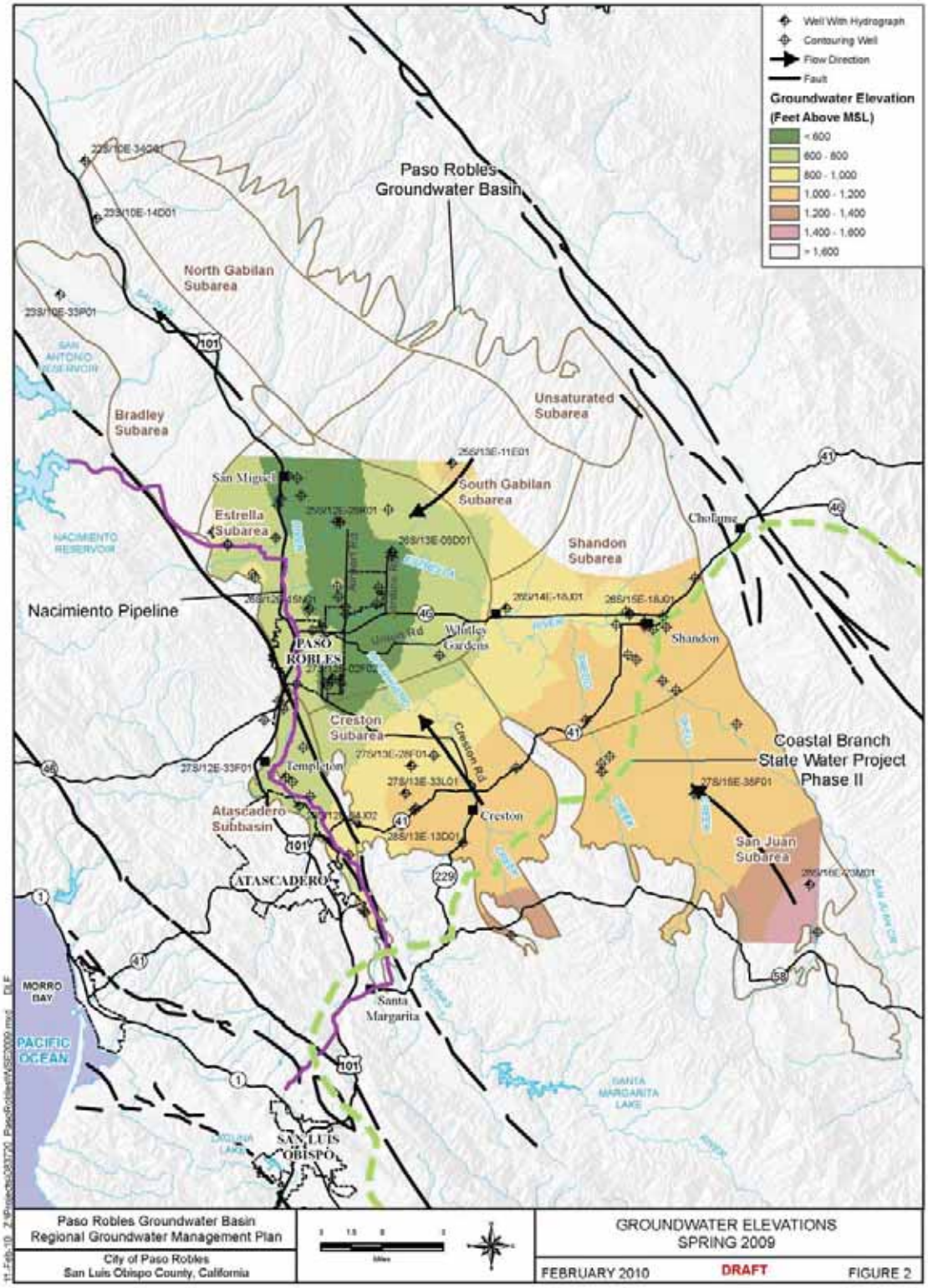

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

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.

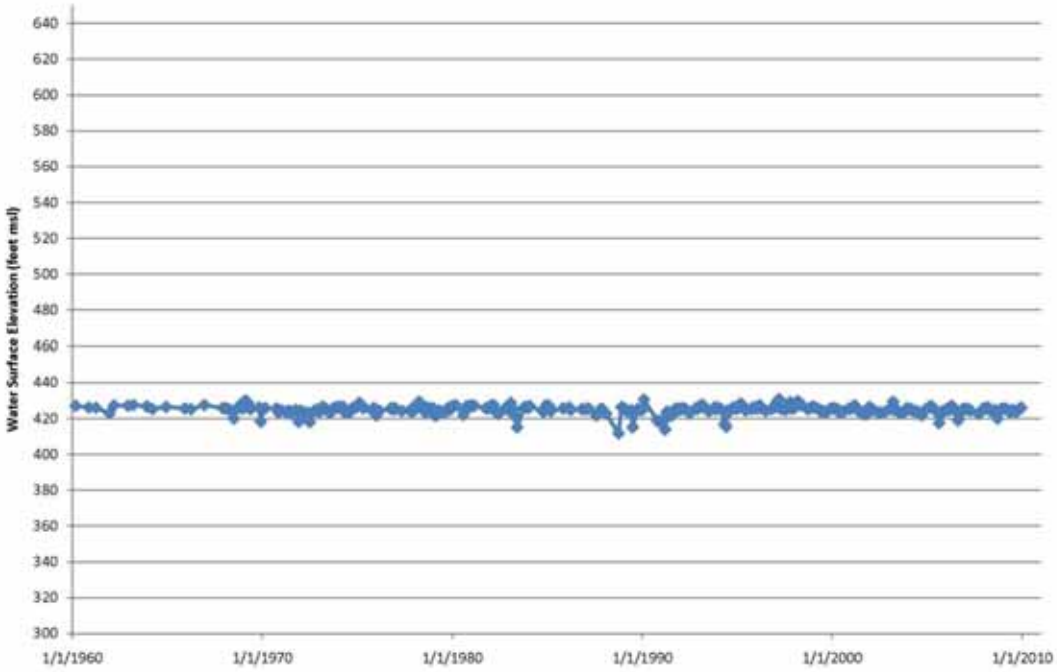

Figure 3. Hydrograph for 22S/10E-34G01

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

Summary of Basin Management Objective Workshop For the Bradley and North Gabilan Subareas

The draft Basin Management Objectives (BMOs) for groundwater levels in the Bradley and North Gabilan Subareas were discussed and developed by stakeholders at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Paso Robles City Council Chambers. The stakeholders from the subareas that attended the workshop are listed below:

Name	Affiliation
Robert Johnson	Monterey County Water Resources Agency
Keith Larson	City of Paso Robles
Christopher Alakel	City of Paso Robles
Courtney Howard	San Luis Obispo County

Courtney Howard recorded the information discussed by the stakeholders.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated every few years as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Bradley and North Gabilan Subareas are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Bradley Subarea are currently recorded at one well that is included in the groundwater monitoring network of Monterey County Water Resources Agency (MCWRA). This well is located near the Salinas River just north of the subarea boundary, and may not be representative of groundwater levels throughout the Bradley or North Gabilan Subareas. The lack of data prevents the development of groundwater level hydrographs, or composite hydrographs as developed for other subareas. The lone hydrograph available for these two subareas is shown in Figure 1.

The hydrograph shown in Figure 1 is for a well located near the Salinas River downstream of the confluence of the Salinas River and the Nacimiento River. It appears that groundwater levels in this well reflect the interaction of the Salinas River and the alluvial aquifer materials adjacent to the river. Flows

from the Salinas River, along with releases from Nacimiento Reservoir, help maintain groundwater levels in alluvial aquiver near the Salinas River.

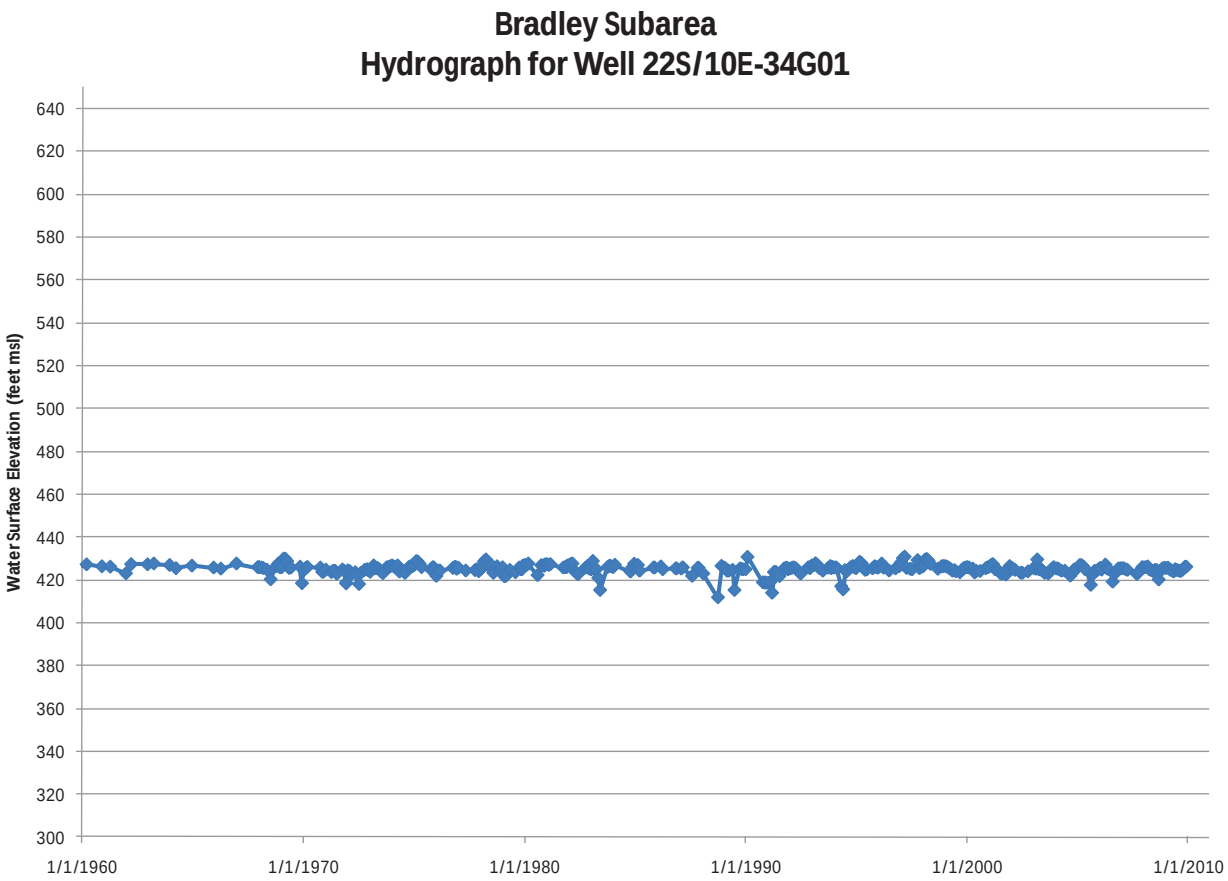

Figure 1. Well Hydrograph in the Bradley Subarea

At this time, we are not aware of any reports or anecdotal information that suggests groundwater levels in the Bradley Subarea or the North Gabilan Subarea are declining to the point of causing problems for local groundwater users.

Water demands in the Bradley Subarea met by groundwater have increased by total of about 1,000 acre-feet between 1997 and 2006 as shown on Table 1.

Table 1. Estimated Water Demands in the Bradley Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE BRADLEY SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	6,933	0	0	184	109	7,226
Estimated 1997 Demand	(acre-feet)	6,001	0	0	136	88	6,225
Difference (2006 less 1997)	(acre-feet)	932	0	0	48	21	1,001
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Water demands in the North Gabilan Subarea met by groundwater have increased by total of about 250 acre-feet between 1997 and 2006 as shown on Table 2.

Table 2. Estimated Water Demands in the North Gabilan Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE NORTH GABILAN SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,758	0	0	0	51	1,809
Estimated 1997 Demand	(acre-feet)	1,522	0	0	0	41	1,563
Difference (2006 less 1997)	(acre-feet)	236	0	0	0	10	246
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. As described above there is very little available information to support the development of very targeted BMOs. Based on the available information, the BMO for the Bradley Subarea and the North Gabilan Subarea are to maintain groundwater levels high. The lack of an extensive monitoring network in this part of the Basin will prevent more detailed analysis of this.

Potential Groundwater Management Activities

GMA 1: Continue monitoring and reporting on groundwater conditions: Continue and improve monitoring – look to add monitoring well near the SLO-Monterey county boundary between the Nacimiento River and the town of San Miguel

GMA 2: Consider reestablishing Cloudseeding Program: Consider benefits of re-establishing the cloud seeding program in the Nacimiento and San Antonio watersheds. Cloud seeding was conducted in the past by MCWRA, and is estimated to have increased outflow of Lake Nacimiento and San Antonio Reservoirs by about 20 percent.

OVERVIEW OF THE CRESTON SUBAREA OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the Creston 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 Creston Subarea.

Paso Robles Groundwater Basin

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

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).

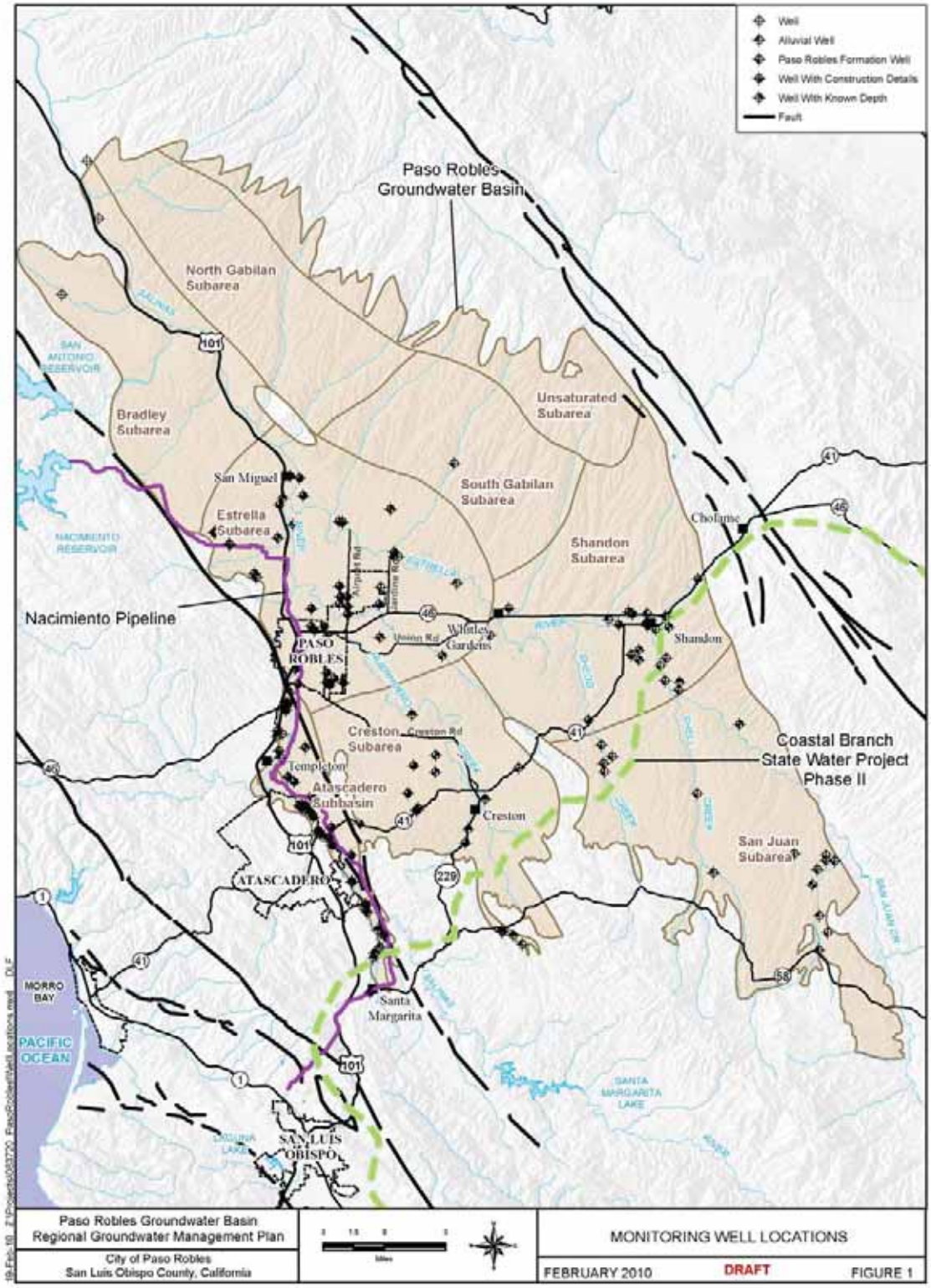

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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. The Atascadero MWC Station No. 34 is one of the gauges with a long, continuous period of record. The long-term average annual precipitation at this gauge is 17.6 inches per year for the 1916 to 2009 period.

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.

Creston Subarea

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

Land and Water Use

The Creston Subarea is located in the southern portion of the Paso Robles Groundwater Basin and has an area of approximately 57,000 acres, which makes up about 11 percent of the area of the Basin. The Rinconada fault separates the Creston Subarea from the Atascadero Subbasin. The Huerhuero Creek flows northwest through the subarea, entering the Estrella Subarea southeast of the City of Paso Robles. This subarea includes the community of Creston. There are no public water purveyors in the subarea.

The water use in 2006 totaled about 12,311 acre-feet representing about 14 percent of the water use in the Basin. The primary use of groundwater in this subarea is for agriculture, with rural uses making up most of the remaining water use. The water users in the Creston Subarea and their uses are shown in Table 1.

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

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
9,936	0	7	37	2,331	**12,311**
(81%)	(0%)	(<1%)	(<1%)	(19%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

In the Creston Subarea, the groundwater system consists of the Paso Robles Formation and the shallow alluvial aquifers associated with the Huerhuero Creek and other tributary creeks.

Most production wells extract water from the Paso Robles Formation. Wells in the Creston Subarea typically range in depth from 200 to 800 feet, and average between 300 to 400 feet. Groundwater wells production ranges from less than 100 to 1,000 gallons per minute.

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 are currently about 13 wells located within Creston Subarea that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Creston Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960's. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping.

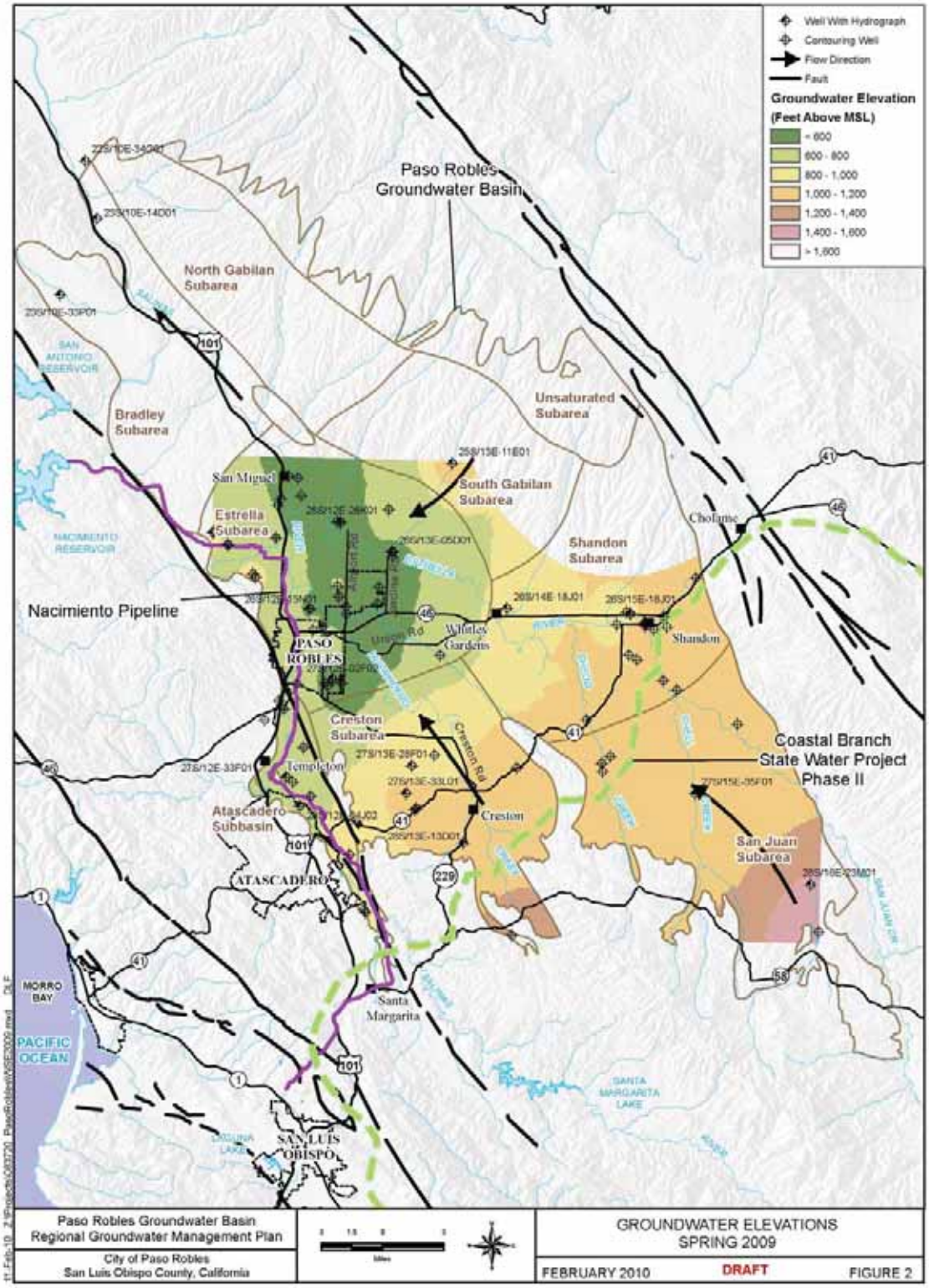

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

Several wells have been identified in the Creston Subarea to demonstrate how groundwater levels have changed through time (well hydrographs) at discrete locations in the subarea. These wells were selected to represent a range of the conditions in the subarea through an extended period of record. Figures 3 through 5 show the groundwater level trends in key wells in the Creston Subarea. The locations of these wells are shown on Figure 6. A brief discussion is provided for each well.

Well 27S/13E-28F01 – This well is located near the center of the greatest groundwater level decline as shown on Figure 6 and is considered to be just outside of the pumping depression that is centered on the Estrella Subarea. Over the 45-year period of record, spring groundwater levels in this well declined almost 60 feet. Since 1997, spring groundwater levels have declined almost 40 feet as shown on Figure 3. During this 12-year period, the rate of decline has averaged about 3 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 10 to 20 feet during this period.

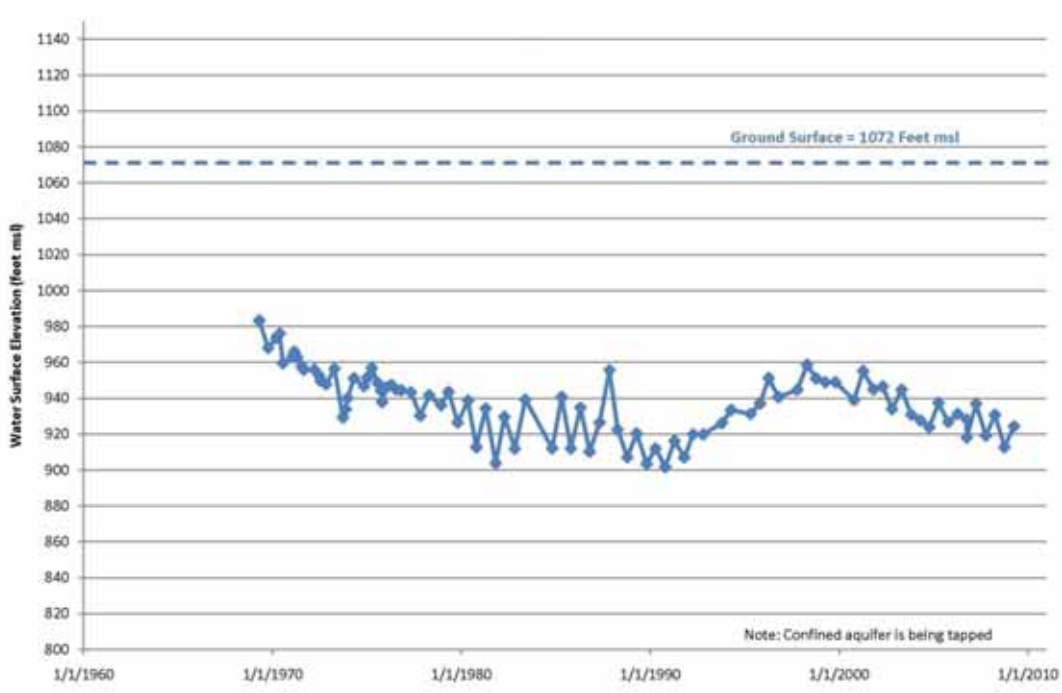

Figure 3. Hydrograph for Well 27S/13E-28F01

Well 27S/13E-33L01 – This well is located near the center of the greatest groundwater level decline as shown on Figure 6, and is considered to be on the southeast edge of the pumping depression that is centered in the Estrella Subarea. Over the 45-year period of record, the spring groundwater levels in this well declined about 40 feet as shown on Figure 4. During this 12-year period, the rate of decline of spring groundwater levels has averaged about 3 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 10 to 50 feet during this period.

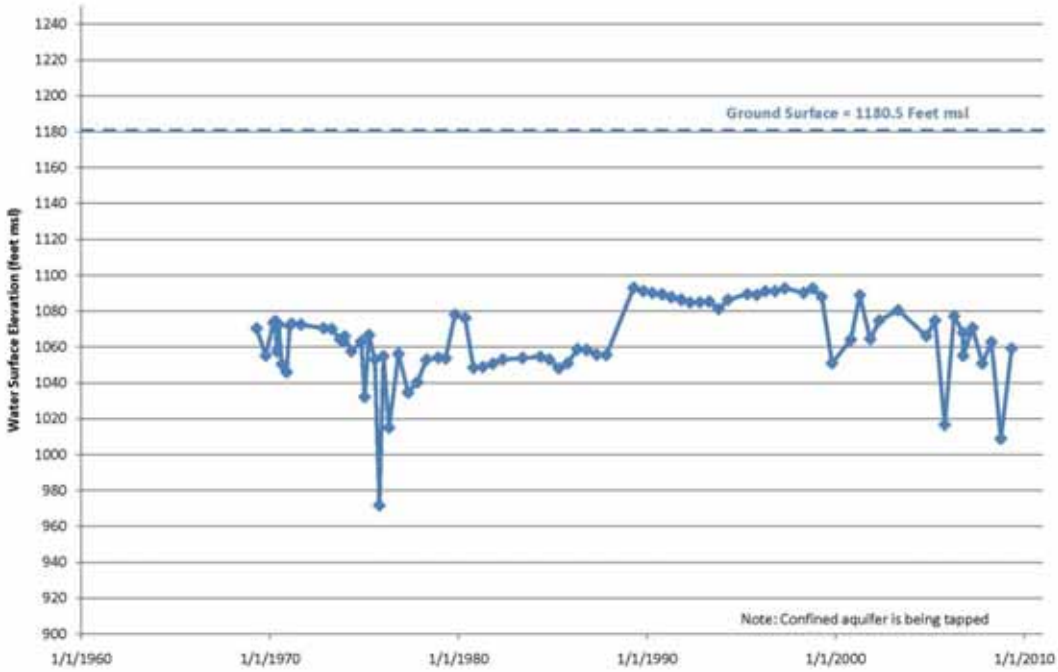

Figure 4. Hydrograph for Well 27S/13E-33L01

Well 28S/13E-13D01 – This well is located along Highway 229 as shown on Figure 6 and is considered to be in the portion of the subarea that is beyond the pumping depression. Over the 50-year period of record, spring groundwater levels in this well have been fairly constant, with no periods of decline as shown in Figure 5. The seasonal variation (difference between spring and fall observations) in groundwater levels ranges from less than10 feet to about 20 feet during this period.

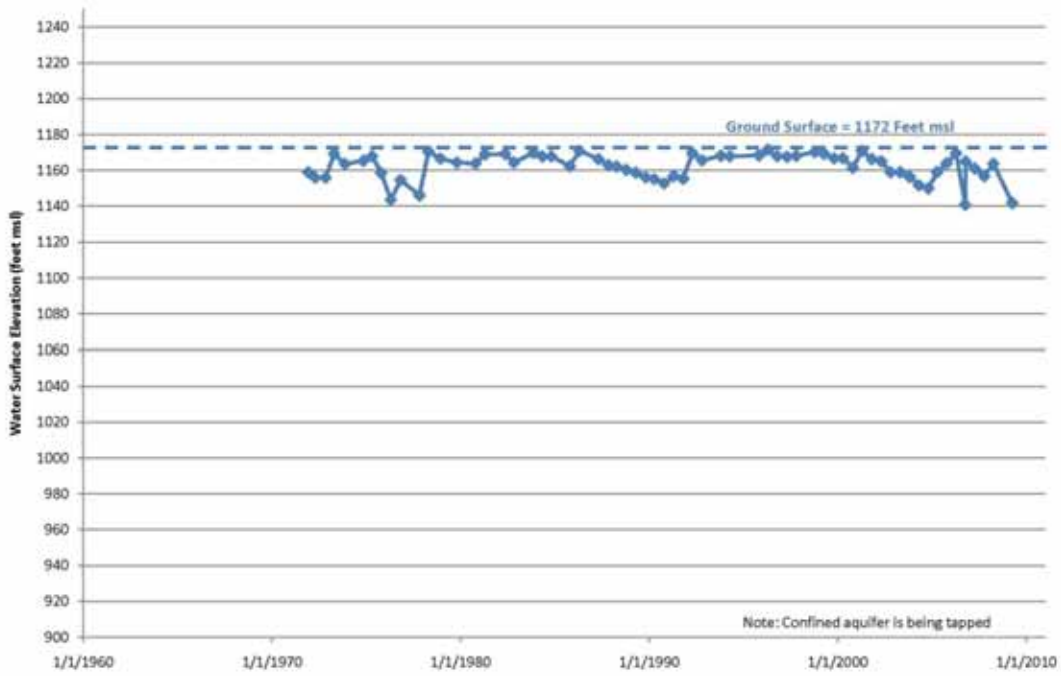

Figure 5. Hydrograph for Well 28S/13E-13D01

Change in Groundwater Storage

It should be noted that the lack of data in the northwest and northern portion of the Creston Subarea may not accurately represent the estimated decline in groundwater levels, and additional observations wells are needed to provide more complete mapping of the groundwater levels in this area.

For purposes of this discussion, groundwater level trends within Creston Subarea vary depending on location relative to Highway 41. Groundwater levels north of Highway 41 are represented by wells 27S/13E-28F01 and 27S/13E-33L01). Groundwater levels south of Highway 41 are represented by well 28S/13E-13D01.

Between 1970 and 1990 there was a decline in groundwater levels in wells northwest of Highway 41. Between 1990 and 2000, groundwater levels stabilized or increased. Since 2000, groundwater levels have fallen in response to increased groundwater pumping.

Groundwater levels south of Highway 41 have been relatively stable through the 1970 to 2000 period, but do show some declines since 2000.

Between 1997 and 2009 groundwater levels within the Creston Subarea have declined as shown on Figure 6. In the part of the subarea near the Estrella Subarea groundwater levels have declined by more than of 70 feet since 1997. Groundwater levels may continue to decline in this part of the subarea in the future even under ‘normal’ hydrologic conditions due to the high groundwater pumping rates.

Groundwater levels south and east of the pumping depression have experienced groundwater declines of 10 to 30 feet during the 1997 to 2009 period. Groundwater level declines in this area may be subject to below normal hydrologic conditions. Some of the recent, localized declining water levels may also be contributed to an increase in agricultural activities and rural ranchette population increases. Groundwater levels in the Creston Subarea have generally declined between 10 and 30 feet during this period.

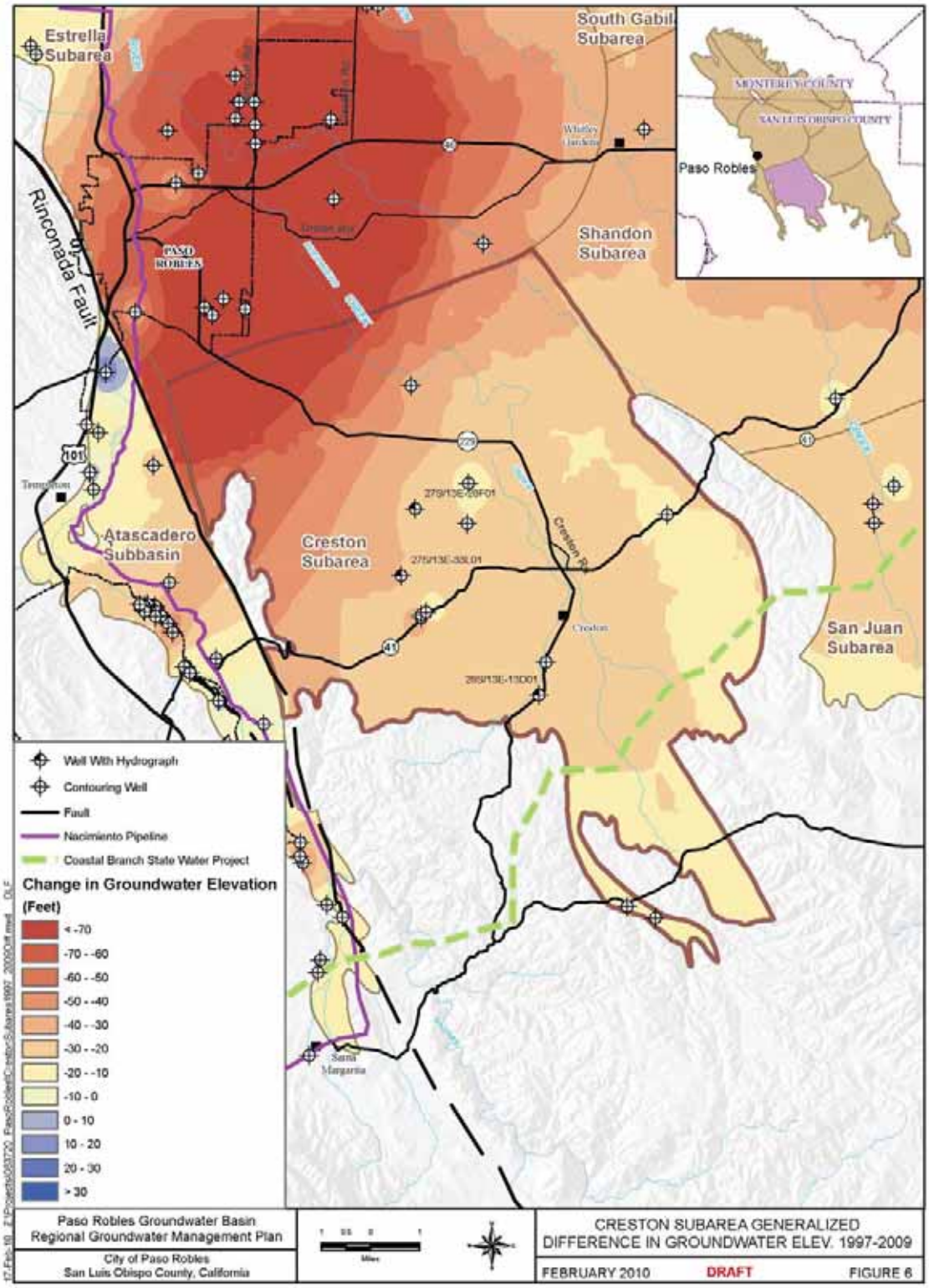

Figure 6. Change in Groundwater Levels in the Creston Subarea for the 1997 to 2009 Period

Groundwater Quality Information

Groundwater quality in the subarea is generally good to moderate for municipal use. Total dissolved solids (TDS), a measurement of the salts in the water, is typically used to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can be usable up to 1,000 mg/l.

The general mineral character of both surface water and groundwater in the Creston subarea is predominately calcium bicarbonate to calcium-sodium bicarbonate. The average shallow aquifer water TDS (excluding Section 14) is 240 mg/l, compared to an average of 450 mg/l in deeper aquifer zones.

Groundwater quality in the subarea (excluding Section 14) is generally suitable for irrigation without restriction, with slight to moderate restrictions for trees and vines in a few wells sampled due to sodium or chloride ion toxicity (Fugro and Cleath, 2002).

Highly mineralized sodium chloride water is documented locally in the shallow alluvial deposits of Section 14 (T27S/R13E; Old Geneseo School area). The cause of the mineralization is not known, but is not likely from the geothermal resource, which occurs as sodium bicarbonate water below depths of 500 feet in the area.

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

Summary of Basin Management Objective Workshop
For the Creston Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Creston Subarea were discussed and developed by stakeholders of Creston Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Creston Subarea that attended the Workshop are listed below:

Name	Affiliation
Sue Luft	WRAC/Grower/RR
Karl Luft	Grower/RR
Sheila Lyons	Rural Resident
David Lyons	Rural Resident
Dana Merrill	Grower
Fritz Helzer	Grower
Claudia Engel	Creston AB
Pam Finley	Templeton AAG

Sue Luft recorded the information discussed by the Creston Subarea Stakeholders. The Creston Subarea Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Creston Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Creston Subarea are currently recorded at 13 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Creston Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to

represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

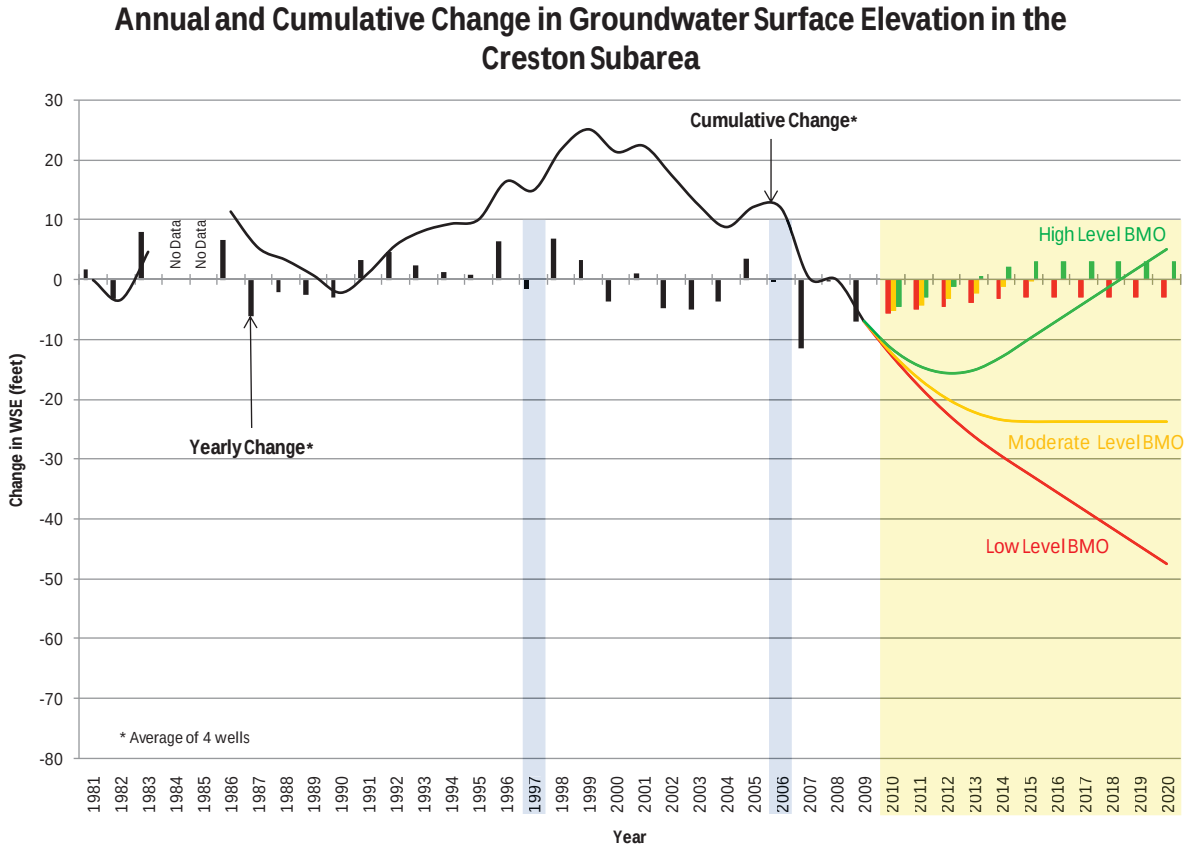

Figure 1. Composite Hydrograph of Four Selected Wells in the Creston Subarea

The average groundwater levels in the subarea appear to have peaked at about 1999. Since this time, groundwater levels have generally declined. This may be due in part to the increase in water demands between 1997 and 2006. During the 1997 to 2006 period, average groundwater levels have declined by less than five feet, but during the 2006 to 2009 period, the average groundwater levels declined by about 20 feet, so it appears that the increase in demands and the numerous dry years have contributed to the declining groundwater levels currently being experienced.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline of groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Creston Subarea met by groundwater increased by about 1,800 acre-feet during the 1997 to 2006 period as shown on Table 1. This information does identify when this increase occurred, but it is likely to have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about seven feet per year) during this period.

Table 1. Estimated Water Demands in the Creston Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE CRESTON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,936	0	0	37	2,338	12,311
Estimated 1997 Demand	(acre-feet)	8,600	0	0	27	1,880	10,507
Difference (2006 less 1997)	(acre-feet)	1,336	0	0	10	458	1,804
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The Creston Subarea stakeholders determined that an acceptable draft BMOs for groundwater levels in the Creston Subarea would include stopping the current rate of decline experienced in the last 10 years, and stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells) in the next five to ten years.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Creston Subarea Stakeholders to stabilize groundwater levels in the Creston Subarea. The potential benefit from these GMAs has not been quantified for the Creston Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Creston Subarea through the addition of new wells to the volunteer monitoring network. Additional wells would be needed in the northwest portion of the subarea near the Estrella Subarea where historic groundwater level decline has been the greatest.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the

Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users. The effectiveness of this GMA will be evaluated on an annual basis. Some of the specific water conservation activities identified include:

- Agricultural Water Conservation
- Rural Residential Water Conservation
    - Landscape Water Use
    - Consider controls on non-agricultural ponds

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of rural residential development in the subarea. Throughout much of the Basin, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. Any policies established would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- No net increase in water use resulting from additional rural residential development

The San Luis Obispo County Department of Planning and Building would likely be responsible for implementing this GMA.

GMA 4: Preventing export of groundwater from the Basin: This GMA includes identifying potential activities that result in exporting groundwater from the Basin. At this time, additional information is necessary to quantify the occurrence of groundwater pumping for export from the Basin.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

DRAFT

OVERVIEW OF THE ESTRELLA SUBAREA OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the Estrella 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 Estrella Subarea.

Paso Robles Groundwater Basin

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

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).

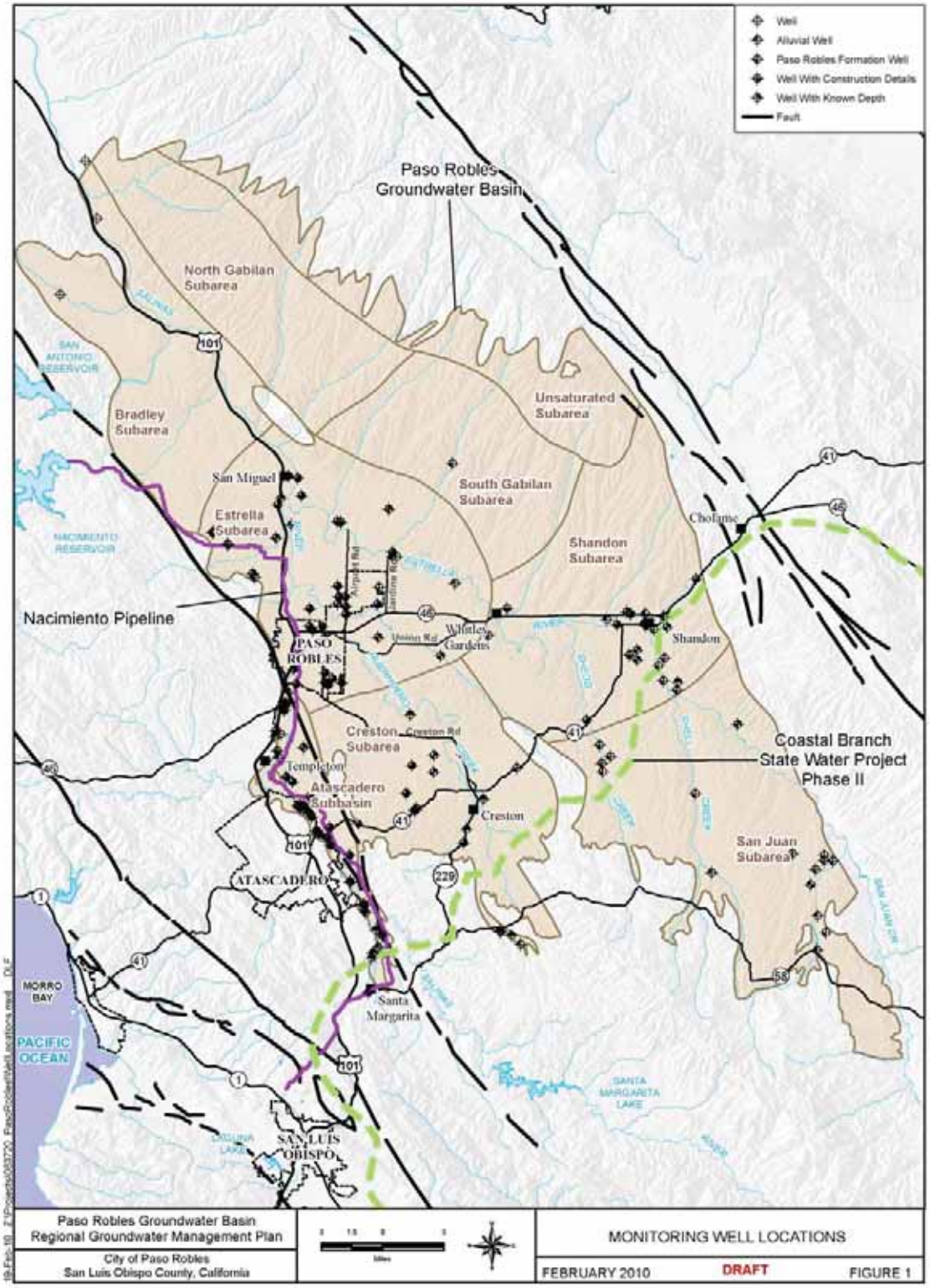

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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. The Atascadero MWC Station No. 34 is one of the gauges with a long, continuous period of record. The long-term average annual precipitation at this gauge is 17.6 inches per year for the 1916 to 2009 period.

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.

Estrella Subarea

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

Land and Water Use

The Estrella Subarea is located in the western portion of the Paso Robles Groundwater Basin and has an area of approximately 82,500 acres, which makes up about 16 percent of the area of the Basin. This subarea includes the City of Paso Robles (City) and the San Miguel Communities Services District. The Salinas River flows north roughly paralleling Highway 101. Huerhuero Creek enters the subarea from the Creston Subarea and flows into the Salinas River near the City of Paso Robles. The Estrella River flows from the Shandon Subarea and enters the Salinas River north of the City.

The water use in 2006 totaled about 34,000 acre-feet representing about 38 percent of the water use in the Basin. The water users in the Estrella Subarea and their uses are shown in Table 1. In 2006, the entire demand was met with groundwater. There is a diverse group of water users in this subarea. About two-thirds of the pumping in this subarea is for agricultural uses. Rural and municipal users account for about one-third of the groundwater pumping.

Beginning in 2010, up to 4,000 acre-feet of surface water from the Nacimiento Pipeline will be available to the City of Paso Robles to offset the municipal groundwater pumping. The City will not be able to directly use this supply until a water treatment plant is constructed, which is anticipated to come on-line in 2012.

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

Agriculture	Municipal	Small Community	Small Commercial	Rural	**2006 Total**
23,111	3,930	156	1,603	5,277	**34,078**
(68%)	(11%)	<1%)	(5%)	(15%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

In the Estrella Subarea, the groundwater system consists of the Paso Robles Formation and the shallow alluvial aquifers.

Most production wells extract water from the Paso Robles Formation. Well total depths in the Estrella Subarea range from 300 to 900 feet and average between 500 to 600 feet. Groundwater wells production ranges from less than 100 to 1,000 gallons per minute. The alluvial aquifer associated with the Salinas River acts a primary source of recharge to the Paso Robles Formation. Wells tapping the alluvial aquifer tend to be less than 100 feet thick.

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 are currently 50 wells located within Estrella Subarea that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Estrella Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping.

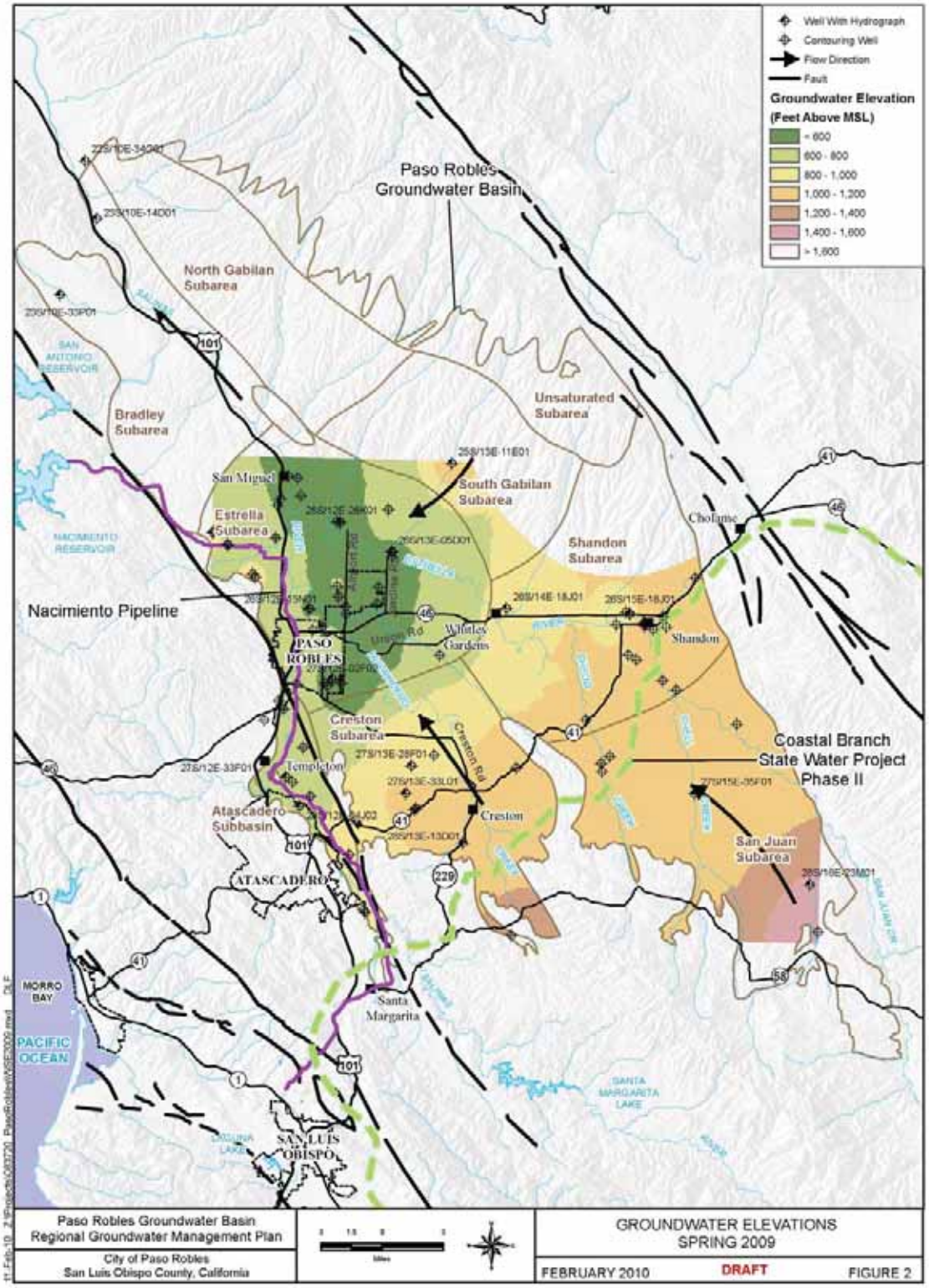

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

Several wells have been identified in the Estrella Subarea to demonstrate how groundwater levels have changed through time (well hydrographs) at discrete locations in the subarea. These wells were selected to represent a range of the conditions in the subarea through an extended period of record. Figures 3 through 6 show the groundwater level trends in key wells in the Estrella Subarea. The locations of these wells are shown on Figure 2. A brief discussion is provided for each well.

Well 25S/12E-26K01 – This well is located north of Airport Road near the Estrella River as shown on Figure 7, and is on the north edge of the pumping depression with the subarea. Over the 50-year period of record, groundwater levels in this well declined almost 80 feet, with about half of this decline between 1997 and 2009, as shown on Figure 3. During this 12-year period, the rate of decline has averaged about three feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 10 to 20 feet during this period.

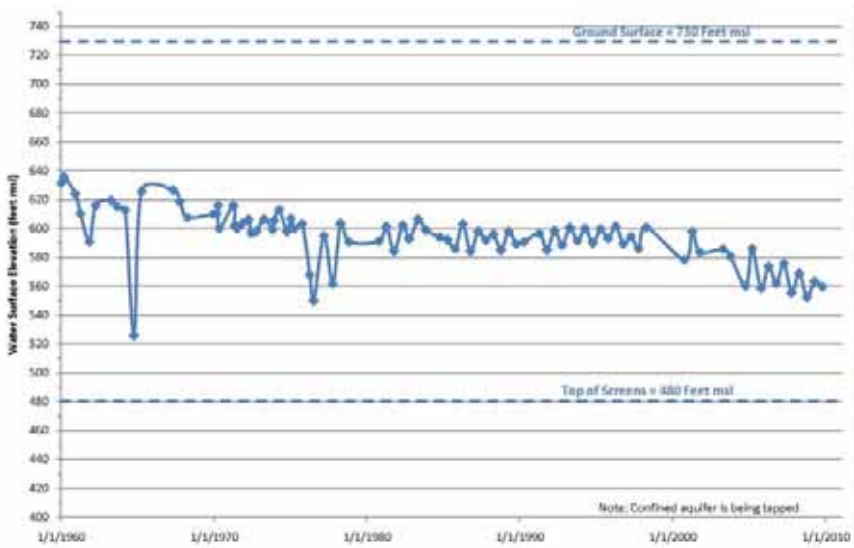

Figure 3. Hydrograph for Well 25S/12E-26K01

Well 26S/13E-5D01– This well is located north of Jardine Road near the Estrella River as shown on Figure 7 and is on the northeast edge of the expanding pumping depression with the subarea. Groundwater levels in this well declined almost 120 feet, with about 90 feet of this decline between 1997 and 2009 as shown on Figure 4. During this 12-year period, the rate of decline has averaged about 7.5 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 20 to 50 feet during this period.

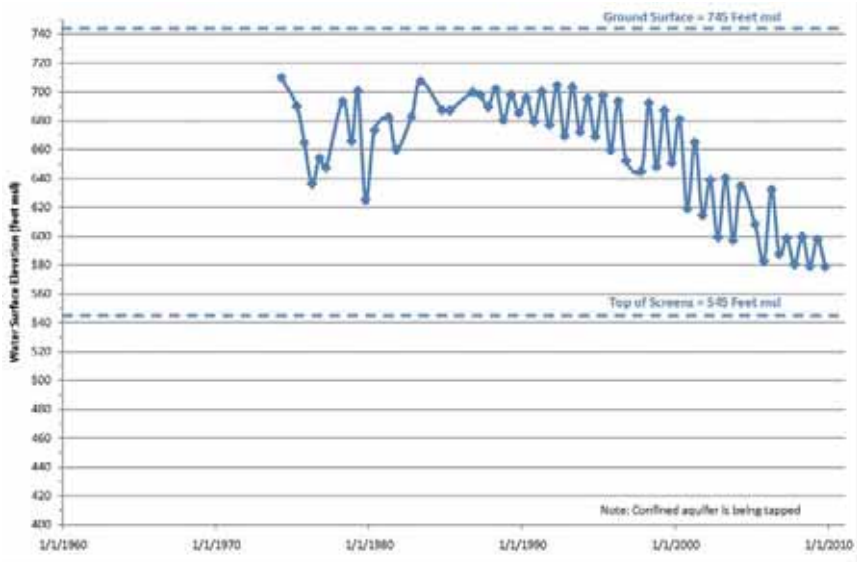

Figure 4. Hydrograph for Well 26S/13E-5D01

Well 27S/12E-2F02– This well is located in the southwest corner of the City of Paso Robles just northeast of Creston Road as shown on Figure 7, and is considered to be within the pumping depression. Over the 40-year period of record, spring groundwater levels in this well declined almost 110 feet as shown on Figure 5. During the 12-year period from 1997 to 2009, water levels dropped about 95 feet. This corresponds to an average rate of decline of about 8 feet per year. The fall groundwater level measurements taken in some years show seasonal drawdowns approaching 120 feet compared to the spring measurements, and in some cases these measurements dropped below the top of the well screens.

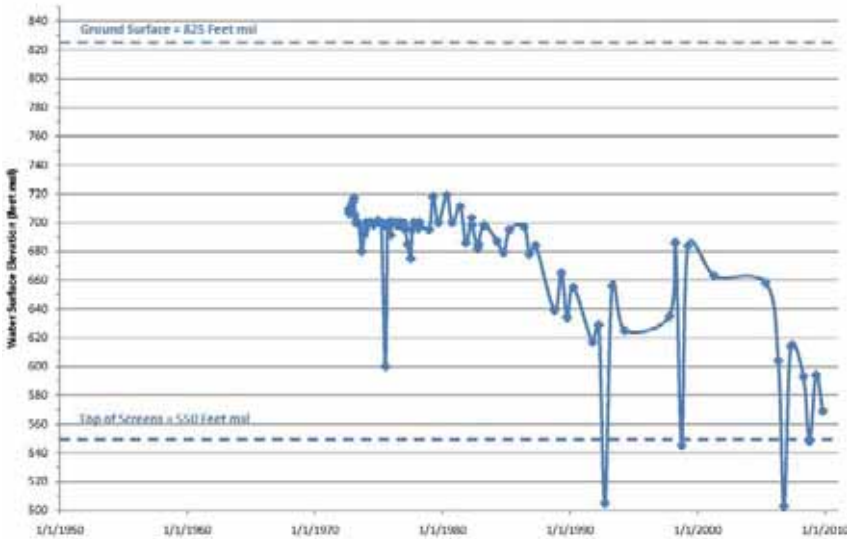

Figure 5. Hydrograph for Well 27S/12E-2F02

Well 26S/12E-15N01– This well is located north of the City of Paso Robles; about one-half mile west of the Estrella River as shown on Figure 7, and is considered to be on the western edge of the pumping depression. Prior to 1980, seasonal groundwater levels fluctuated by as much as 60 feet as shown on Figure 6. Between 1980 and 2000, groundwater levels were stable near the highest levels and had much smaller seasonal fluctuations.

During the period from 1997 to 2009, water levels dropped by about 80 feet. This corresponds to an average rate of decline of about 6.5 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels is about 20 to 50 feet during this period. These measurements suggest that groundwater elevations have dropped below the top of the well screens.

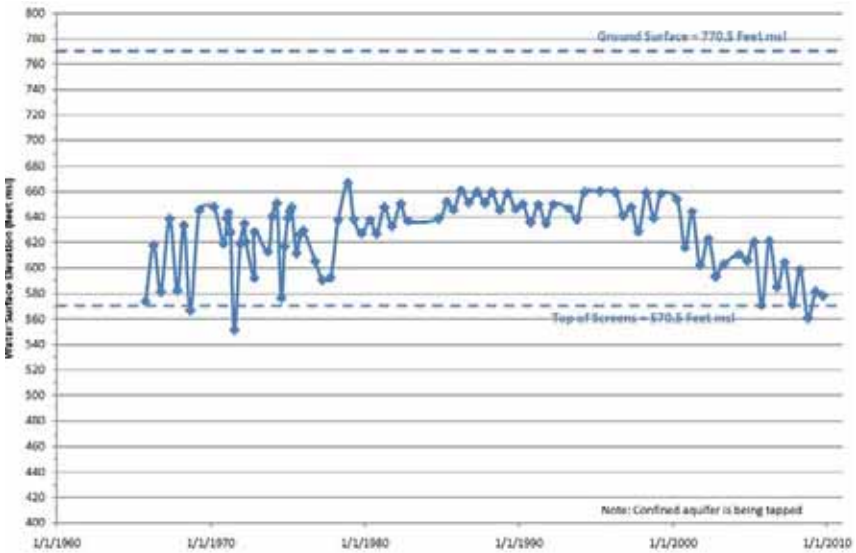

Figure 6. Hydrograph for Well 26S/12E-15N01

Change in Groundwater Storage

Overall, groundwater levels have been steadily declining in the Estrella Subarea for many years due to groundwater pumping. A slow decline in groundwater levels occurred between 1960 and 1980. Between 1980 and 2000, groundwater levels stabilized. Since 2000, groundwater levels have fallen in response to increased groundwater pumping. The pumping depression that was identified previously appears to have expanded since 2000 in response to increased groundwater pumping and below normal hydrologic conditions.

Between 1997 and 2009 groundwater levels within the Estrella Subarea have declined significantly as shown on Figure 7. In much of the subarea between the City of Paso Robles and Whitley Gardens and toward the Creston Subarea groundwater levels have declined by as much as 70 feet. Groundwater levels in the San Miguel area have generally declined between 10 and 20 feet during this period. In the area northeast of the City of Paso Robles, near Jardine Road, groundwater levels have declined by more than 50 feet. In some cases, groundwater levels have dropped below the existing rural domestic wells, causing those wells to go dry and require deepening to restore production.

Because of the lack of data east of Jardine Road and south of Union Road, the extent of the area with groundwater level decline greater than 70 feet may appear larger than actually exists. Additional observations wells are needed to provide more complete mapping of the groundwater levels in the area.

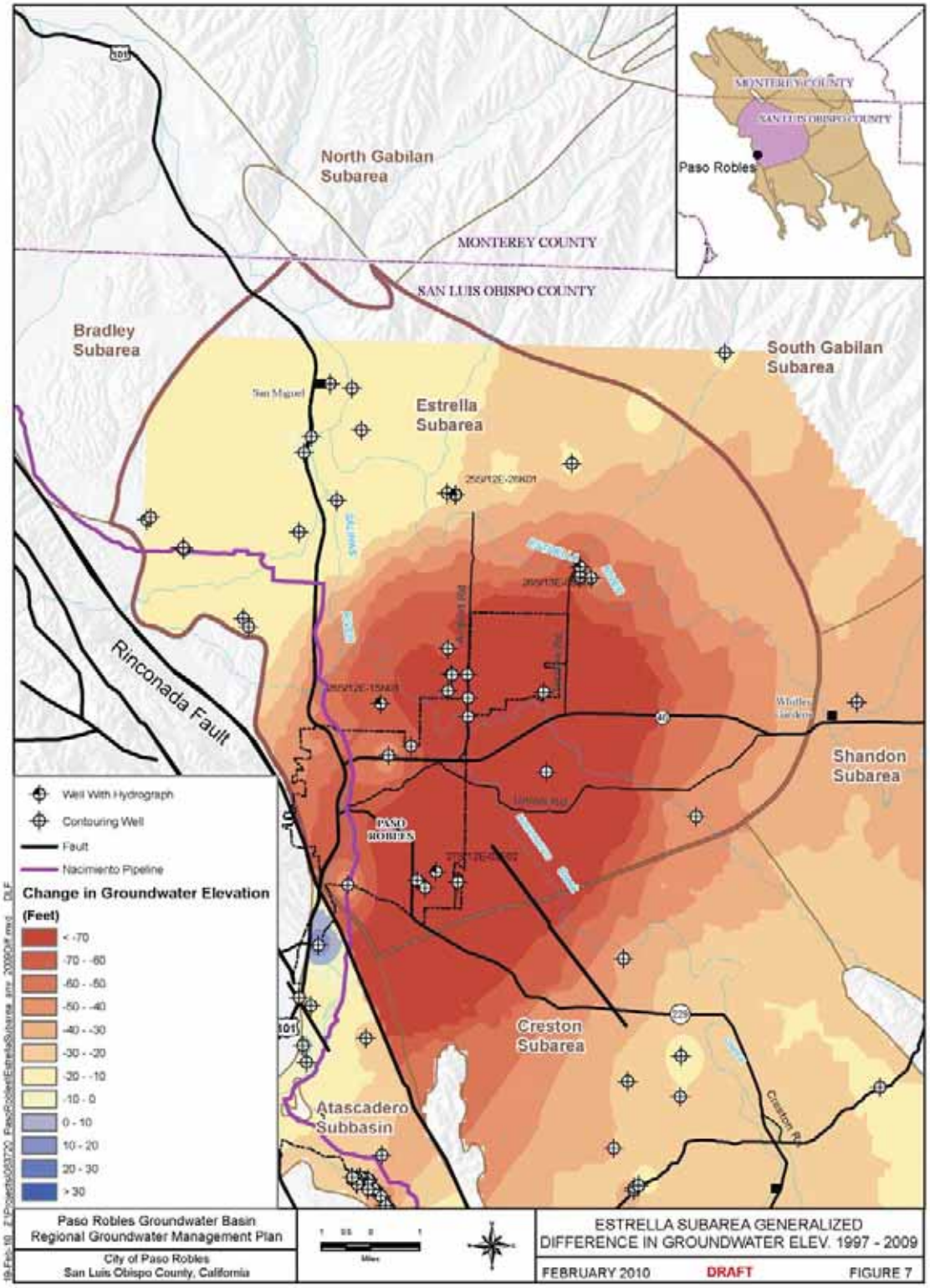

Figure 7. Change in Groundwater Levels in the Estrella Subarea for the 1997 to 2009 Period

Groundwater Quality Information

Groundwater quality in the subarea is generally good to moderate for municipal use. Total dissolved solids (TDS), a measurement of the salts in the water, is typically used to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can be usable up to 1,000 mg/l. TDS concentrations in local municipal supply wells, as reported in the 2007-2008 Consumer Confidence Reports, ranged from 370 to 740 mg/l (averaging 518 mg/l) for the City of Paso Robles, and ranged from 450 to 740 mg/l (averaging 580 mg/l) for San Miguel Community Services District(CSD).

Groundwater quality in the subarea is generally suitable for irrigation with slight to moderate restriction for trees and vines due to potential sodium and chloride ion toxicity (Fugro and Cleath, 2002).

Two locations have been identified as contamination sites within the Paso Robles Basin. The first is Sherwood Well #6 located on Niblick Avenue just east of Creston Road. Concentrations of PCE (perchloroethylene) have gone down at this site between 2002 and 2010. The second site is located at 1730, 1740, and 1750 Commerce Avenue. During a two-year period, between 2006 and 2008, contaminant concentrations have remained stable.

The influence of geothermal water on basin groundwater quality is generally restricted, based on structure and water levels, to basin sediments west of Paso Robles. Sodium concentrations across most of the Estrella Subarea do not appear to increase with depth, and no significant influence on water quality from geothermal waters in basin sediments is found east of Paso Robles.

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

Summary of Basin Management Objective Workshop
For the Estrella Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Estrella Subarea were discussed and developed by stakeholders of Estrella Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Estrella Subarea that attended the Workshop are listed below:

Name	Affiliation
Joy Sprague	Rural Resident
Walter Heer	
Christopher Alakel	City of Paso Robles
Chuck Pritchard	Upper Salinas/Las Tablas Resource Conservation District (US/LT RCD)
Jerry Reaugh	Grower
Lisa Bodrogi	(Paso Robles Wine Country Alliance (PRWCA)
Joe Plummer	Grower
Debra Compton	Grower
Steve Carter	Grower
John Wallace	San Miguel CSD
Tom Zehnder	

Iris Priestaf recorded the information discussed by the Estrella Subarea Stakeholders. The Estrella Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives, but did not reach consensus on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Estrella Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

DRAFT

The changes in groundwater levels in the Estrella Subarea are currently recorded at 50 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Estrella Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of six wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

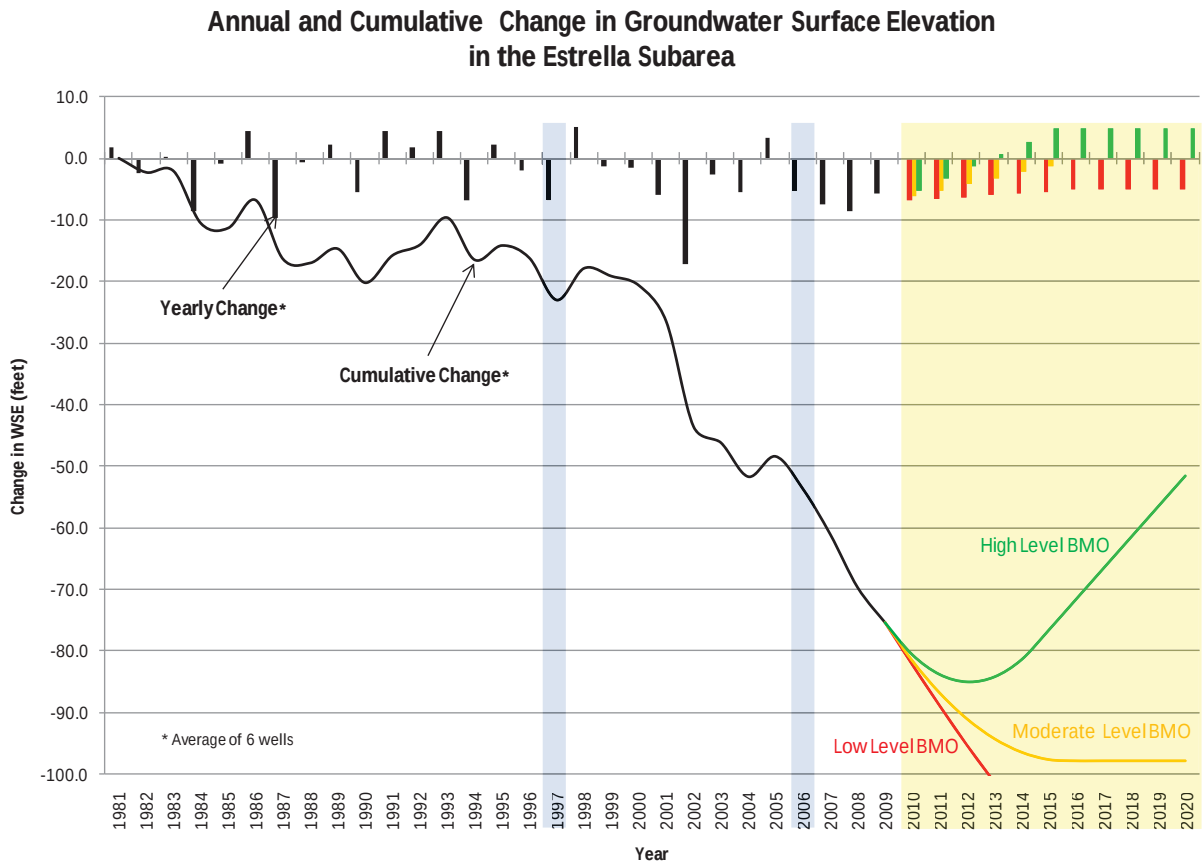

Figure 1. Composite Hydrograph of Six Selected Wells in the Estrella Subarea

Based on the composite hydrograph shown in Figure 1, the average groundwater levels in the Estrella Subarea have declined by about 20 feet between 1981 and 1997. Then, between 1997 and 2006 average groundwater levels have declined by an additional 30 feet. During this same period, water demands in the Estrella Subarea met by groundwater have increased by a total of about 6,300 acre-feet as shown on Table 1. Finally, from 2006 to 2009 the average groundwater levels declined by about 35 feet. During the 1981 to 2009 period, average groundwater levels in the Estrella Subarea declined by about 80 feet, in response to a combination of increasing in water demands that are met by groundwater and a series of dry years in the later years of the period.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Estrella Subarea met by groundwater increased by about 6,300 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands contributed to the significant decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (almost 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Estrella Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ESTRELLA SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	23,111	3,930	0	1,603	5,433	34,077
Estimated 1997 Demand	(acre-feet)	20,004	2,137	0	1,186	4,368	27,695
Difference (2006 less 1997)	(acre-feet)	3,107	1,793	0	417	1,065	6,382
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						
	1997 Municipal demand includes City of Paso Robles groundwater pumping from basin wells(1,911 acre-feet) and San Miguel (226 acre-feet)						
	Small community demands included in rural domestic demand						

Draft Basin Management Objectives

Three levels of BMOs were discussed by the Estrella Subarea stakeholders. There was consensus that groundwater level declines are a shared problem for the subarea, and that the severity of decline varies across the area. It was also identified that the proposed low-level BMO (essentially do-nothing) was unacceptable.

The medium level BMO of stabilizing groundwater levels was identified as a reasonable objective at this time, but there was concern about the cost and feasibility.

The high-level BMO of recovery of groundwater levels was identified as desirable by private domestic wells owner, but the group agreed that such an objective was over-reaching at this time.

Potential Groundwater Management Activities

The stakeholders reached consensus that there is no magic bullet that will solve the problem, but that the solution will likely involve a combination of activities such as additional water conservation, Nacimiento water supplies, a groundwater recharge program (e.g. using State Water Project or urban runoff), redistribution of pumping, and wastewater discharge/water recycling.

The following Groundwater Management Activities (GMAs) were identified by the Estrella Subarea Stakeholders to stabilize groundwater levels in the Estrella Subarea. The potential benefit from these GMAs has not been quantified for the Estrella Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase data collection and monitoring and reporting on groundwater conditions: It was determined that there is enough information to know that there is a problem, however, additional and better information is needed to further understand the problem.

The stakeholders recognize that this GMA does not directly result in changes in groundwater levels, but will help communicate condition to individuals and support implementation of groundwater management activities in the subarea. It was recognized that additional private wells need to be made part of the County well network on a voluntary basis. This is particularly true in specific areas within the subarea currently lacking wells in the water level monitoring network.

GMA 2: Increase water conservation education and implementation: The stakeholders recognized that additional conservation is needed. Some stakeholders felt that the amount of savings that can be achieved is limited. Other stakeholders felt that additional conservation in the agricultural sector could play a significant role in reducing groundwater demand and achieving the BMO of stabilizing water levels. There were several discussions about the potential additional savings from conservation, but consensus could not be reached about the potential savings that could be achieved by the different water use categories (urban, agricultural, and rural). During the conversations each group stated that they believed there was limited opportunity for additional gains from conservation in their demand type, but believed additional conservation could be achieved in other demand types.

GMA 3: Nacimiento Project Water: The stakeholder reached consensus regarding the use of Nacimiento Project Water help alleviate the groundwater decline problem, but it was also recognized as not being the sole solution.

Issues Lacking Consensus

The two primary issues lacking consensus in the subarea was the degree to which additional conservation could be implemented for urban, agricultural, and rural uses.

The Paso Robles Groundwater Basin has largely centralized management because of a lack of water districts or local water agencies, so there was no consensus about the agency or organization that would have the responsibility for prioritizing and implementing the identified groundwater management activities.

DRAFT

OVERVIEW OF THE NORTH AND SOUTH GABILAN SUBAREAS OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the North and South Gabilan Subareas 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 North and South Gabilan Subareas.

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 (which are presented in well hydrographs), or across an area for a specific date (which are presented as water level maps).

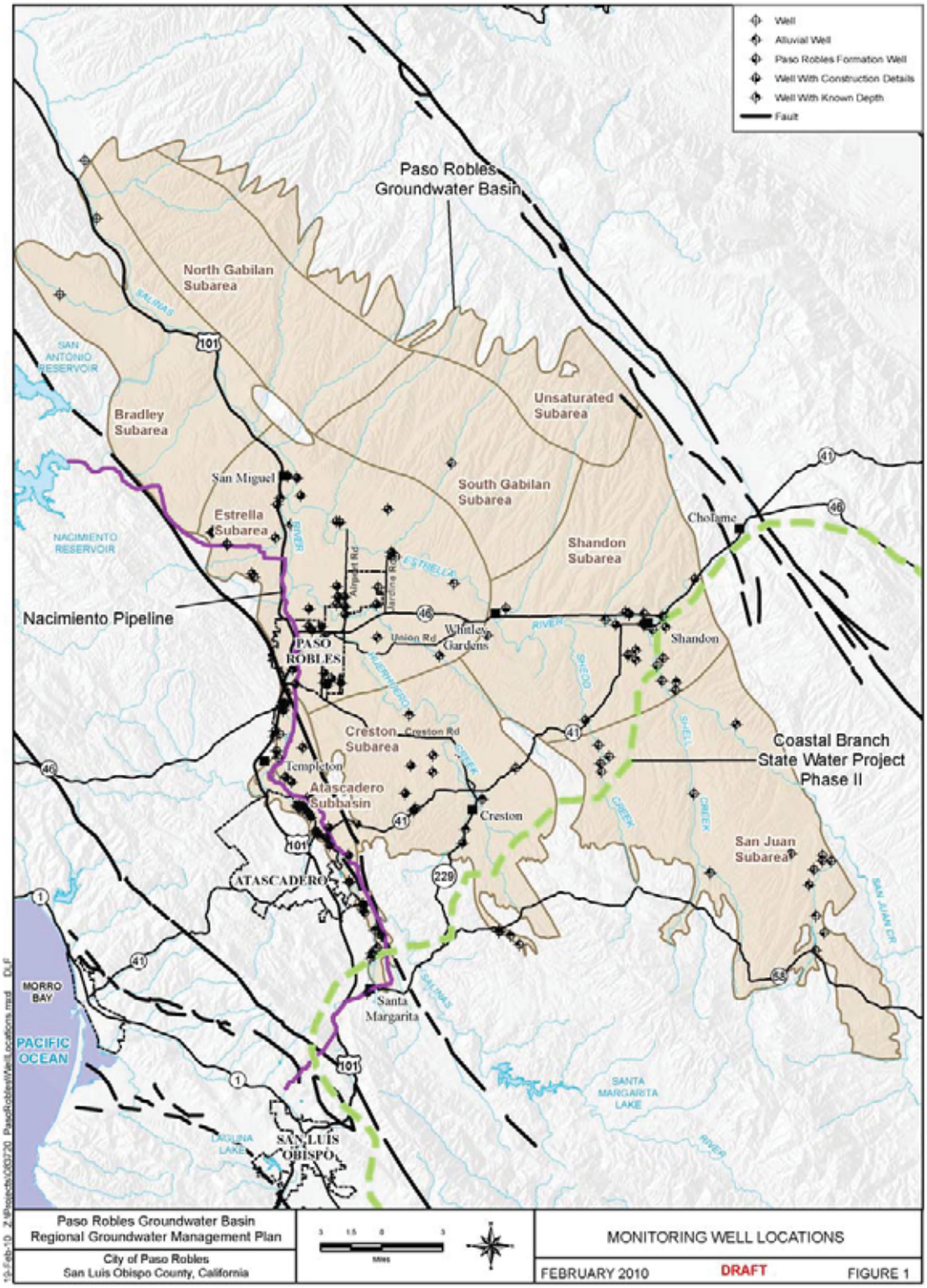

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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.

North Gabilan and South Gabilan Subareas

The following information for the North Gabilan and South Gabilan Subareas includes the recent land and water conditions and local groundwater conditions.

Land and Water Use

The North Gabilan and South Gabilan Subareas are located along the northeastern portion of the Paso Robles Groundwater Basin. The North Gabilan Subarea has an area of approximately 52,600 acres, which makes up about 11percent of the area of the Basin. The South Gabilan Subarea has an area of approximately 44,500 acres, which makes up about nine percent of the area of the Basin. Almost all of the North Gabilan Subarea, and the northern portion of the South Gabilan Subarea is located in Monterey County The South Gabilan Subarea is drained by several small creeks that flow into the Estrella River; the small creeks draining the North Gabilan Subarea flow into the Salinas River .

The water use in 2006 totaled about 5,452 acre-feet representing about six percent of the water use in the Basin. The water users in the North Gabilan Subarea and their uses are shown on Table 1. The water users in the South Gabilan Subarea and their uses are shown on Table 2 .In 2006, the entire demand was met with groundwater.

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

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
1,758	0	0	0	51	**1,809**
(97%)	(0%)	(0%)	(0%)	(3%)	**(100%)**

(Todd, 2009)

Table 2 Total Estimated Pumping in the South Gabilan Subarea in 2006 (AF)

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
1,670	0	0	0	213	**1,884**
(89%)	(0%)	(0%)	(0%)	(11%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

The Gabilan Mesa area is a southwestern to southern sloping ridge that rises from the Salinas and Estrella rivers to the watershed boundary. This uplift rises from an elevation of 600 to 1,000 feet along the rivers to elevations of more than 2,000 feet along the ridgeline. This is an area dissected by several south-flowing parallel, 100 to 200-foot deep canyons that drain to the Estrella River between Estrella and San Miguel, and to the Salinas River between San Miguel and San Ardo. These canyons are each several miles long and typically less than 500 feet wide. None of the canyons has been extensively developed, with existing development concentrated along the lower reaches of the valley.

The water-bearing Paso Robles Formation underlying this area is roughly four miles wide and 20 miles long, extending from San Ardo to east of San Miguel. The Paso Robles Formation in this area reaches a depth of up to 1,000 feet. Production zones are comprised of sand and gravel zones in the upper portion with increasing thickness of sand beds in the lower section. Sand and gravel beds are interbedded with clay and comprise less than 25 percent of the full thickness of the deposits. Some wells are capable of producing up to 1,000 gallons per minute (gpm); however, most domestic wells produce less than 25 gpm. Typically, the higher-producing wells are more than 600 feet deep; whereas domestic wells are less than 100 feet deep. In the North Gabilan and South Gabilan Subareas, most production wells extract water from the Paso Robles Formation.

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 South Gabilan Subarea.

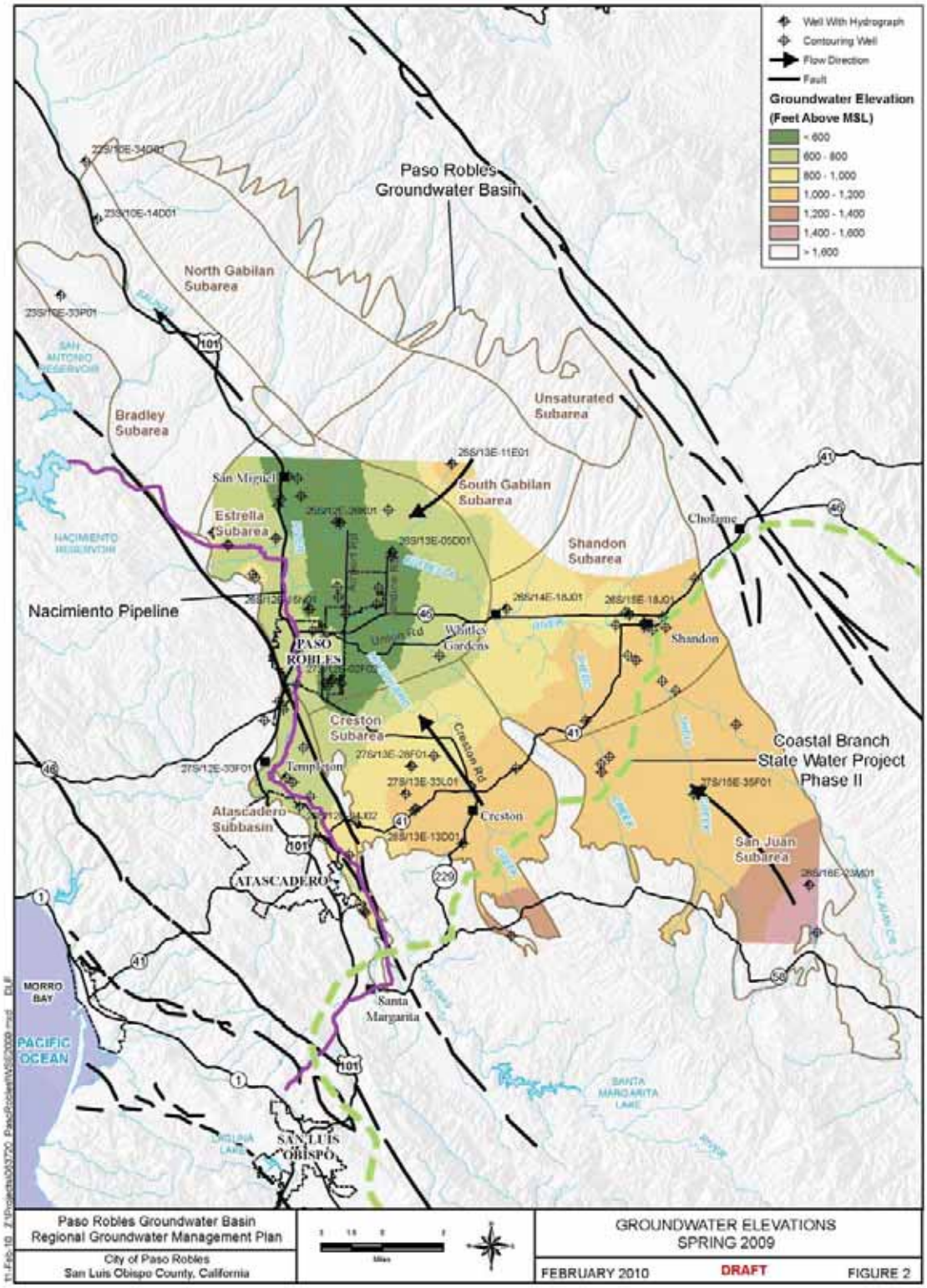

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

The available monitoring well in the South Gabilan 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 25S/13E-11E01 - This well is located near the center of the subarea in Hog Canyon as shown on Figure 2. Over the 50-year period of record, groundwater levels in this well have generally ranged between 1,140 and 1,160 feet above msl. Since 1997, groundwater levels have declined about 20 feet. During this 12-year period, the rate of decline has averaged about 1.5 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels during this period is about less than five feet.

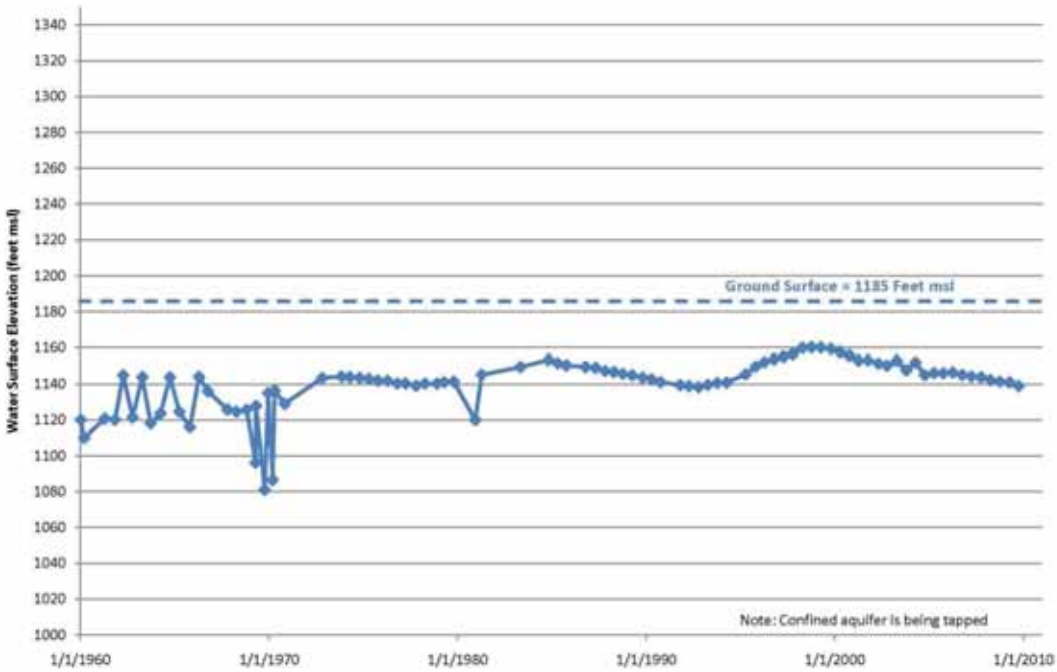

Figure 3. Hydrograph for Well 25S/13E-11E01

Groundwater Quality

Total dissolved solids (TDS), a measurement of the salts in the water, is typically sued to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can be up to 1,000 mg/l. There are no municipal users in the subarea.

TDS concentrations in groundwater from the 2002 survey ranged from 370 mg/l in Portuguese Canyon, to a high of 1,320 mg/l in Indian Valley. The average TDS concentration in samples collected from six wells and one spring in the Gabilan subareas was 700 mg/l.

Most groundwater samples reviewed in the subarea have no irrigation restrictions, with two samples reporting a slight to moderate restriction on irrigating trees and vines due to potential sodium and chloride ion toxicity (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

DRAFT

OVERVIEW OF THE SAN JUAN SUBAREA OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the San Juan 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 San Juan 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).

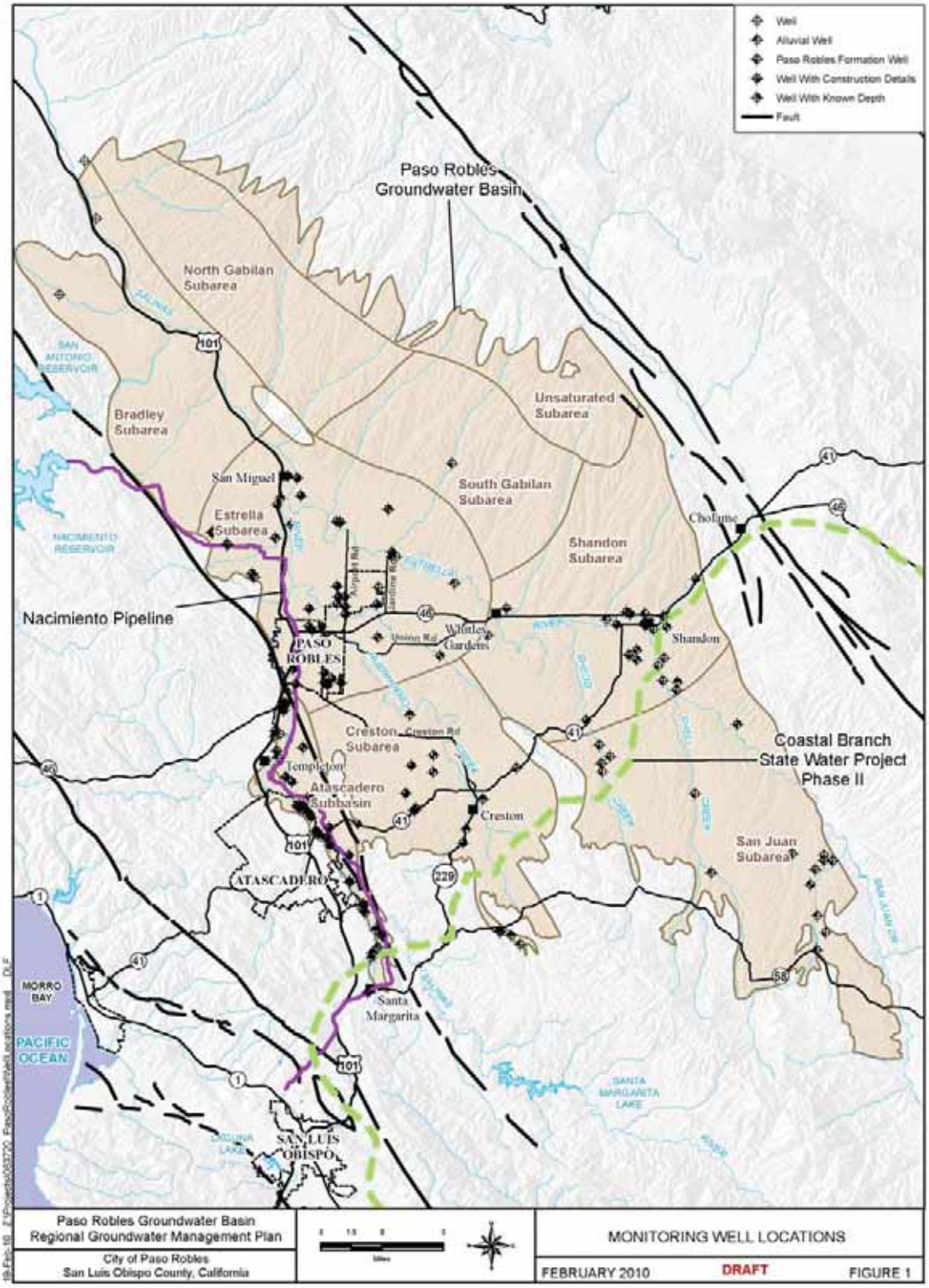

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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. The Atascadero MWC Station No. 34 is one of the gauges with a long, continuous period of record. The long-term average annual precipitation at this gauge is 17.6 inches per year for the 1916 to 2009 period.

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.

San Juan Subarea

The following information was summarized for the San Juan Subarea from existing reports and available information.

Land and Water Use

The San Juan Subarea is located in the southeastern portion of the Paso Robles Groundwater Basin and has an area of approximately 84,000 acres, which makes up about 17 percent of the area of the Basin. The San Juan Subarea lies south-southeast of Shandon and includes the agricultural land along San Juan Creek, Camatta Canyon, Shell Creek Road, and Shedd Canyon. These creeks flow northward through the subarea where they eventually become part of the Estrella River in the Shandon Subarea.

The water use in 2006 totaled about 5,452 acre-feet representing about six percent of the water use in the Basin. The water users in the Shandon Subarea and their uses are delineated in Table 1. In 2006, the entire demand was met with groundwater.

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

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
5,347	0	0	0	105	**5,452**
(98%)	(0%)	(2%)	(<1%)	(2%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

In the San Juan Subarea, the groundwater system consists of the Paso Robles Formation and the shallow alluvial aquifers.

Very little information is available for the wells in the San Juan Subarea except for some information about the wells along Camatta Canyon. Production from these wells is typically more than 1,000 gallons per minute, and some wells are capable of pumping 2,000 gpm. In the San Juan Subarea, most production wells extract water from the Paso Robles Formation.

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 are currently 10 wells located within San Juan Subarea that are included in the groundwater monitoring network.

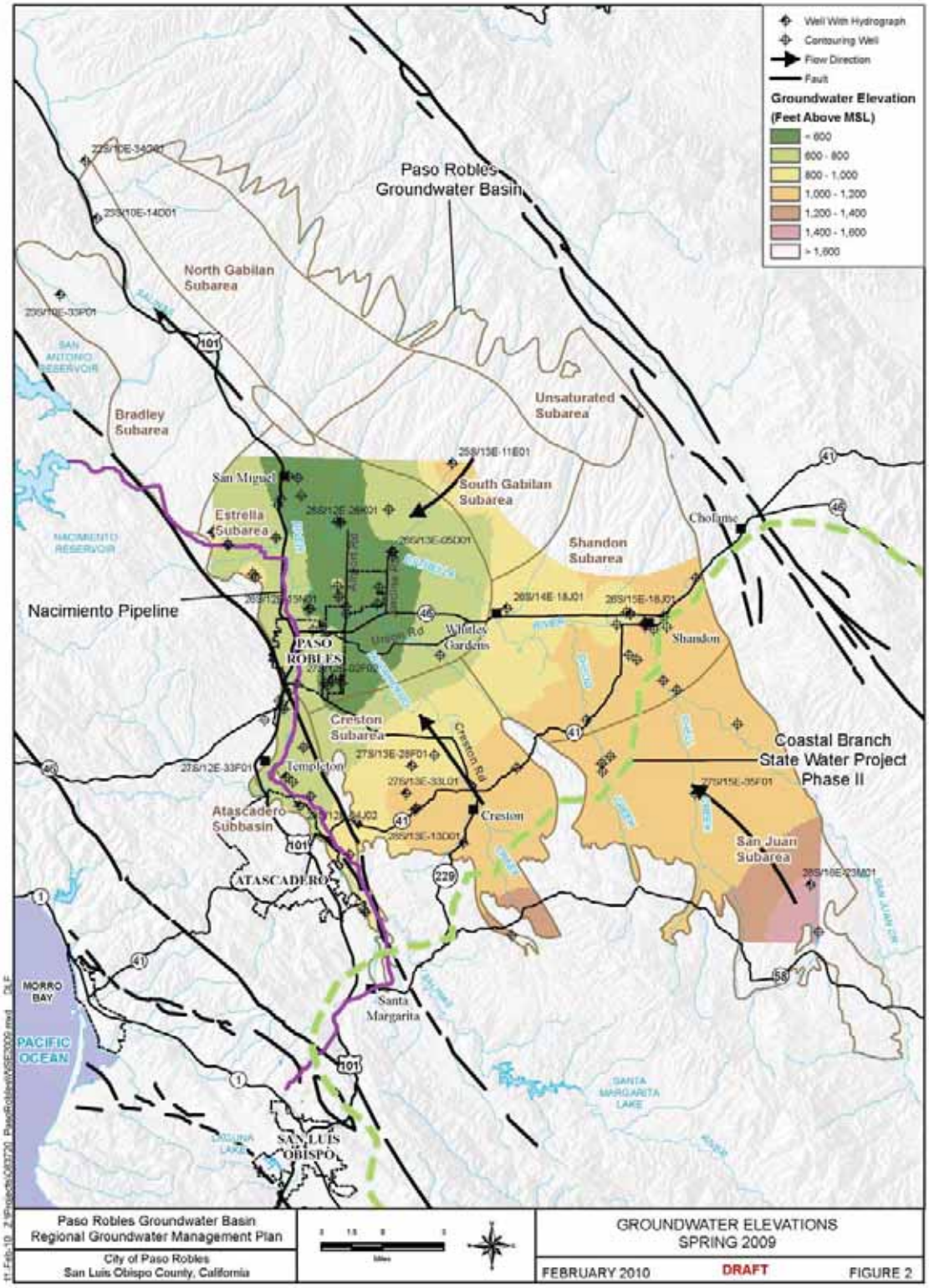

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

Several wells have been identified in the San Juan Subarea to demonstrate how groundwater levels have changed through time (well hydrographs) at discrete locations in the subarea. These wells were selected to represent a range of the conditions in the subarea through an extended period of record. Figures 3 and 4 show the groundwater level trends in key wells in the San Juan Subarea. The locations of these wells are shown on Figure 2. A brief discussion is provided for each well.

Well 27S/154E-35F01– This well is located near the center of the subarea, adjacent to Shell Creek as shown on Figure 5. Spring groundwater levels observed in this well are fairly constant throughout the period of record as shown on Figure 3. Prior to 1975, seasonal groundwater levels fluctuated by as much as 80 feet as shown on Figure 3. After the mid-1970s, groundwater levels were stable near the highest levels and had much smaller seasonal fluctuations.

During the period from 1998 to 2009, spring groundwater levels have declined about 20 feet. During this period, the rate of decline of the spring groundwater levels has averaged about 1.5 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels during this period has ranged from less than 5 feet up to 80 feet (during the early 1970s).

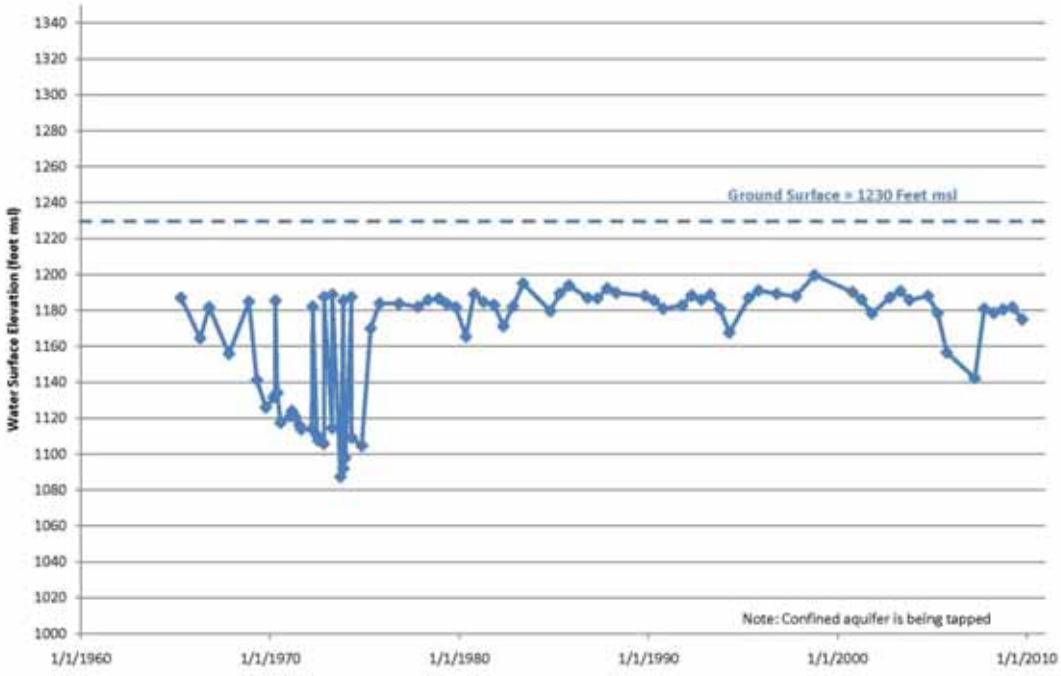

Figure 3. Hydrograph for Well 27S/15E-35F01

Well 28S/16E-23M01– This well is located in the southeast corner of the subarea adjacent to San Juan Creek as shown on Figure 5. This well has been identified as an alluvial well. Spring groundwater levels observed in this well have shown a general decline throughout the period of record with a total decline of about 60 feet as shown on Figure 4. Groundwater levels at this well have been observed to rise up to 40 feet in a single year in response to wet conditions. During the period from 1998 to 2009, spring groundwater levels have declined about 30 feet and the rate of decline has averaged about 2.5 feet per year. There are a limited number of observations in the last ten years. The seasonal variation (difference between spring and fall observations) in groundwater levels has ranged from less than 5 feet up to 40 feet of recovery during wet years of this period.

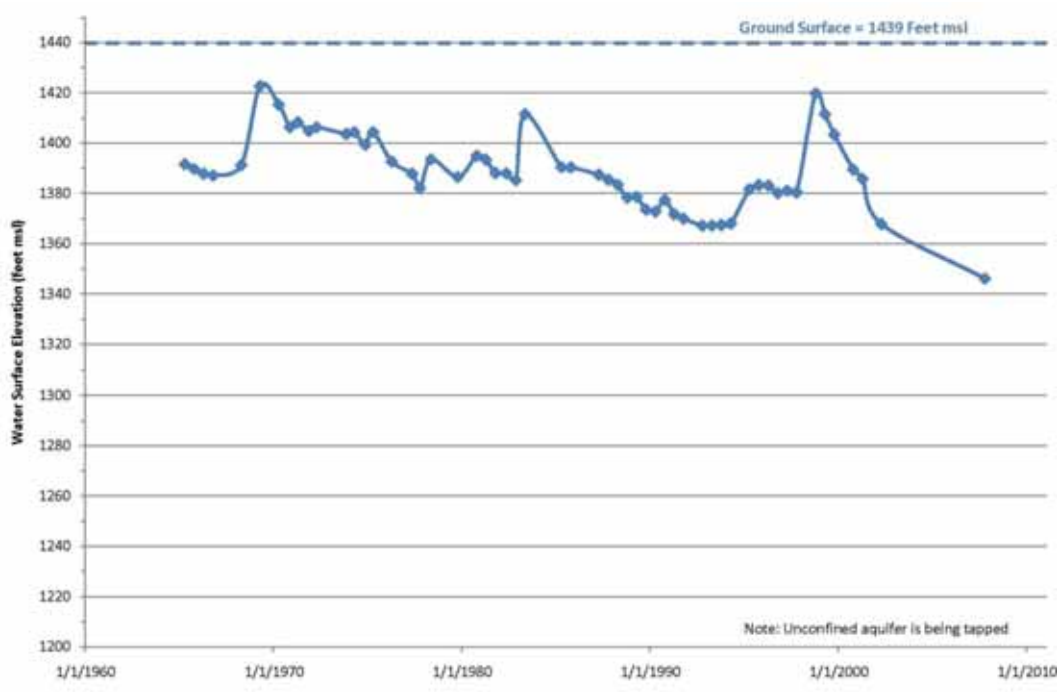

Figure 4. Hydrograph for Well 28S/16E-23M01

Change in Groundwater Storage

Overall, groundwater levels have been fairly stable in the San Juan Subarea. In the center of the subarea, groundwater levels appear to recharge seasonally, as seen in well 27S/15E-35F01. Between 1997 and 2009 groundwater levels within the San Juan Subarea have declined between 10 and 30 feet as shown on Figure 5. Additional observations of the Paso Robles Formation are needed in these areas to provide more complete mapping of the groundwater levels.

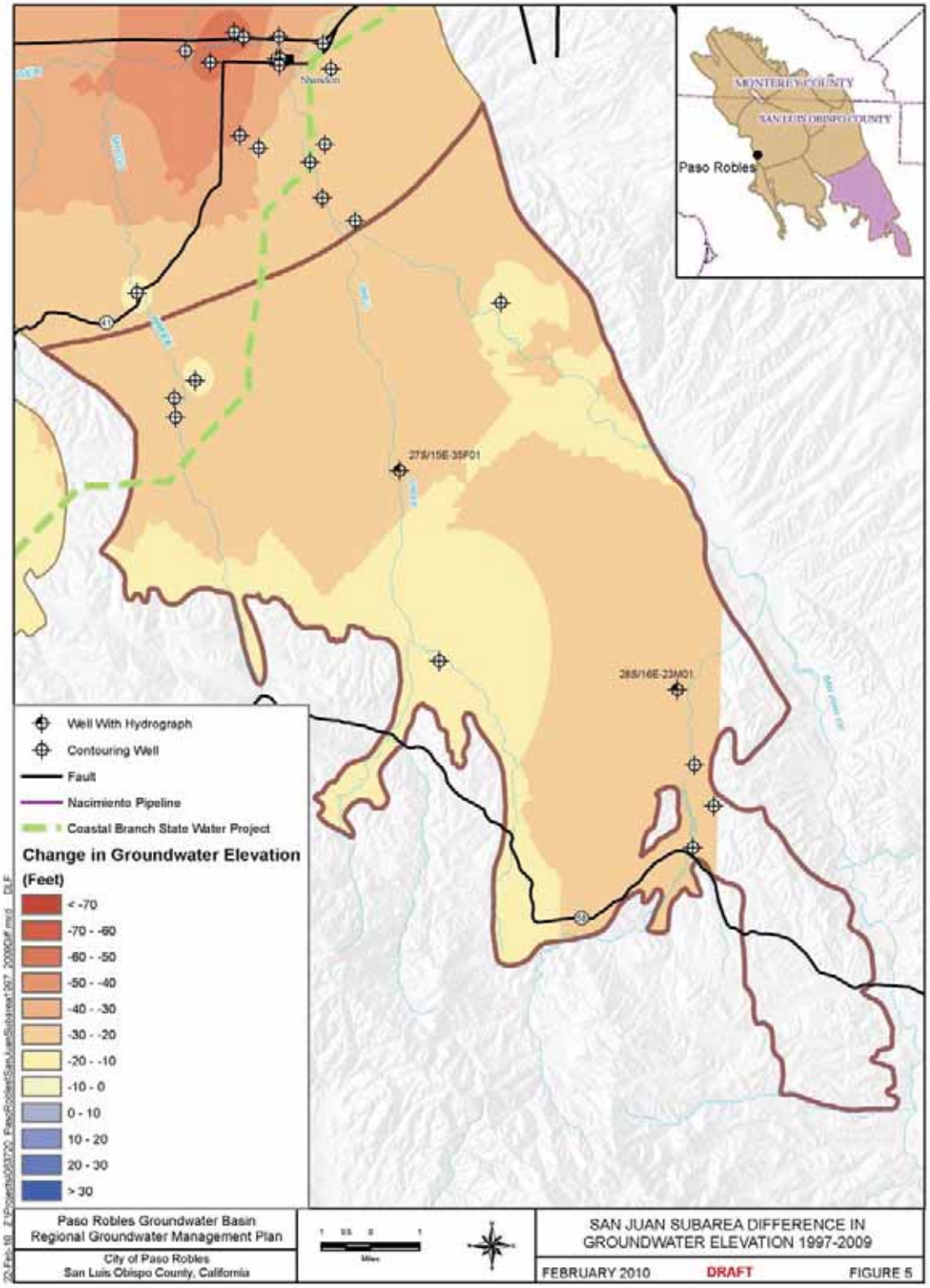

Figure 5. Change in Groundwater Levels in the San Juan Subarea for the 1997 to 2009 Period

Groundwater Quality Information

Total dissolved solids (TDS), a measurement of the salts in the water, is typically used to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can usable be up to 1,000 mg/l. There are no municipal users in the subarea.

TDS concentrations in groundwater from the 2002 survey ranged from 70 mg/l in Camatta Canyon, to a high of 2,170 mg/l in the lower San Juan Creek valley. The average TDS concentration in samples collected from eight wells in the San Juan subarea was 750 mg/l.

Most groundwater samples reviewed in the subarea have no irrigation restrictions, except two samples in the lower San Juan Creek Valley that reported a severe restriction on irrigating trees and vines due to potential sodium, chloride, and boron ion toxicity (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

Summary of Basin Management Objective Workshop
For the San Juan Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the San Juan Subarea of the Paso Robles Groundwater Basin (Basin) were discussed and developed by stakeholders of San Juan Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the San Juan Subarea that attended the Workshop are listed below:

Name	Affiliation
Amy Gillman	5th District Legislative Assistant
Steve Sinton	Shandon
Randy Diffenbaugh	Shandon Advisory Committee
Susan Litteral	Natural Resource Conservation Service
Doug Felipponi	SJV FET
Mary Russell	Shandon

Susan Litteral recorded the information discussed by the San Juan Stakeholders.

The San Juan Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives and on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the San Juan Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the San Juan Subarea are currently recorded at 10 wells that are included in the groundwater monitoring network. Overall, groundwater levels have been fairly stable in the San Juan Subarea. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1 for the 1981 to 2009

period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

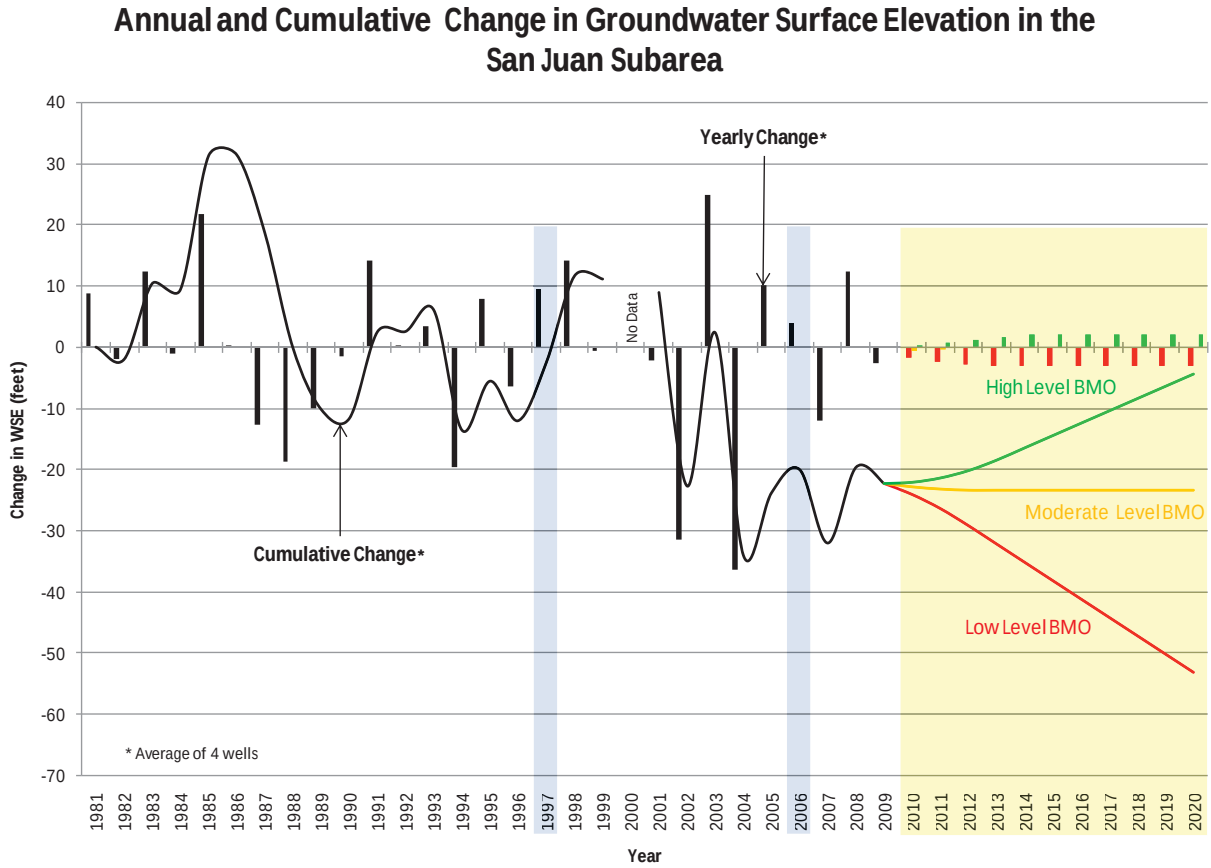

Figure 1. Composite Hydrograph of Four Selected Wells in the San Juan Subarea

Based on the composite hydrograph shown in Figure 1, the San Juan Subarea shows highly variable annual changes in groundwater levels. It appears that groundwater levels in the San Juan Subarea respond quickly to changes in hydrologic conditions, with average groundwater levels increasing or decreasing by as much as 35 feet in a single year.

During the 1981 and 1997 period, average groundwater levels changed considerably on a year-to-year basis, but there was no net significant difference in the cumulative groundwater levels at the end of the 16-year period. During the 1997 and 2006 period, the average groundwater levels in the San Juan Subarea declined by about 20 feet. Finally, during the 2006 to 2009 period, the average groundwater levels declined slightly (less than 5 feet). Overall, during the 1981 to 2009 period, average groundwater levels in the San Juan Subarea declined by about 25 feet.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater

levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

The stakeholders mentioned that the area is primarily planted with field crops, and very few permanent crops. The statement was made that the amount of annual plantings are based in part on the depth to groundwater, because greater depth to groundwater increases pumping costs, at some point it will become uneconomical to grow some crops. This pattern of behavior (not planting some crops when groundwater levels are low) may contribute to the recovery response in groundwater levels, and preventing long-term groundwater level declines in the subarea.

Water demands in the San Juan Subarea met by groundwater have increased by a total of about 740 acre-feet between 1997 and 2006 as shown on Table 1. Looking at just these two single years of estimated water demand data may not provide a clear picture of the annual variation in agricultural water demand in the subarea.

Table 1. Estimated Water Demands in the San Juan Subarea for 1997 and 2006

Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	5,347	0	0	0	105	5,452
Estimated 1997 Demand	(acre-feet)	4,628	0	0	0	84	4,712
Difference (2006 less 1997)	(acre-feet)	719	0	0	0	21	740
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. There was consensus among the stakeholders that groundwater levels fluctuate considerably, but that there was no real concern of long-term declining groundwater levels at this time. Because the subarea experiences periods of rising and falling groundwater levels, the stakeholders expect the cumulative change in average groundwater levels to fluctuate over time, but return to zero net change in groundwater levels (no change from 1981 levels) without implementation of large scale groundwater management activities.

Potential Groundwater Management Activities

Because of the nature of the subarea, and pattern of groundwater use, this subarea may not have the same need for Groundwater Management Activities (GMAs) as other subareas in the

Basin. The following GMA was identified by the San Juan Subarea Stakeholders to stabilize groundwater levels in the San Juan Subarea.

GMA 1: Continue monitoring and reporting on groundwater conditions: The stakeholders suggest continuing the groundwater level monitoring and reporting program. The existing monitoring network provides reasonable coverage for the subarea at this time based upon the current groundwater level conditions. Additional monitoring wells could be added, but are not considered as important as continuing to actively monitoring and reporting on groundwater levels to extend the historical period of record.

DRAFT

OVERVIEW OF THE SHANDON SUBAREA OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the Shandon Subarea is 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 Shandon 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).

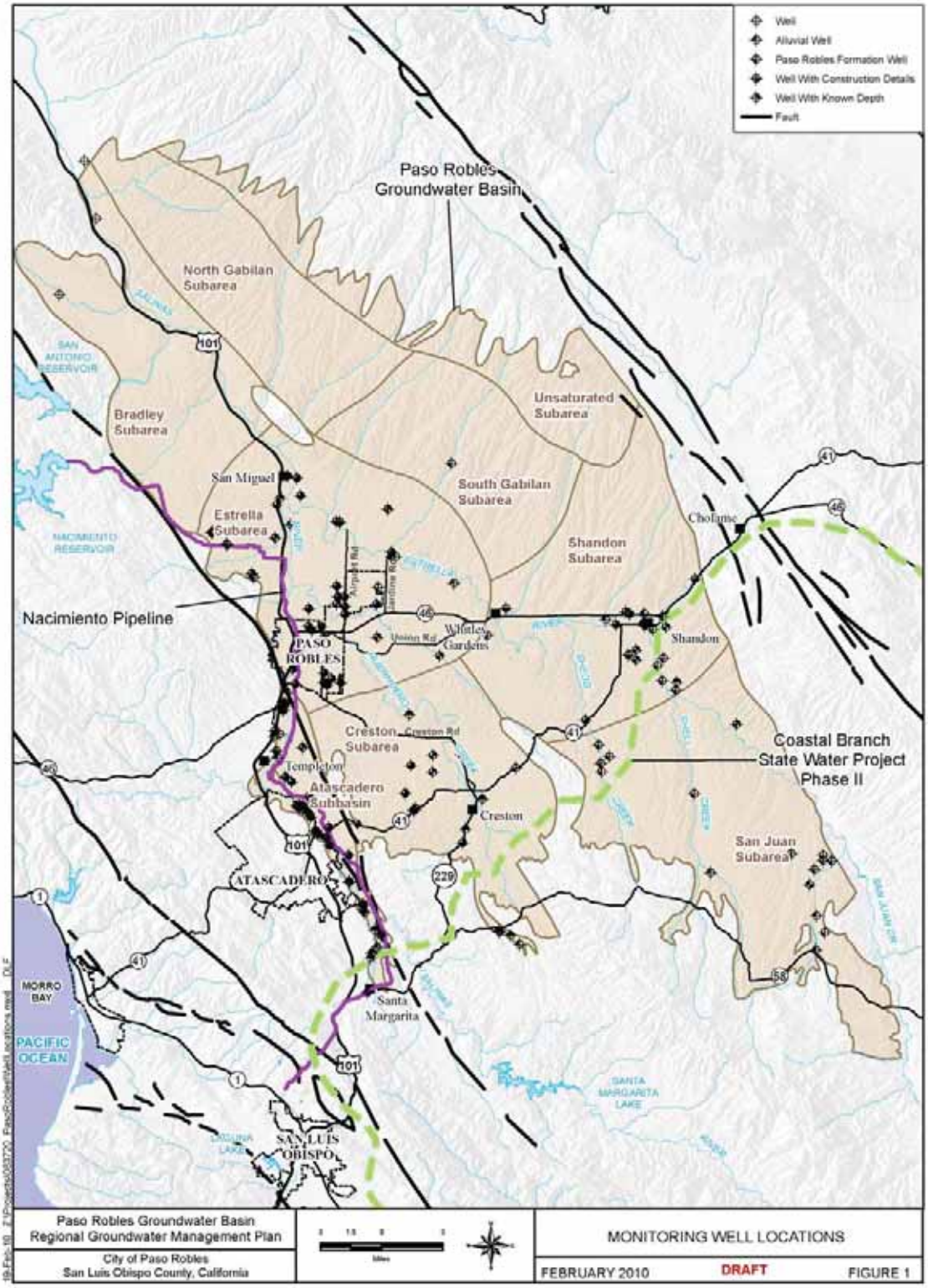

Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

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. The Atascadero MWC Station No. 34 is one of the gauges with a long, continuous period of record. The long-term average annual precipitation at this gauge is 17.6 inches per year for the 1916 to 2009 period.

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.

Shandon Subarea

The following information was summarized from existing reports and available information for the Shandon Subarea.

Land and Water Use

The Shandon Subarea is located in the eastern portion of the Paso Robles Groundwater Basin and has an area of approximately 74,800 acres, which makes up about 15 percent of the area of the Basin. This subarea includes the communities of Whitley Gardens and Shandon. Cholame Creek enters the Basin from the northeast flowing westward. It is joined by the San Juan Creek which flows northward from the San Juan Subarea, near the town of Shandon to form the Estrella River which then flows west and northwest through the Estrella Subarea and enters the Salinas River north of the City of Paso Robles.

The water use in 2006 totaled about 11,170 acre-feet representing about 12 percent of the water use in the Basin. The water users in the Shandon Subarea and their uses are delineated in Table 1. In 2006, the entire demand was met with groundwater.

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

Agriculture	Municipal	Small Community	Small Commercial	Rural	**Total**
9,896	0	218	69	987	**11,170**
(89%)	(0%)	(2%)	(<1%)	(9%)	**(100%)**

(Todd, 2009)

Local Groundwater Conditions

The historical presence of numerous flowing wells along the north flank of the Estrella River floodplain and on the south side of the river near Whitley Gardens indicates the presence of semi-confined to confined conditions beneath the Estrella River.

In the Shandon Subarea, most production wells extract water from the Paso Robles Formation. Wells in the Shandon Subarea typically range in depth from 250 to 600 feet, and average between 300 to 400 feet. Groundwater wells production ranges from 300 to 900 gallons per minute.

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 are currently 18 wells located within Shandon Subarea that are included in the groundwater monitoring network.

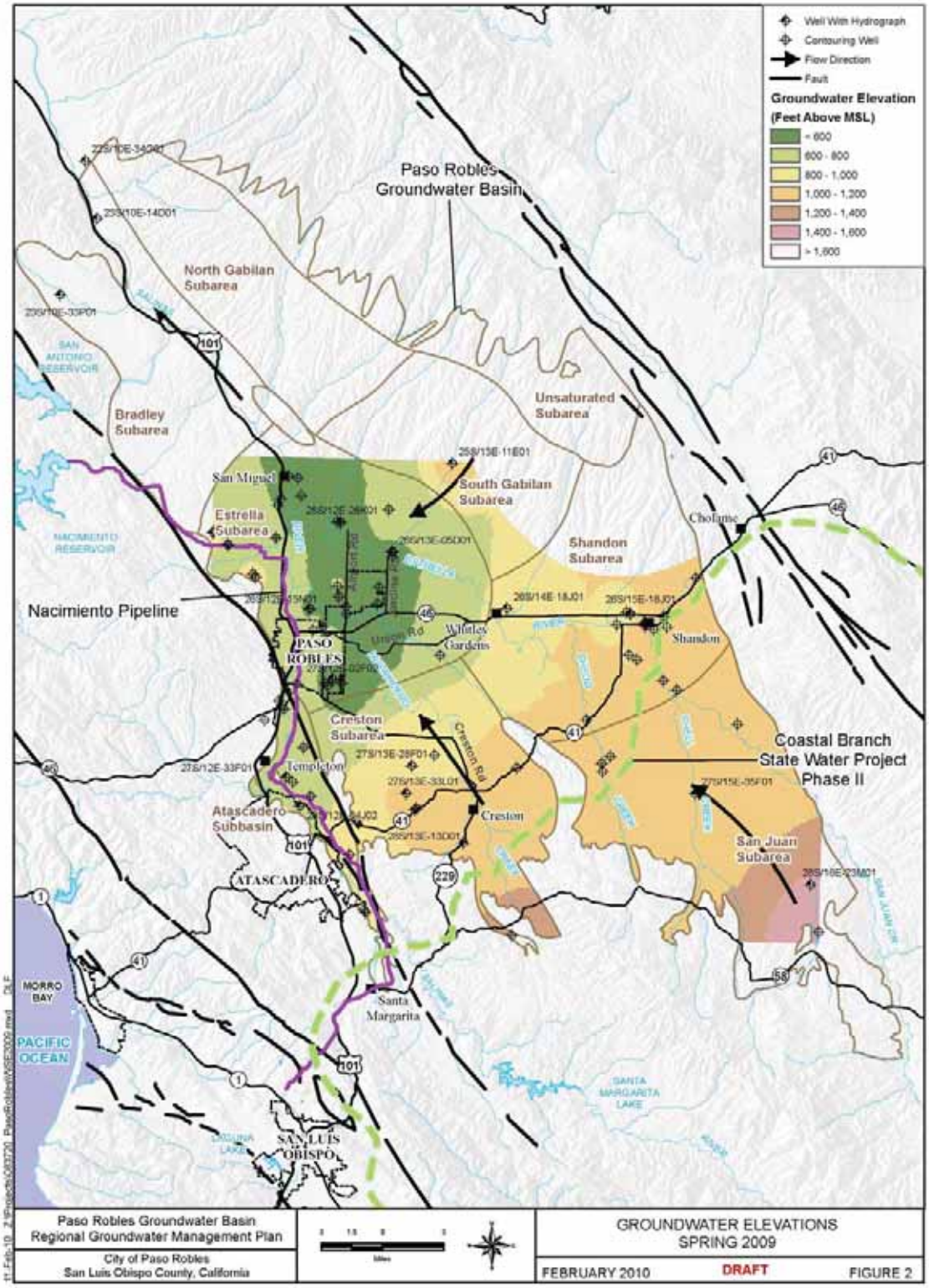

Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

Several wells have been identified in the Shandon Subarea to demonstrate how groundwater levels have changed through time (well hydrographs) at discrete locations in the subarea. These wells were selected to represent a range of the conditions in the subarea through an extended period of record. Figures 3 and 4 show the groundwater level trends in key wells in the Shandon Subarea. The locations of these wells are shown on Figure 2. A brief discussion is provided for each well.

Well 26S/14E-18J01 – This well is located east of Whitley Gardens north of the Estrella River as shown on Figure 5 and is considered to be on the eastern edge of the expanding pumping depression that is centered in the Estrella Subarea. Over the 45-year period of record, spring groundwater levels in this well declined almost 90 feet with about 30 feet of this decline in groundwater levels occurring between 1998 and 2009 as shown on Figure 3. During this 12-year period, the rate of decline of spring groundwater levels has averaged about 2.5 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels during this period has ranged from less than 5 feet up to 20 feet.

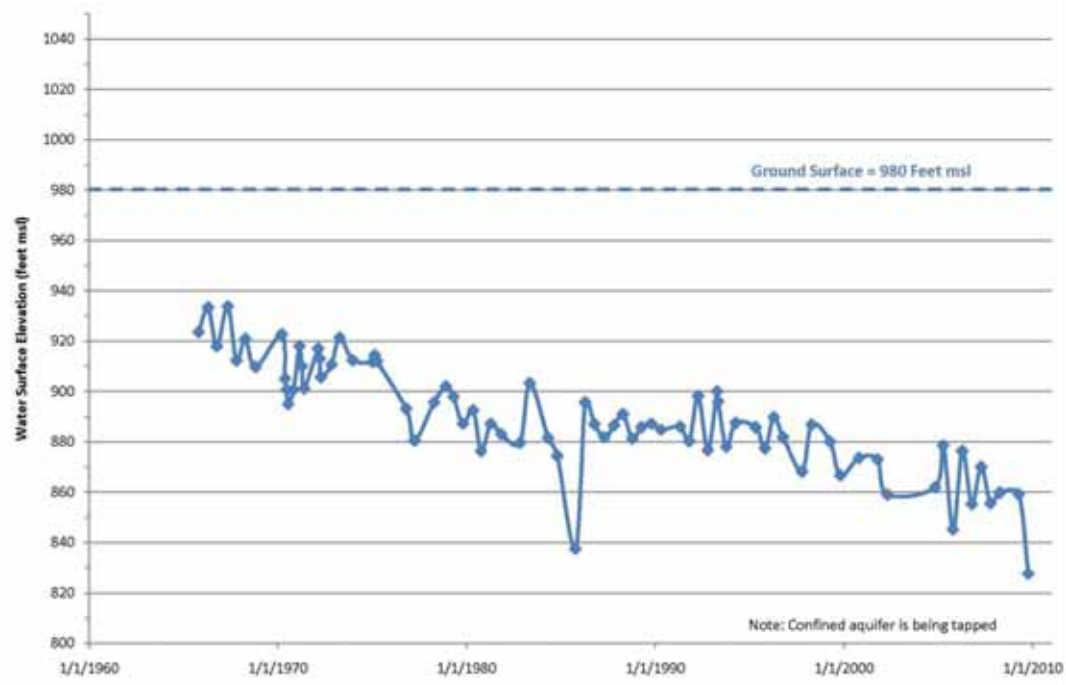

Figure 3. Hydrograph for Well 26S/14E-18J01

Well 26S/15E-18J01– This well is located near Highway 46 just west of Shandon as shown on Figure 5. Over the 45-year period of record, spring groundwater levels in this well declined almost 90 feet with about 80 feet of this decline in groundwater levels occurring between 1998 and 2009 as shown on Figure 4. During this 12-year period, the rate of decline of spring groundwater levels has averaged about 6.5 feet per year. The seasonal variation (difference between spring and fall observations) in groundwater levels during this period has ranged from less than 5 feet up to50 feet.

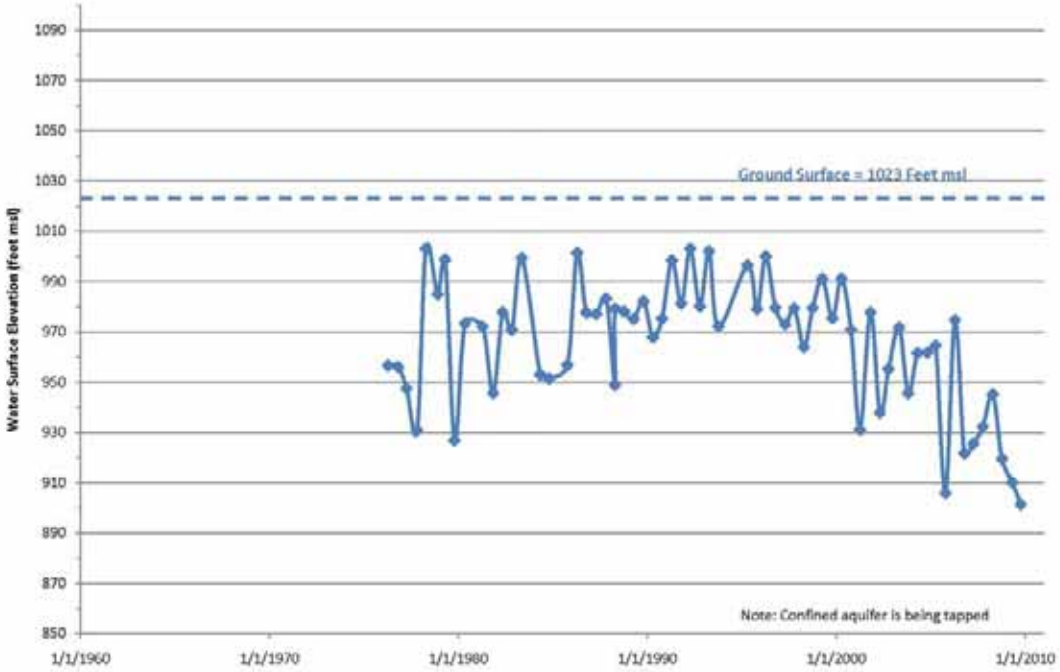

Figure 4. Hydrograph for Well 26S/15E-18J01

Change in Groundwater Storage

Overall, groundwater levels have been steadily declining in the Shandon Subarea for many years due to groundwater pumping. In the western part of the subarea near Whitley Gardens (as represented by well 26S/14E-18J01), groundwater levels have declined steadily since the 1960s.

In the central part of the subarea near Shandon (as represented by well 26S/15E-18J01), spring groundwater levels fluctuated seasonally, and declined from the mid-1970s until about 1990. Spring groundwater levels were fairly stable through the mid-1990s, but began to decline from the late 1990s to present.

Between 1997 and 2009 groundwater levels near Shandon have declined by more than 60 feet as shown on Figure 5. During this period groundwater levels near Whitley Gardens has declined by about 30 to 40 feet. Figures 3 and 4 show that both of these areas have experienced similar levels of total decline in groundwater levels.

Other parts of the Shandon Subarea show groundwater level declines on the order of 20 to 30 feet during the 1997 and 2009 period. Additional observations wells are needed in western part of the subarea to provide more complete mapping of the groundwater levels in the area.

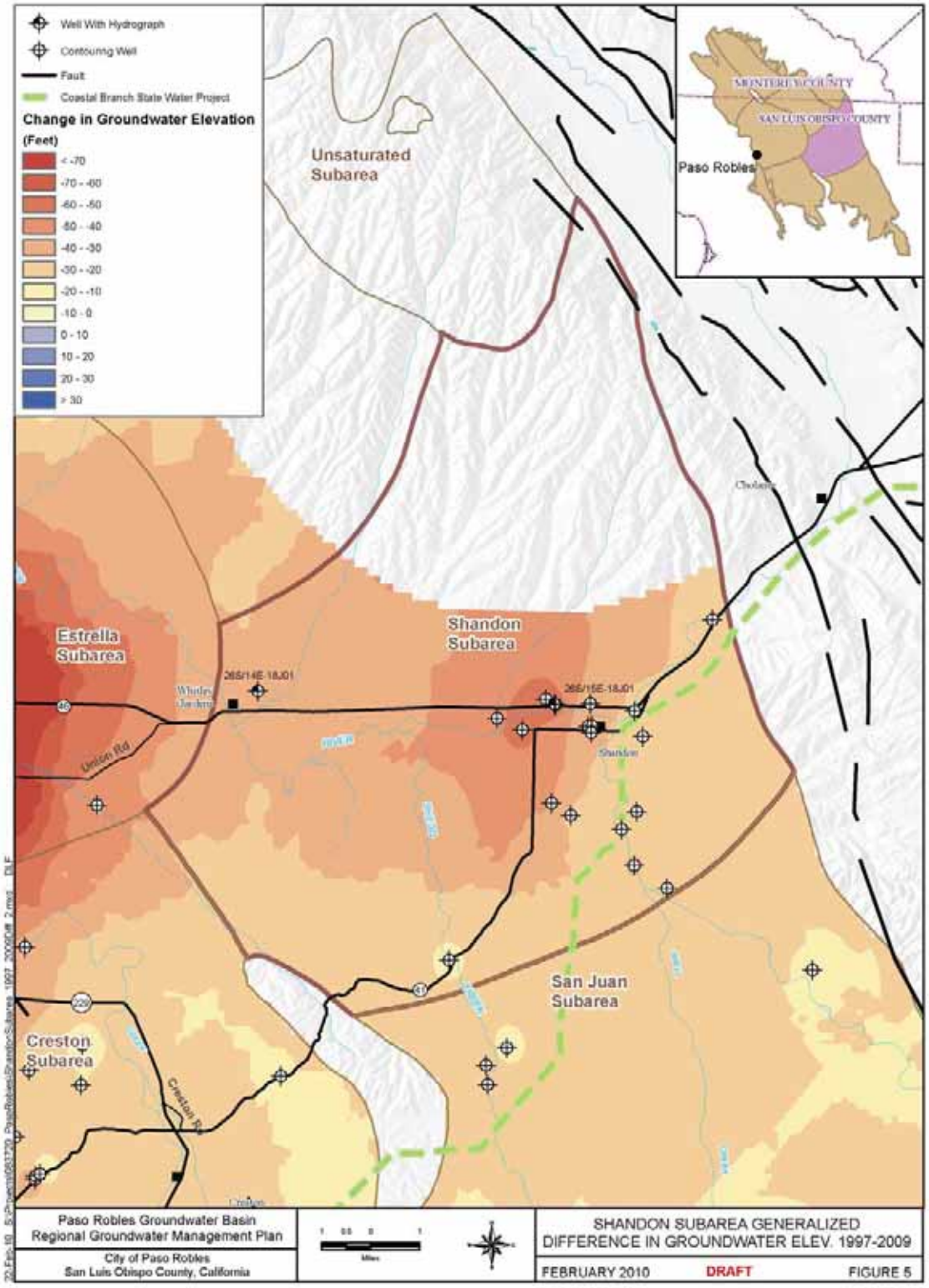

Figure 5. Change in Groundwater Levels in the Shandon Subarea for the 1997 to 2009 Period

Groundwater Quality Information

The general mineral quality of groundwater in the Shandon subarea is also of variable quality, with relatively highly mineralized sodium chloride-sulfate water on the east side of the subarea, and calcium-sodium bicarbonate water with lower total dissolved solids (TDS) between Shandon and Whitley Gardens.

Groundwater quality in the subarea is generally good to moderate for municipal use. TDS, a measurement of the salts in the water, is typically used to assess water quality. For municipal purposes, the TDS should be less than 500 mg/l, but can be usable up to 1,000 mg/l. TDS concentrations in local municipal supply wells, as reported in the 2007 Consumer Confidence Report for County Service Area 16 (Shandon), ranged from 360 to 450 mg/l, averaging 405 mg/l.

Most groundwater samples reviewed in the subarea have either no irrigation restrictions or a slight restriction on irrigating trees and vines due to potential sodium ion toxicity. A moderate irrigation restriction due to potential sodium and chloride ion toxicity generally exists east of Shandon (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

Summary of Basin Management Objective Workshop
For the Shandon Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Shandon Subarea of the Paso Robles Groundwater Basin were discussed and developed by stakeholders of the Shandon Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the Shandon Subarea that attended the Workshop are listed below:

Name	Affiliation
Mike Clay	Red Cedar Vineyard
Dennis Bowman	Green River Mutual Water
Greg Jaeger (South Gabilan)	Rural Resident
Sydney Wattles	Shandon Home-Owner
Keith Larson	City of Paso Robles
Frank Mecham	SLO County
Kate Twisselman	Shandon Advisory Committee
Raymond Twisselman	Shandon Resident
Les Diffenbaugh	Shandon Resident
Fritz Helzer	Shandon Hills Vineyard

Courtney Howard (San Luis Obispo County Public Works Department Staff) recorded the information discussed by the Shandon Subarea Stakeholders. One stakeholder from the South Gabilan Subarea attended the workshop and participated in the discussions of the Shandon Subarea stakeholders.

While not all of the Shandon Subarea stakeholders are experiencing the same magnitude of groundwater level decline or type of groundwater quality deterioration, they generally reached consensus on the level of Basin Management Objectives, and some of the Groundwater Management Activities. One of the biggest concerns was the cost of the GMAs identified, and their overall cost effectiveness at improving groundwater levels in the subarea.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Shandon Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Shandon Subarea are currently recorded at 18 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Shandon Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea (shown on Figure 1) for the 1981 to 2009 period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

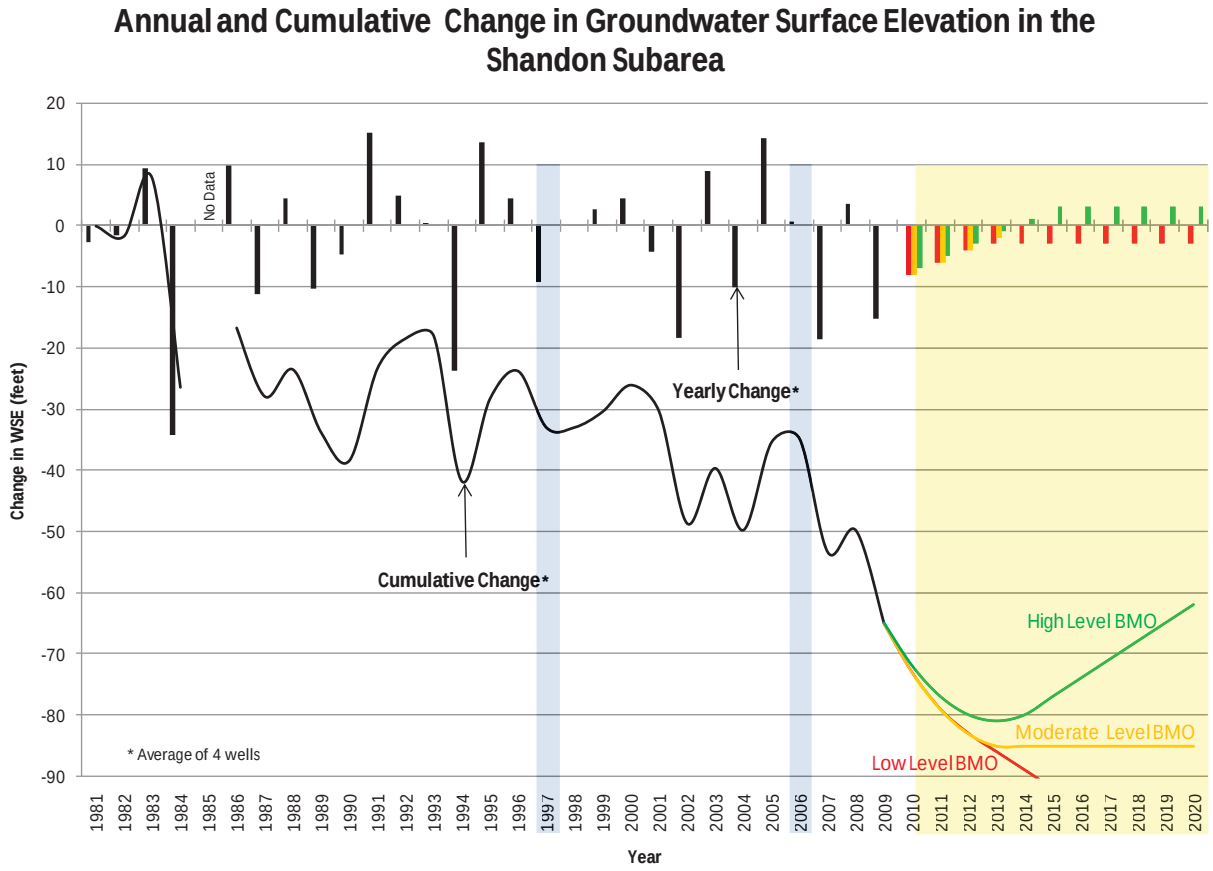

Figure 1. Composite Hydrograph of Four Selected Wells in the Shandon Subarea

Based on the composite hydrograph shown in Figure 1, the Shandon Subarea shows a wide range of annual changes in groundwater levels, with a general trend of declining groundwater levels.

During the 1981 to 1997 period, average groundwater levels in the Shandon Subarea have declined by about 33 feet. During the 1997 to 2006 period, average groundwater levels fluctuated annually, but resulted in very little net decline (about 2 feet) compared to 1997 levels. Finally, from 2006 to 2009 period, the average groundwater levels declined by about 30 feet. Overall, during the 1981 to 2009 period (28 years), average groundwater levels in the Shandon Subarea declined by about 65 feet (about 2.3 feet per year), in response to a combination of increasing in water demands that are met by groundwater, and in the later years of the period, a series of dry years.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Shandon Subarea met by groundwater increased by about 1,600 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Shandon Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE SHANDON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,896	0	0	69	1,205	11,170
Estimated 1997 Demand	(acre-feet)	8,566	0	0	51	969	9,586
Difference (2006 less 1997)	(acre-feet)	1,330	0	0	18	236	1,584
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The stakeholders were initially concerned that the only way to stop the declining groundwater levels was to force people to stop pumping. Initially, the discussions of the group suggested a 'survival of the fittest' approach to groundwater pumping where only those with the deepest wells and the ability to afford pumping would continue to pump as costs increased. The others would be put out of business or be forced to make changes to their water use requirements.

After continued discussions, it was generally agreed that stabilizing groundwater levels was an appropriate objective at this time, but there is a concern about the cost and feasibility of stabilizing groundwater levels.

Potential Groundwater Management Activities

The stakeholders reached consensus that there was no single activity that would solve the problem, but that the solution will likely involve a combination of activities. The following Groundwater Management Activities (GMAs) were identified by the Shandon Subarea stakeholders to stabilize groundwater levels in the Shandon Subarea. The potential benefit from these GMAs has not been quantified for the Shandon Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Groundwater Recharge and Banking Programs: The discussions did not focus on the details of this project or the approach, but did identify potential groundwater recharge or banking of either imported supplies or from storm water runoff as potential sources of groundwater recharge. One potential project that was discussed was an inflatable dam project such as was done along the Salinas River in Northern Monterey County. No additional details were provided on that potential project.

GMA 2: State Water Project supplies for Shandon: The community of Shandon has not used its 100 acre-feet of State Water Project water (SWP) to date. This project would include tying in to the Coastal Branch were it passes through Shandon to access the 100 acre-feet of supply. SWP supplies on the Coastal Branch are treated at the Polonio Pass Water Treatment Plant. This project would reduce municipal groundwater pumping in the Shandon area by the amount delivered from the SWP, thereby reducing groundwater pumping.

An alternative of this GMA would be to pursue additional SWP supplies that could also be delivered to Shandon. San Luis Obispo County has a contract allocation to additional SWP supplies that it has not used, and is not currently using. These supplies could be a potential source of water to the area. Additional capacity in Phase II of the Coastal Branch would be needed to deliver water in excess of the 100 acre-feet supply currently contracted to Shandon by the County. An investigation regarding the additional capacity of the Coastal Branch is currently being pursued by the District.

GMA 3: Formation of Irrigation District or Water District: The discussion focused on the potential need to form an irrigation district or water district to import surface water into the Paso Robles Groundwater Basin. Irrigation Districts/Water Districts are often formed to pursue large projects that benefit a larger group of water users. Such a district may be formed to

pursue a groundwater recharge or water banking project that would rely on imported surface water.

GMA 4: Increase water conservation education and implementation: The stakeholders recognized that additional conservation may result in a water savings, but were not sure if it would be cost effective. There was no objection to promoting conservation, and some discussions explored different conservation methods (such as alternative frost-control measures) since most growing operations are already on drip, and landscaping in Shandon is generally modest.

GMA 5: Precipitation Enhancement: This was brought up for discussion, but it was unclear whether this project would work for the Shandon area.

DRAFT

Summary of Basin Management Objective Workshop
For the Atascadero Subbasin

The draft Basin Management Objectives (BMOs) for groundwater levels in the Atascadero Subbasin were discussed and developed by stakeholders of Atascadero Subbasin at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Atascadero Subbasin that attended the Workshop are listed below:

Name	Affiliation
Della Barret	Resident (private well or AMCW)
Kathy Sweet	Resident (private well or AMCW)
Keith Larson	City of Paso Robles
Bob Roos	Resident (private well or AMCW)
Jackie Magill	Resident (private well or AMCW)
John Neil	Atascadero Mutual Water Company
John Hollenbeck	Resident (private well or AMCW)
Carrie Jones	Resident (private well or AMCW)
Jay Short	Templeton CSD
Susan Litteral	Resident (private well or AMCW)/NRCS

Jim Magill recorded the information discussed by the Atascadero Subarea Stakeholders. The Atascadero Subbasin Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Atascadero Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date. The changes in groundwater levels in the Atascadero Subbasin are currently recorded at 33 wells that are included in the groundwater monitoring network.

Groundwater Levels in the Atascadero Subbasin are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subbasin is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

Groundwater levels in the Atascadero Subbasin tend to have a greater range in annual response than other subareas, with average groundwater levels increasing or decreasing by up to 15 feet in single years. The overall trend of the average groundwater levels has remained relatively constant since the early 1980s with groundwater levels rising and falling in response to changing hydrologic conditions and increasing demands. The 2009 average groundwater levels are within ten feet of the 1981 levels as shown on Figure 1. Based on the pattern exhibited on this figure, a single wet year could return the average groundwater levels to the 1981 conditions. It is not clear how the increase in demands since the late 1990s likely contributes to the overall declining groundwater levels of about 30 feet during the 1997 to 2009 period.

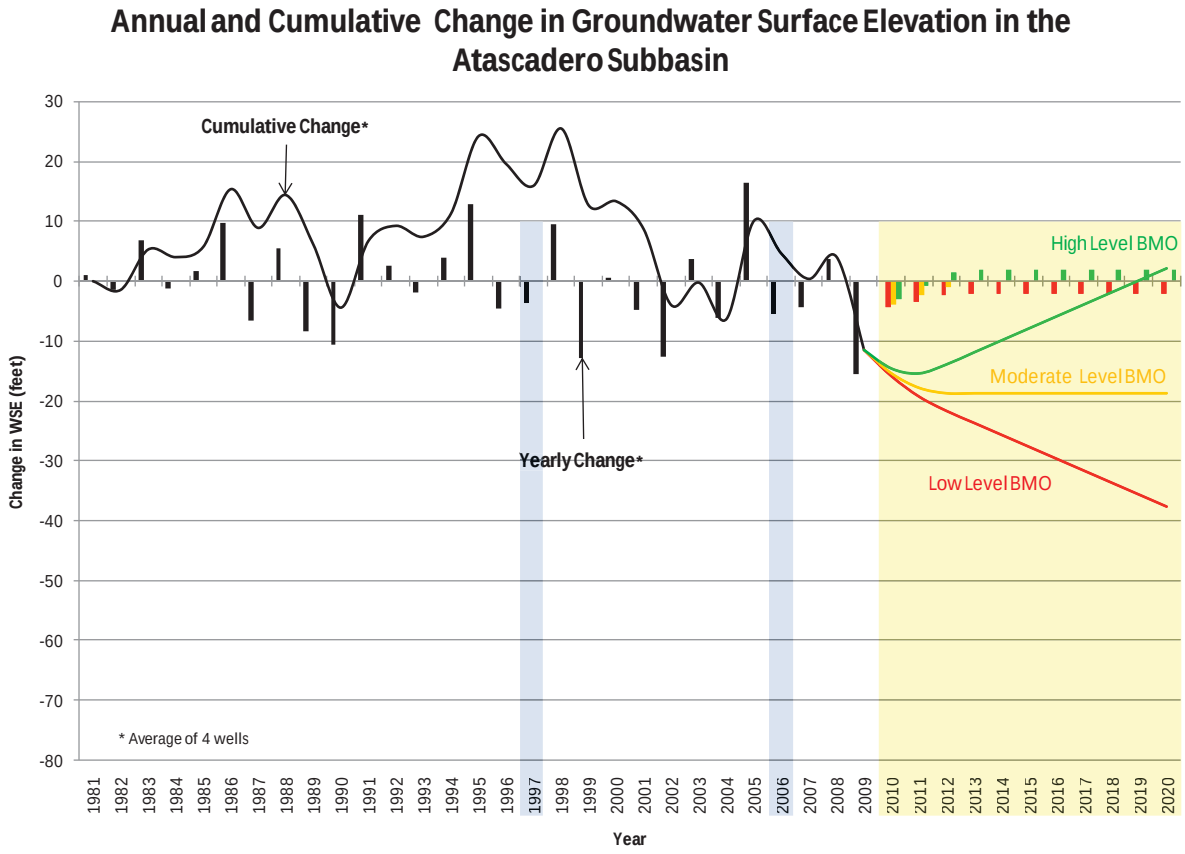

Figure 1. Composite Hydrograph of Four Selected Wells in the Atascadero Subbasin

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Atascadero Subarea met by groundwater increased by about 1,000 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period, likely contributed to the increased rate of groundwater level decline (about five feet per year) during this period.

Table 1. Estimated Water Demands in the Atascadero Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ATASCADERO SUBBASIN							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,348	11,735	0	430	2,032	15,545
Estimated 1997 Demand	(acre-feet)	1,023	11,376	0	300	1,800	14,499
Difference (2006 less 1997)	(acre-feet)	325	359	0	130	232	1,046

2006 Demand Assumptions: Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)

1997 Demand Assumptions: 1997 Demands form Paso Robles Groundwater Basin Study (Fugro, 2002)
Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.
1997 Municipal demand includes City of Paso Robles groundwater pumping from river wells(3,933 acre-feet)
Small community demands included in rural domestic demand

Draft Basin Management Objectives

The Atascadero Subbasin stakeholders determined that an acceptable draft BMO for groundwater levels in the Atascadero Subbasin would include stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells). This draft BMO had strong consensus among the participants.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Atascadero Subbasin Stakeholders to stabilize groundwater levels in the Atascadero Subbasin. The potential benefit from these GMAs has not been quantified for the Atascadero Subbasin (in terms of changes in groundwater

levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Atascadero Subbasin through the addition of new wells to the volunteer monitoring network.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis. Atascadero Mutual Water Company, City of Paso Robles and Templeton Community Services District collect water level data that is provided to the District for inclusion in the monitoring program.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users and impacts on groundwater level trends in the area. The effectiveness of this GMA will be evaluated on an annual basis.

This GMA had large consensus of the Atascadero Subbasin stakeholders. Some of the specific water conservation activities identified include:

- Municipal water purveyors have implemented some level of conservation to date. The effectiveness of these efforts can be tracked by the delivery volumes. Because municipal water demands compose the largest single demand type in the subbasin, there is the greatest opportunity for reduction in groundwater pumping. Based on 2006 municipal demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 880 acre-feet per year.
- Agricultural Water Conservation (opportunities for reductions in groundwater pumping resulting from agricultural conservation programs may be limited in the Atascadero Subbasin due to the comparatively small agricultural demand). Based on 2006 agricultural

demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 130 acre-feet per year.

- Rural Residential Water Conservation (opportunities for reductions in groundwater pumping resulting from rural residential conservation programs may be limited in the Atascadero Subbasin due to the comparatively small rural residential demand). Based on 2006 rural domestic demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 200 acre-feet per year. Water conservation programs in the rural residential sector may focus on the following:
    - Landscape Water Use
    - Consider controls on non-agricultural ponds
    - Development of conservation outreach and incentive programs implemented by San Luis Obispo County

Responsibility for implementing certain components of this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District. The Atascadero Mutual Water Company, City of Paso Robles, and Templeton Community Services District are responsible for implementing water conservation programs within their service areas.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of water demand in the subbasin. In areas outside the jurisdiction of the cities of Atascadero and Paso Robles, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. The cities have implemented land use policies that limit water use rates and promote water conservation, such as limiting turf in new development. In addition, higher water rates paid by city water customers encourage efficient water use. Any policies established in areas where San Luis Obispo County has jurisdiction would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- Discretionary lots splits would require meters on the new well and the existing well
- No net increase in water use resulting from additional rural residential development
- Promote greywater use
- Minimize turf areas
- Meter new wells
- Offset water use
- Explore opportunities for residential rainwater harvesting

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building and the cities of Atascadero and Paso Robles.

DRAFT

GMA 4: Maximize the amount of Nacimiento Project Water in the Subbasin: This GMA includes utilizing the existing Nacimiento Project Water already acquired for use in the subbasin, and explore opportunities to utilize unassigned Nacimiento Project Water.

The San Luis Obispo County Flood Control and Water Conservation District would be one of the lead agencies responsible for implementing this GMA. Local water purveyors would be responsible for developing and implementing projects to acquire supplies from the Nacimiento Water Project.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building, and City of Atascadero would likely be the lead agencies responsible for implementing this GMA.

DRAFT

Summary of Basin Management Objective Workshop For the Bradley and North Gabilan Subareas

The draft Basin Management Objectives (BMOs) for groundwater levels in the Bradley and North Gabilan Subareas were discussed and developed by stakeholders at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Paso Robles City Council Chambers. The stakeholders from the subareas that attended the workshop are listed below:

Name	Affiliation
Robert Johnson	Monterey County Water Resources Agency
Keith Larson	City of Paso Robles
Christopher Alakel	City of Paso Robles
Courtney Howard	San Luis Obispo County

Courtney Howard recorded the information discussed by the stakeholders.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated every few years as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Bradley and North Gabilan Subareas are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Bradley Subarea are currently recorded at one well that is included in the groundwater monitoring network of Monterey County Water Resources Agency (MCWRA). This well is located near the Salinas River just north of the subarea boundary, and may not be representative of groundwater levels throughout the Bradley or North Gabilan Subareas. The lack of data prevents the development of groundwater level hydrographs, or composite hydrographs as developed for other subareas. The lone hydrograph available for these two subareas is shown in Figure 1.

The hydrograph shown in Figure 1 is for a well located near the Salinas River downstream of the confluence of the Salinas River and the Nacimiento River. It appears that groundwater levels in this well reflect the interaction of the Salinas River and the alluvial aquifer materials adjacent to the river. Flows

from the Salinas River, along with releases from Nacimiento Reservoir, help maintain groundwater levels in alluvial aquiver near the Salinas River.

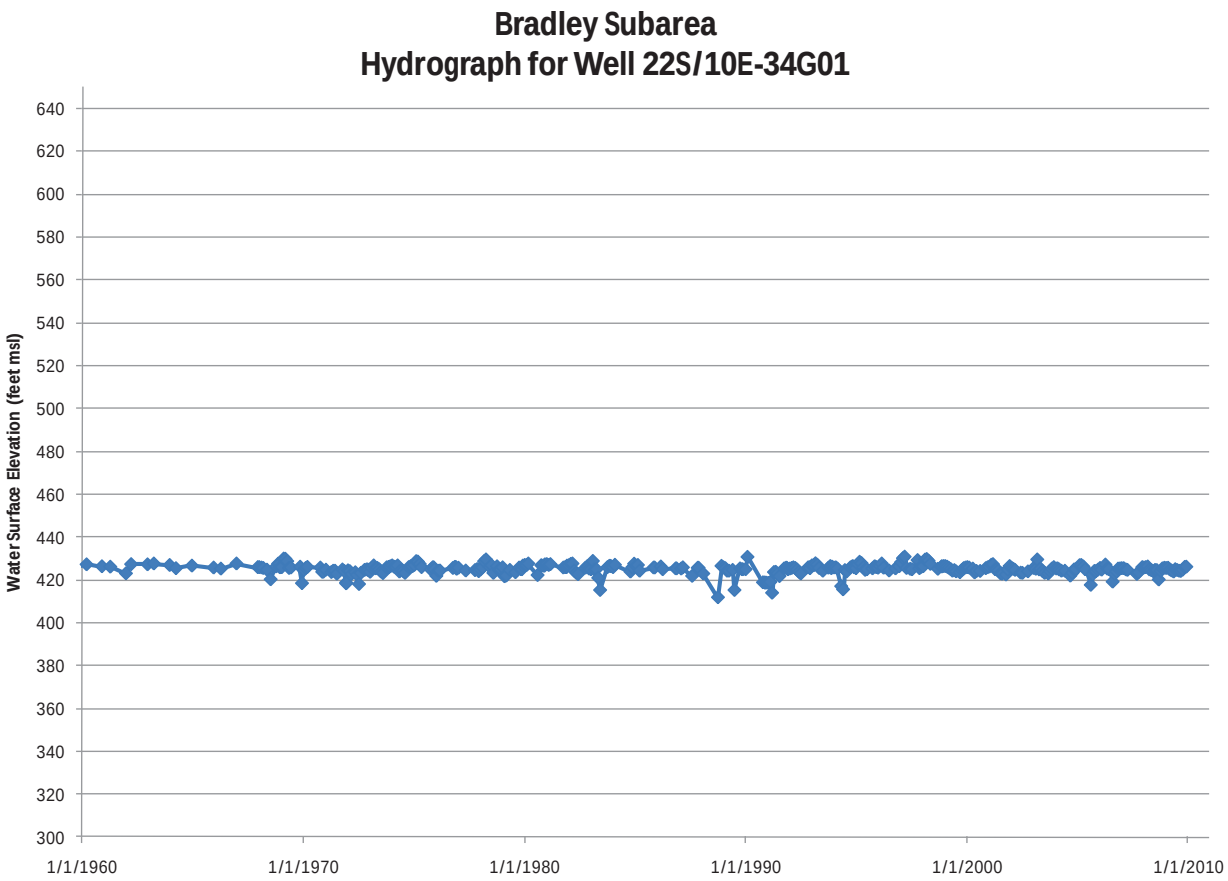

Figure 1. Well Hydrograph in the Bradley Subarea

At this time, we are not aware of any reports or anecdotal information that suggests groundwater levels in the Bradley Subarea or the North Gabilan Subarea are declining to the point of causing problems for local groundwater users.

Water demands in the Bradley Subarea met by groundwater have increased by total of about 1,000 acre-feet between 1997 and 2006 as shown on Table 1.

Table 1. Estimated Water Demands in the Bradley Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE BRADLEY SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	6,933	0	0	184	109	7,226
Estimated 1997 Demand	(acre-feet)	6,001	0	0	136	88	6,225
Difference (2006 less 1997)	(acre-feet)	932	0	0	48	21	1,001
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Water demands in the North Gabilan Subarea met by groundwater have increased by total of about 250 acre-feet between 1997 and 2006 as shown on Table 2.

Table 2. Estimated Water Demands in the North Gabilan Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE NORTH GABILAN SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,758	0	0	0	51	1,809
Estimated 1997 Demand	(acre-feet)	1,522	0	0	0	41	1,563
Difference (2006 less 1997)	(acre-feet)	236	0	0	0	10	246
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. As described above there is very little available information to support the development of very targeted BMOs. Based on the available information, the BMO for the Bradley Subarea and the North Gabilan Subarea are to maintain groundwater levels high. The lack of an extensive monitoring network in this part of the Basin will prevent more detailed analysis of this.

Potential Groundwater Management Activities

GMA 1: Continue monitoring and reporting on groundwater conditions: Continue and improve monitoring – look to add monitoring well near the SLO-Monterey county boundary between the Nacimiento River and the town of San Miguel

GMA 2: Consider reestablishing Cloudseeding Program: Consider benefits of re-establishing the cloud seeding program in the Nacimiento and San Antonio watersheds. Cloud seeding was conducted in the past by MCWRA, and is estimated to have increased outflow of Lake Nacimiento and San Antonio Reservoirs by about 20 percent.

Summary of Basin Management Objective Workshop
For the Creston Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Creston Subarea were discussed and developed by stakeholders of Creston Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Creston Subarea that attended the Workshop are listed below:

Name	Affiliation
Sue Luft	WRAC/Grower/RR
Karl Luft	Grower/RR
Sheila Lyons	Rural Resident
David Lyons	Rural Resident
Dana Merrill	Grower
Fritz Helzer	Grower
Claudia Engel	Creston AB
Pam Finley	Templeton AAG

Sue Luft recorded the information discussed by the Creston Subarea Stakeholders. The Creston Subarea Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Creston Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Creston Subarea are currently recorded at 13 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Creston Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to

represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

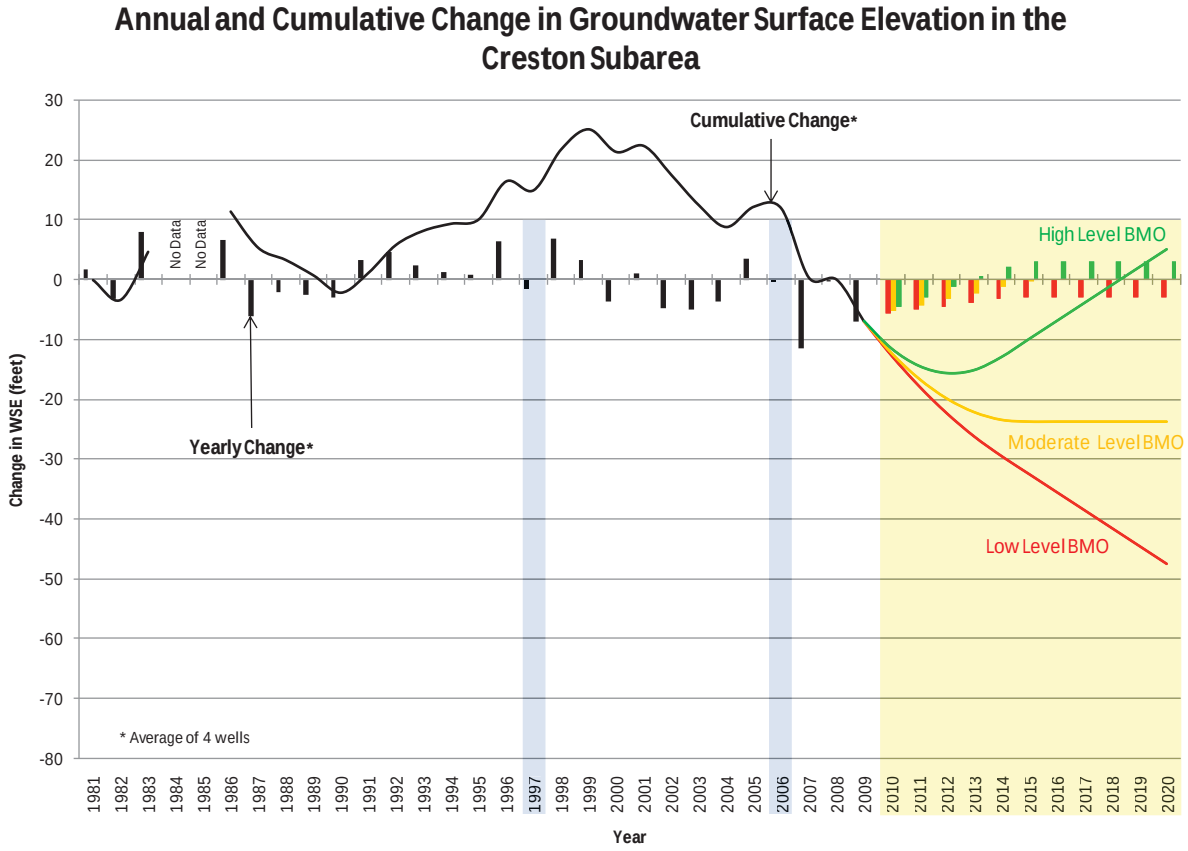

Figure 1. Composite Hydrograph of Four Selected Wells in the Creston Subarea

The average groundwater levels in the subarea appear to have peaked at about 1999. Since this time, groundwater levels have generally declined. This may be due in part to the increase in water demands between 1997 and 2006. During the 1997 to 2006 period, average groundwater levels have declined by less than five feet, but during the 2006 to 2009 period, the average groundwater levels declined by about 20 feet, so it appears that the increase in demands and the numerous dry years have contributed to the declining groundwater levels currently being experienced.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline of groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Creston Subarea met by groundwater increased by about 1,800 acre-feet during the 1997 to 2006 period as shown on Table 1. This information does identify when this increase occurred, but it is likely to have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about seven feet per year) during this period.

Table 1. Estimated Water Demands in the Creston Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE CRESTON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,936	0	0	37	2,338	12,311
Estimated 1997 Demand	(acre-feet)	8,600	0	0	27	1,880	10,507
Difference (2006 less 1997)	(acre-feet)	1,336	0	0	10	458	1,804
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The Creston Subarea stakeholders determined that an acceptable draft BMOs for groundwater levels in the Creston Subarea would include stopping the current rate of decline experienced in the last 10 years, and stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells) in the next five to ten years.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Creston Subarea Stakeholders to stabilize groundwater levels in the Creston Subarea. The potential benefit from these GMAs has not been quantified for the Creston Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Creston Subarea through the addition of new wells to the volunteer monitoring network. Additional wells would be needed in the northwest portion of the subarea near the Estrella Subarea where historic groundwater level decline has been the greatest.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the

Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users. The effectiveness of this GMA will be evaluated on an annual basis. Some of the specific water conservation activities identified include:

- Agricultural Water Conservation
- Rural Residential Water Conservation
    - Landscape Water Use
    - Consider controls on non-agricultural ponds

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of rural residential development in the subarea. Throughout much of the Basin, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. Any policies established would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- No net increase in water use resulting from additional rural residential development

The San Luis Obispo County Department of Planning and Building would likely be responsible for implementing this GMA.

GMA 4: Preventing export of groundwater from the Basin: This GMA includes identifying potential activities that result in exporting groundwater from the Basin. At this time, additional information is necessary to quantify the occurrence of groundwater pumping for export from the Basin.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

DRAFT

Summary of Basin Management Objective Workshop
For the Estrella Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Estrella Subarea were discussed and developed by stakeholders of Estrella Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Estrella Subarea that attended the Workshop are listed below:

Name	Affiliation
Joy Sprague	Rural Resident
Walter Heer	
Christopher Alakel	City of Paso Robles
Chuck Pritchard	Upper Salinas/Las Tablas Resource Conservation District (US/LT RCD)
Jerry Reaugh	Grower
Lisa Bodrogi	(Paso Robles Wine Country Alliance (PRWCA)
Joe Plummer	Grower
Debra Compton	Grower
Steve Carter	Grower
John Wallace	San Miguel CSD
Tom Zehnder	

Iris Priestaf recorded the information discussed by the Estrella Subarea Stakeholders. The Estrella Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives, but did not reach consensus on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Estrella Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

DRAFT

The changes in groundwater levels in the Estrella Subarea are currently recorded at 50 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Estrella Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of six wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

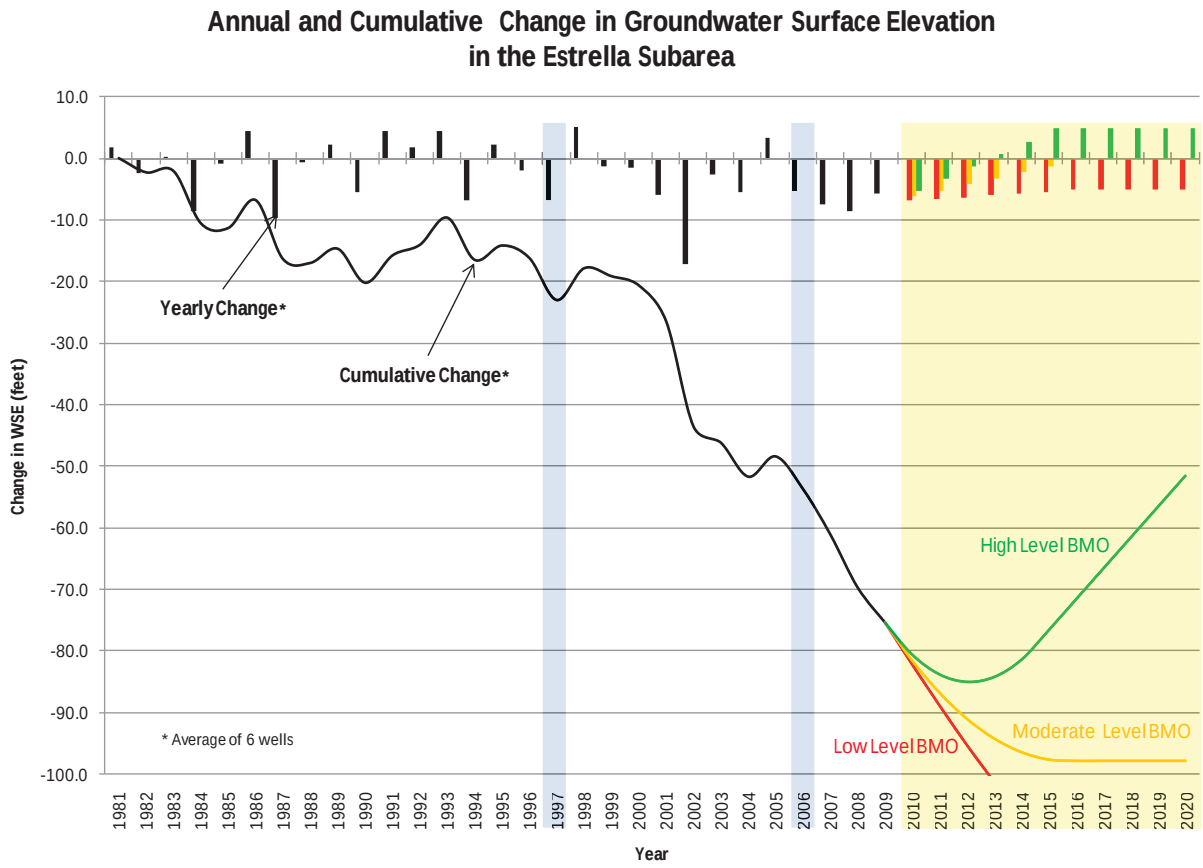

Figure 1. Composite Hydrograph of Six Selected Wells in the Estrella Subarea

Based on the composite hydrograph shown in Figure 1, the average groundwater levels in the Estrella Subarea have declined by about 20 feet between 1981 and 1997. Then, between 1997 and 2006 average groundwater levels have declined by an additional 30 feet. During this same period, water demands in the Estrella Subarea met by groundwater have increased by a total of about 6,300 acre-feet as shown on Table 1. Finally, from 2006 to 2009 the average groundwater levels declined by about 35 feet. During the 1981 to 2009 period, average groundwater levels in the Estrella Subarea declined by about 80 feet, in response to a combination of increasing in water demands that are met by groundwater and a series of dry years in the later years of the period.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Estrella Subarea met by groundwater increased by about 6,300 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands contributed to the significant decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (almost 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Estrella Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ESTRELLA SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	23,111	3,930	0	1,603	5,433	34,077
Estimated 1997 Demand	(acre-feet)	20,004	2,137	0	1,186	4,368	27,695
Difference (2006 less 1997)	(acre-feet)	3,107	1,793	0	417	1,065	6,382
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						
	1997 Municipal demand includes City of Paso Robles groundwater pumping from basin wells(1,911 acre-feet) and San Miguel (226 acre-feet)						
	Small community demands included in rural domestic demand						

Draft Basin Management Objectives

Three levels of BMOs were discussed by the Estrella Subarea stakeholders. There was consensus that groundwater level declines are a shared problem for the subarea, and that the severity of decline varies across the area. It was also identified that the proposed low-level BMO (essentially do-nothing) was unacceptable.

The medium level BMO of stabilizing groundwater levels was identified as a reasonable objective at this time, but there was concern about the cost and feasibility.

The high-level BMO of recovery of groundwater levels was identified as desirable by private domestic wells owner, but the group agreed that such an objective was over-reaching at this time.

Potential Groundwater Management Activities

The stakeholders reached consensus that there is no magic bullet that will solve the problem, but that the solution will likely involve a combination of activities such as additional water conservation, Nacimiento water supplies, a groundwater recharge program (e.g. using State Water Project or urban runoff), redistribution of pumping, and wastewater discharge/water recycling.

The following Groundwater Management Activities (GMAs) were identified by the Estrella Subarea Stakeholders to stabilize groundwater levels in the Estrella Subarea. The potential benefit from these GMAs has not been quantified for the Estrella Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase data collection and monitoring and reporting on groundwater conditions: It was determined that there is enough information to know that there is a problem, however, additional and better information is needed to further understand the problem.

The stakeholders recognize that this GMA does not directly result in changes in groundwater levels, but will help communicate condition to individuals and support implementation of groundwater management activities in the subarea. It was recognized that additional private wells need to be made part of the County well network on a voluntary basis. This is particularly true in specific areas within the subarea currently lacking wells in the water level monitoring network.

GMA 2: Increase water conservation education and implementation: The stakeholders recognized that additional conservation is needed. Some stakeholders felt that the amount of savings that can be achieved is limited. Other stakeholders felt that additional conservation in the agricultural sector could play a significant role in reducing groundwater demand and achieving the BMO of stabilizing water levels. There were several discussions about the potential additional savings from conservation, but consensus could not be reached about the potential savings that could be achieved by the different water use categories (urban, agricultural, and rural). During the conversations each group stated that they believed there was limited opportunity for additional gains from conservation in their demand type, but believed additional conservation could be achieved in other demand types.

GMA 3: Nacimiento Project Water: The stakeholder reached consensus regarding the use of Nacimiento Project Water help alleviate the groundwater decline problem, but it was also recognized as not being the sole solution.

Issues Lacking Consensus

The two primary issues lacking consensus in the subarea was the degree to which additional conservation could be implemented for urban, agricultural, and rural uses.

The Paso Robles Groundwater Basin has largely centralized management because of a lack of water districts or local water agencies, so there was no consensus about the agency or organization that would have the responsibility for prioritizing and implementing the identified groundwater management activities.

DRAFT

Summary of Basin Management Objective Workshop
For the San Juan Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the San Juan Subarea of the Paso Robles Groundwater Basin (Basin) were discussed and developed by stakeholders of San Juan Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the San Juan Subarea that attended the Workshop are listed below:

Name	Affiliation
Amy Gillman	5th District Legislative Assistant
Steve Sinton	Shandon
Randy Diffenbaugh	Shandon Advisory Committee
Susan Litteral	Natural Resource Conservation Service
Doug Felipponi	SJV FET
Mary Russell	Shandon

Susan Litteral recorded the information discussed by the San Juan Stakeholders.

The San Juan Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives and on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the San Juan Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the San Juan Subarea are currently recorded at 10 wells that are included in the groundwater monitoring network. Overall, groundwater levels have been fairly stable in the San Juan Subarea. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1 for the 1981 to 2009

period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

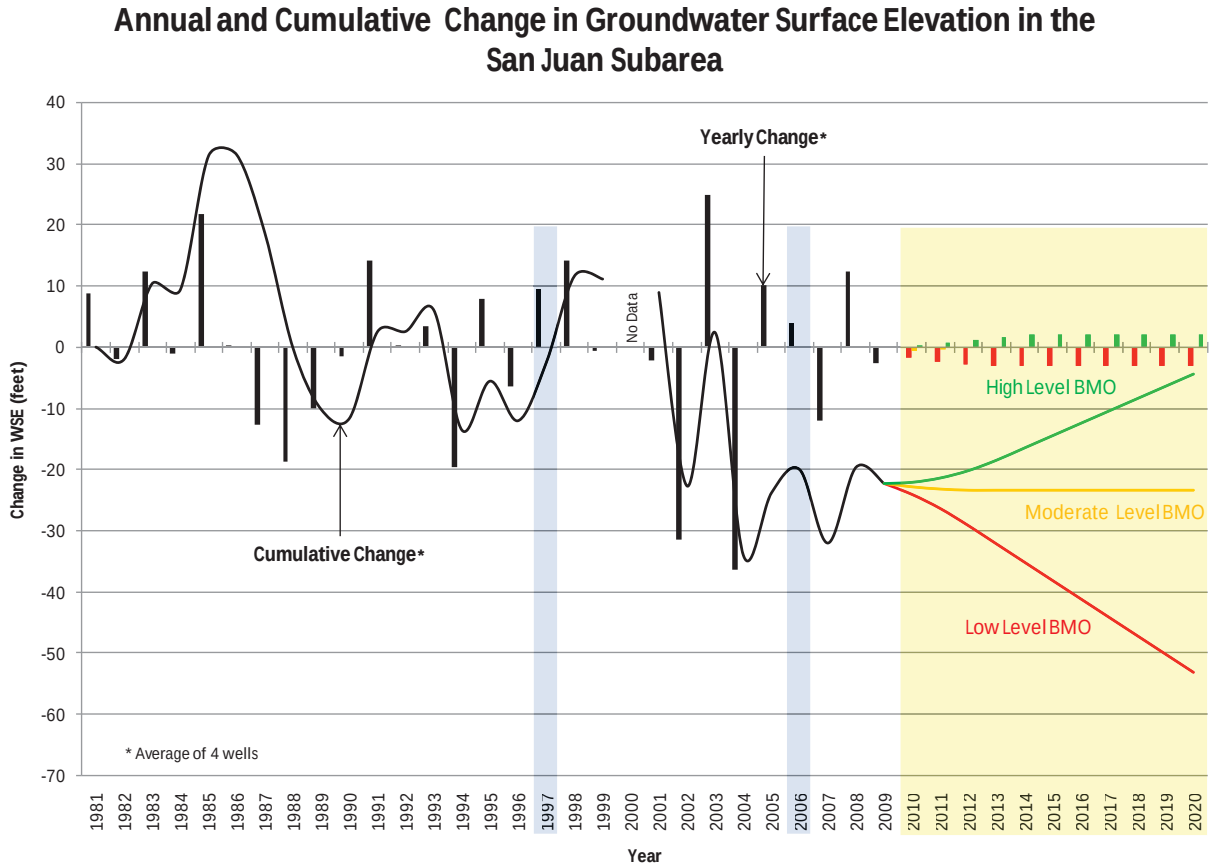

Figure 1. Composite Hydrograph of Four Selected Wells in the San Juan Subarea

Based on the composite hydrograph shown in Figure 1, the San Juan Subarea shows highly variable annual changes in groundwater levels. It appears that groundwater levels in the San Juan Subarea respond quickly to changes in hydrologic conditions, with average groundwater levels increasing or decreasing by as much as 35 feet in a single year.

During the 1981 and 1997 period, average groundwater levels changed considerably on a year-to-year basis, but there was no net significant difference in the cumulative groundwater levels at the end of the 16-year period. During the 1997 and 2006 period, the average groundwater levels in the San Juan Subarea declined by about 20 feet. Finally, during the 2006 to 2009 period, the average groundwater levels declined slightly (less than 5 feet). Overall, during the 1981 to 2009 period, average groundwater levels in the San Juan Subarea declined by about 25 feet.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater

levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

The stakeholders mentioned that the area is primarily planted with field crops, and very few permanent crops. The statement was made that the amount of annual plantings are based in part on the depth to groundwater, because greater depth to groundwater increases pumping costs, at some point it will become uneconomical to grow some crops. This pattern of behavior (not planting some crops when groundwater levels are low) may contribute to the recovery response in groundwater levels, and preventing long-term groundwater level declines in the subarea.

Water demands in the San Juan Subarea met by groundwater have increased by a total of about 740 acre-feet between 1997 and 2006 as shown on Table 1. Looking at just these two single years of estimated water demand data may not provide a clear picture of the annual variation in agricultural water demand in the subarea.

Table 1. Estimated Water Demands in the San Juan Subarea for 1997 and 2006

Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	5,347	0	0	0	105	5,452
Estimated 1997 Demand	(acre-feet)	4,628	0	0	0	84	4,712
Difference (2006 less 1997)	(acre-feet)	719	0	0	0	21	740
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. There was consensus among the stakeholders that groundwater levels fluctuate considerably, but that there was no real concern of long-term declining groundwater levels at this time. Because the subarea experiences periods of rising and falling groundwater levels, the stakeholders expect the cumulative change in average groundwater levels to fluctuate over time, but return to zero net change in groundwater levels (no change from 1981 levels) without implementation of large scale groundwater management activities.

Potential Groundwater Management Activities

Because of the nature of the subarea, and pattern of groundwater use, this subarea may not have the same need for Groundwater Management Activities (GMAs) as other subareas in the

Basin. The following GMA was identified by the San Juan Subarea Stakeholders to stabilize groundwater levels in the San Juan Subarea.

GMA 1: Continue monitoring and reporting on groundwater conditions: The stakeholders suggest continuing the groundwater level monitoring and reporting program. The existing monitoring network provides reasonable coverage for the subarea at this time based upon the current groundwater level conditions. Additional monitoring wells could be added, but are not considered as important as continuing to actively monitoring and reporting on groundwater levels to extend the historical period of record.

DRAFT

Summary of Basin Management Objective Workshop
For the Shandon Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Shandon Subarea of the Paso Robles Groundwater Basin were discussed and developed by stakeholders of the Shandon Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the Shandon Subarea that attended the Workshop are listed below:

Name	Affiliation
Mike Clay	Red Cedar Vineyard
Dennis Bowman	Green River Mutual Water
Greg Jaeger (South Gabilan)	Rural Resident
Sydney Wattles	Shandon Home-Owner
Keith Larson	City of Paso Robles
Frank Mecham	SLO County
Kate Twisselman	Shandon Advisory Committee
Raymond Twisselman	Shandon Resident
Les Diffenbaugh	Shandon Resident
Fritz Helzer	Shandon Hills Vineyard

Courtney Howard (San Luis Obispo County Public Works Department Staff) recorded the information discussed by the Shandon Subarea Stakeholders. One stakeholder from the South Gabilan Subarea attended the workshop and participated in the discussions of the Shandon Subarea stakeholders.

While not all of the Shandon Subarea stakeholders are experiencing the same magnitude of groundwater level decline or type of groundwater quality deterioration, they generally reached consensus on the level of Basin Management Objectives, and some of the Groundwater Management Activities. One of the biggest concerns was the cost of the GMAs identified, and their overall cost effectiveness at improving groundwater levels in the subarea.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Shandon Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Shandon Subarea are currently recorded at 18 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Shandon Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea (shown on Figure 1) for the 1981 to 2009 period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

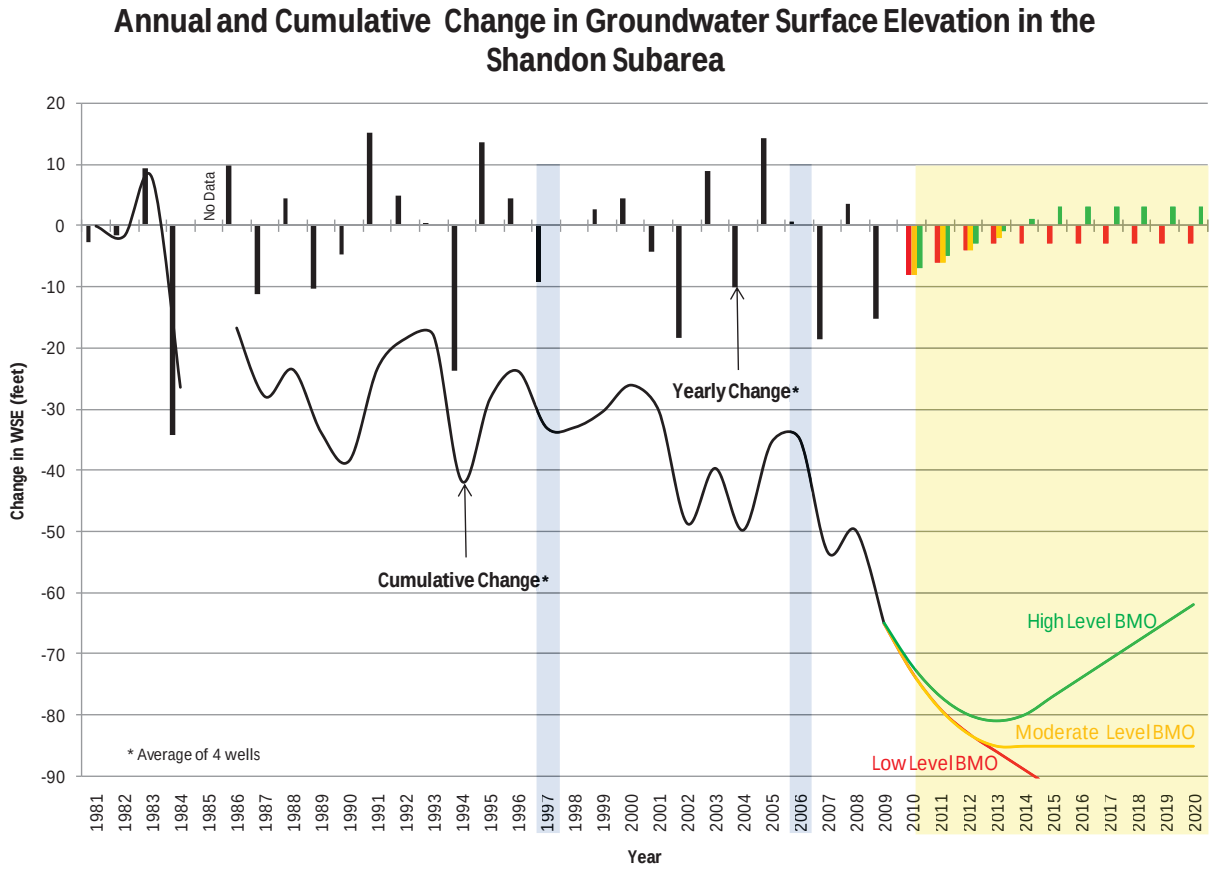

Figure 1. Composite Hydrograph of Four Selected Wells in the Shandon Subarea

Based on the composite hydrograph shown in Figure 1, the Shandon Subarea shows a wide range of annual changes in groundwater levels, with a general trend of declining groundwater levels.

During the 1981 to 1997 period, average groundwater levels in the Shandon Subarea have declined by about 33 feet. During the 1997 to 2006 period, average groundwater levels fluctuated annually, but resulted in very little net decline (about 2 feet) compared to 1997 levels. Finally, from 2006 to 2009 period, the average groundwater levels declined by about 30 feet. Overall, during the 1981 to 2009 period (28 years), average groundwater levels in the Shandon Subarea declined by about 65 feet (about 2.3 feet per year), in response to a combination of increasing in water demands that are met by groundwater, and in the later years of the period, a series of dry years.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Shandon Subarea met by groundwater increased by about 1,600 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Shandon Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE SHANDON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,896	0	0	69	1,205	11,170
Estimated 1997 Demand	(acre-feet)	8,566	0	0	51	969	9,586
Difference (2006 less 1997)	(acre-feet)	1,330	0	0	18	236	1,584
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The stakeholders were initially concerned that the only way to stop the declining groundwater levels was to force people to stop pumping. Initially, the discussions of the group suggested a 'survival of the fittest' approach to groundwater pumping where only those with the deepest wells and the ability to afford pumping would continue to pump as costs increased. The others would be put out of business or be forced to make changes to their water use requirements.

After continued discussions, it was generally agreed that stabilizing groundwater levels was an appropriate objective at this time, but there is a concern about the cost and feasibility of stabilizing groundwater levels.

Potential Groundwater Management Activities

The stakeholders reached consensus that there was no single activity that would solve the problem, but that the solution will likely involve a combination of activities. The following Groundwater Management Activities (GMAs) were identified by the Shandon Subarea stakeholders to stabilize groundwater levels in the Shandon Subarea. The potential benefit from these GMAs has not been quantified for the Shandon Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Groundwater Recharge and Banking Programs: The discussions did not focus on the details of this project or the approach, but did identify potential groundwater recharge or banking of either imported supplies or from storm water runoff as potential sources of groundwater recharge. One potential project that was discussed was an inflatable dam project such as was done along the Salinas River in Northern Monterey County. No additional details were provided on that potential project.

GMA 2: State Water Project supplies for Shandon: The community of Shandon has not used its 100 acre-feet of State Water Project water (SWP) to date. This project would include tying in to the Coastal Branch were it passes through Shandon to access the 100 acre-feet of supply. SWP supplies on the Coastal Branch are treated at the Polonio Pass Water Treatment Plant. This project would reduce municipal groundwater pumping in the Shandon area by the amount delivered from the SWP, thereby reducing groundwater pumping.

An alternative of this GMA would be to pursue additional SWP supplies that could also be delivered to Shandon. San Luis Obispo County has a contract allocation to additional SWP supplies that it has not used, and is not currently using. These supplies could be a potential source of water to the area. Additional capacity in Phase II of the Coastal Branch would be needed to deliver water in excess of the 100 acre-feet supply currently contracted to Shandon by the County. An investigation regarding the additional capacity of the Coastal Branch is currently being pursued by the District.

GMA 3: Formation of Irrigation District or Water District: The discussion focused on the potential need to form an irrigation district or water district to import surface water into the Paso Robles Groundwater Basin. Irrigation Districts/Water Districts are often formed to pursue large projects that benefit a larger group of water users. Such a district may be formed to

pursue a groundwater recharge or water banking project that would rely on imported surface water.

GMA 4: Increase water conservation education and implementation: The stakeholders recognized that additional conservation may result in a water savings, but were not sure if it would be cost effective. There was no objection to promoting conservation, and some discussions explored different conservation methods (such as alternative frost-control measures) since most growing operations are already on drip, and landscaping in Shandon is generally modest.

GMA 5: Precipitation Enhancement: This was brought up for discussion, but it was unclear whether this project would work for the Shandon area.

DRAFT

Groundwater Levels in the Atascadero Subbasin are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subbasin is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

Groundwater levels in the Atascadero Subbasin tend to have a greater range in annual response than other subareas, with average groundwater levels increasing or decreasing by up to 15 feet in single years. The overall trend of the average groundwater levels has remained relatively constant since the early 1980s with groundwater levels rising and falling in response to changing hydrologic conditions and increasing demands. The 2009 average groundwater levels are within ten feet of the 1981 levels as shown on Figure 1. Based on the pattern exhibited on this figure, a single wet year could return the average groundwater levels to the 1981 conditions. It is not clear how the increase in demands since the late 1990s likely contributes to the overall declining groundwater levels of about 30 feet during the 1997 to 2009 period.

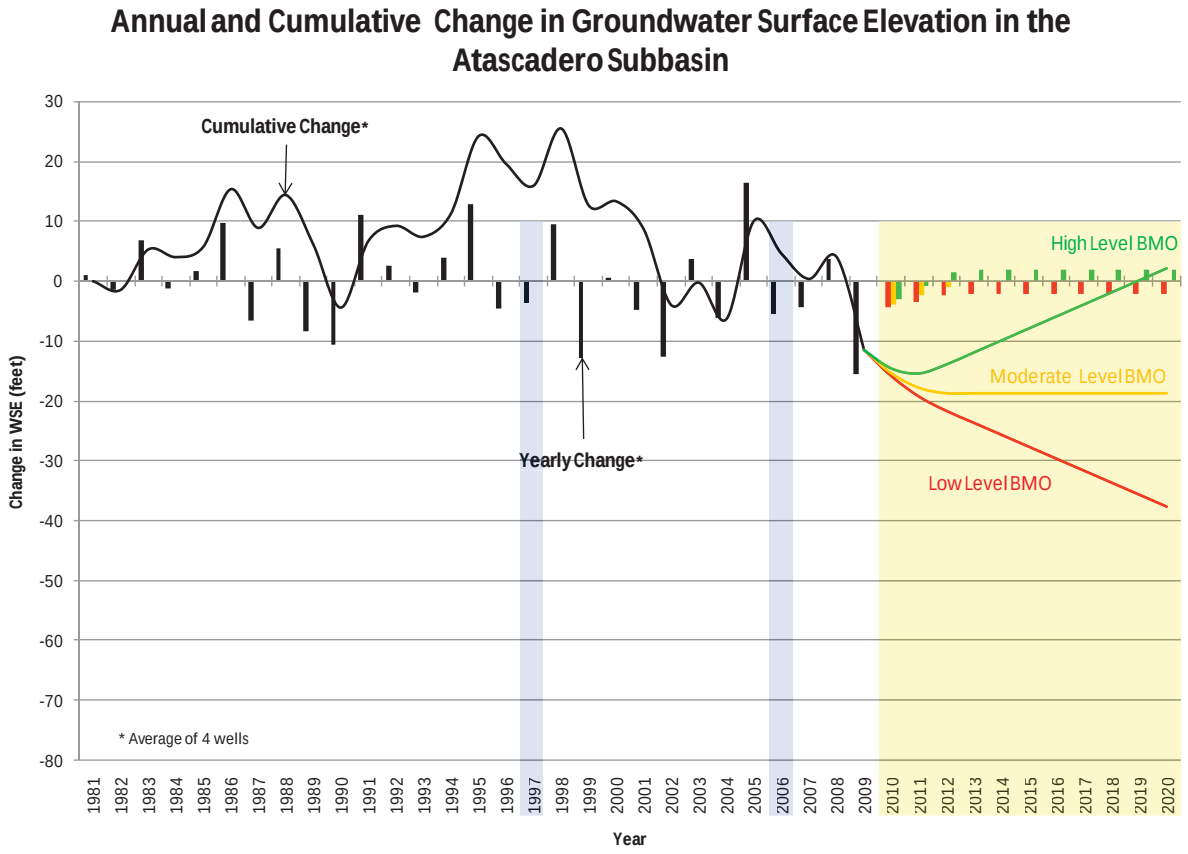

Figure 1. Composite Hydrograph of Four Selected Wells in the Atascadero Subbasin

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Atascadero Subarea met by groundwater increased by about 1,000 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period, likely contributed to the increased rate of groundwater level decline (about five feet per year) during this period.

Table 1. Estimated Water Demands in the Atascadero Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ATASCADERO SUBBASIN							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,348	11,735	0	430	2,032	15,545
Estimated 1997 Demand	(acre-feet)	1,023	11,376	0	300	1,800	14,499
Difference (2006 less 1997)	(acre-feet)	325	359	0	130	232	1,046

2006 Demand Assumptions: Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)

1997 Demand Assumptions: 1997 Demands form Paso Robles Groundwater Basin Study (Fugro, 2002)
Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.
1997 Municipal demand includes City of Paso Robles groundwater pumping from river wells(3,933 acre-feet)
Small community demands included in rural domestic demand

Draft Basin Management Objectives

The Atascadero Subbasin stakeholders determined that an acceptable draft BMO for groundwater levels in the Atascadero Subbasin would include stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells). This draft BMO had strong consensus among the participants.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Atascadero Subbasin Stakeholders to stabilize groundwater levels in the Atascadero Subbasin. The potential benefit from these GMAs has not been quantified for the Atascadero Subbasin (in terms of changes in groundwater

levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Atascadero Subbasin through the addition of new wells to the volunteer monitoring network.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis. Atascadero Mutual Water Company, City of Paso Robles and Templeton Community Services District collect water level data that is provided to the District for inclusion in the monitoring program.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users and impacts on groundwater level trends in the area. The effectiveness of this GMA will be evaluated on an annual basis.

This GMA had large consensus of the Atascadero Subbasin stakeholders. Some of the specific water conservation activities identified include:

- Municipal water purveyors have implemented some level of conservation to date. The effectiveness of these efforts can be tracked by the delivery volumes. Because municipal water demands compose the largest single demand type in the subbasin, there is the greatest opportunity for reduction in groundwater pumping. Based on 2006 municipal demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 880 acre-feet per year.
- Agricultural Water Conservation (opportunities for reductions in groundwater pumping resulting from agricultural conservation programs may be limited in the Atascadero Subbasin due to the comparatively small agricultural demand). Based on 2006 agricultural

demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 130 acre-feet per year.

- Rural Residential Water Conservation (opportunities for reductions in groundwater pumping resulting from rural residential conservation programs may be limited in the Atascadero Subbasin due to the comparatively small rural residential demand). Based on 2006 rural domestic demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 200 acre-feet per year. Water conservation programs in the rural residential sector may focus on the following:
    - Landscape Water Use
    - Consider controls on non-agricultural ponds
    - Development of conservation outreach and incentive programs implemented by San Luis Obispo County

Responsibility for implementing certain components of this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District. The Atascadero Mutual Water Company, City of Paso Robles, and Templeton Community Services District are responsible for implementing water conservation programs within their service areas.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of water demand in the subbasin. In areas outside the jurisdiction of the cities of Atascadero and Paso Robles, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. The cities have implemented land use policies that limit water use rates and promote water conservation, such as limiting turf in new development. In addition, higher water rates paid by city water customers encourage efficient water use. Any policies established in areas where San Luis Obispo County has jurisdiction would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- Discretionary lots splits would require meters on the new well and the existing well
- No net increase in water use resulting from additional rural residential development
- Promote greywater use
- Minimize turf areas
- Meter new wells
- Offset water use
- Explore opportunities for residential rainwater harvesting

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building and the cities of Atascadero and Paso Robles.

DRAFT

GMA 4: Maximize the amount of Nacimiento Project Water in the Subbasin: This GMA includes utilizing the existing Nacimiento Project Water already acquired for use in the subbasin, and explore opportunities to utilize unassigned Nacimiento Project Water.

The San Luis Obispo County Flood Control and Water Conservation District would be one of the lead agencies responsible for implementing this GMA. Local water purveyors would be responsible for developing and implementing projects to acquire supplies from the Nacimiento Water Project.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building, and City of Atascadero would likely be the lead agencies responsible for implementing this GMA.

DRAFT

Summary of Basin Management Objective Workshop For the Bradley and North Gabilan Subareas

The draft Basin Management Objectives (BMOs) for groundwater levels in the Bradley and North Gabilan Subareas were discussed and developed by stakeholders at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Paso Robles City Council Chambers. The stakeholders from the subareas that attended the workshop are listed below:

Name	Affiliation
Robert Johnson	Monterey County Water Resources Agency
Keith Larson	City of Paso Robles
Christopher Alakel	City of Paso Robles
Courtney Howard	San Luis Obispo County

Courtney Howard recorded the information discussed by the stakeholders.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated every few years as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Bradley and North Gabilan Subareas are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Bradley Subarea are currently recorded at one well that is included in the groundwater monitoring network of Monterey County Water Resources Agency (MCWRA). This well is located near the Salinas River just north of the subarea boundary, and may not be representative of groundwater levels throughout the Bradley or North Gabilan Subareas. The lack of data prevents the development of groundwater level hydrographs, or composite hydrographs as developed for other subareas. The lone hydrograph available for these two subareas is shown in Figure 1.

The hydrograph shown in Figure 1 is for a well located near the Salinas River downstream of the confluence of the Salinas River and the Nacimiento River. It appears that groundwater levels in this well reflect the interaction of the Salinas River and the alluvial aquifer materials adjacent to the river. Flows

from the Salinas River, along with releases from Nacimiento Reservoir, help maintain groundwater levels in alluvial aquiver near the Salinas River.

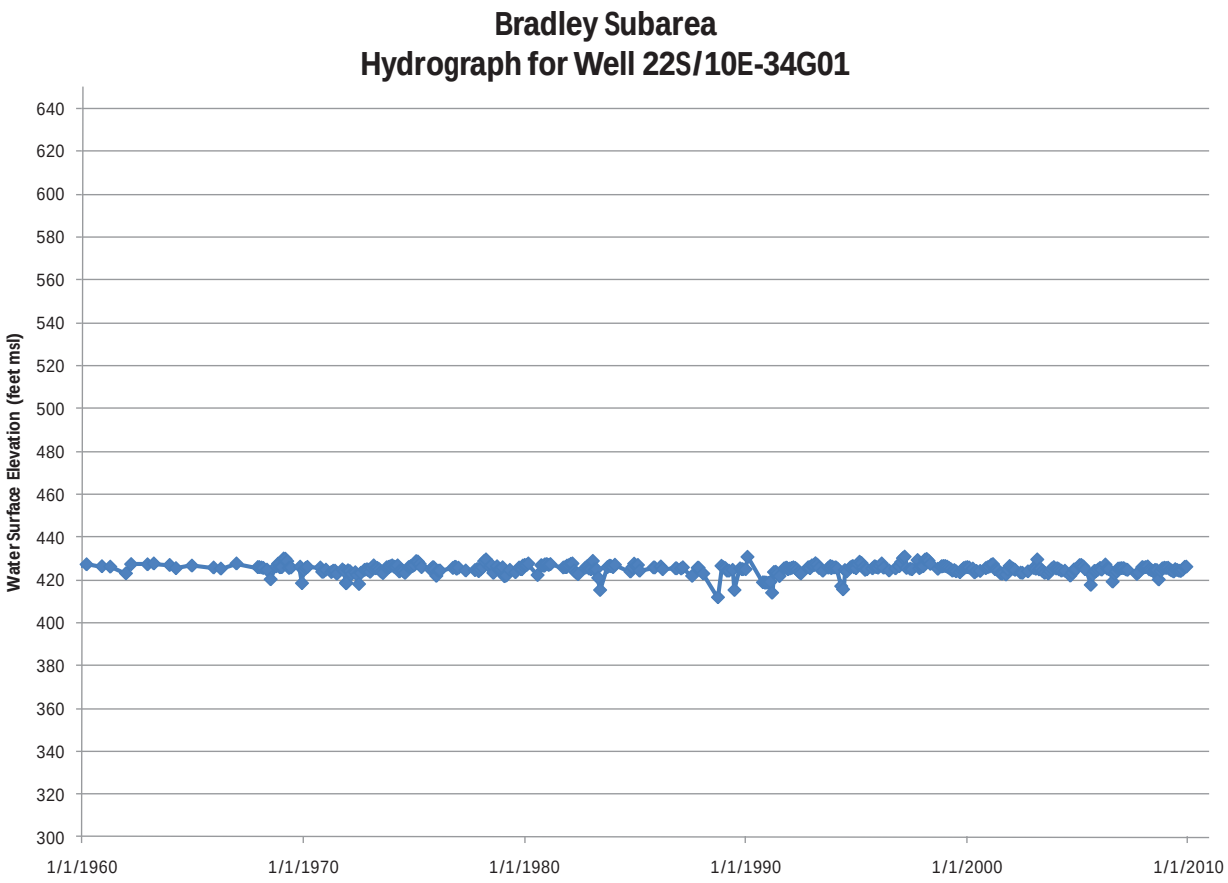

Figure 1. Well Hydrograph in the Bradley Subarea

At this time, we are not aware of any reports or anecdotal information that suggests groundwater levels in the Bradley Subarea or the North Gabilan Subarea are declining to the point of causing problems for local groundwater users.

Water demands in the Bradley Subarea met by groundwater have increased by total of about 1,000 acre-feet between 1997 and 2006 as shown on Table 1.

Table 1. Estimated Water Demands in the Bradley Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE BRADLEY SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	6,933	0	0	184	109	7,226
Estimated 1997 Demand	(acre-feet)	6,001	0	0	136	88	6,225
Difference (2006 less 1997)	(acre-feet)	932	0	0	48	21	1,001
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Water demands in the North Gabilan Subarea met by groundwater have increased by total of about 250 acre-feet between 1997 and 2006 as shown on Table 2.

Table 2. Estimated Water Demands in the North Gabilan Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE NORTH GABILAN SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,758	0	0	0	51	1,809
Estimated 1997 Demand	(acre-feet)	1,522	0	0	0	41	1,563
Difference (2006 less 1997)	(acre-feet)	236	0	0	0	10	246
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. As described above there is very little available information to support the development of very targeted BMOs. Based on the available information, the BMO for the Bradley Subarea and the North Gabilan Subarea are to maintain groundwater levels high. The lack of an extensive monitoring network in this part of the Basin will prevent more detailed analysis of this.

Potential Groundwater Management Activities

GMA 1: Continue monitoring and reporting on groundwater conditions: Continue and improve monitoring – look to add monitoring well near the SLO-Monterey county boundary between the Nacimiento River and the town of San Miguel

GMA 2: Consider reestablishing Cloudseeding Program: Consider benefits of re-establishing the cloud seeding program in the Nacimiento and San Antonio watersheds. Cloud seeding was conducted in the past by MCWRA, and is estimated to have increased outflow of Lake Nacimiento and San Antonio Reservoirs by about 20 percent.

Summary of Basin Management Objective Workshop
For the Creston Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Creston Subarea were discussed and developed by stakeholders of Creston Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Creston Subarea that attended the Workshop are listed below:

Name	Affiliation
Sue Luft	WRAC/Grower/RR
Karl Luft	Grower/RR
Sheila Lyons	Rural Resident
David Lyons	Rural Resident
Dana Merrill	Grower
Fritz Helzer	Grower
Claudia Engel	Creston AB
Pam Finley	Templeton AAG

Sue Luft recorded the information discussed by the Creston Subarea Stakeholders. The Creston Subarea Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Creston Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Creston Subarea are currently recorded at 13 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Creston Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to

represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

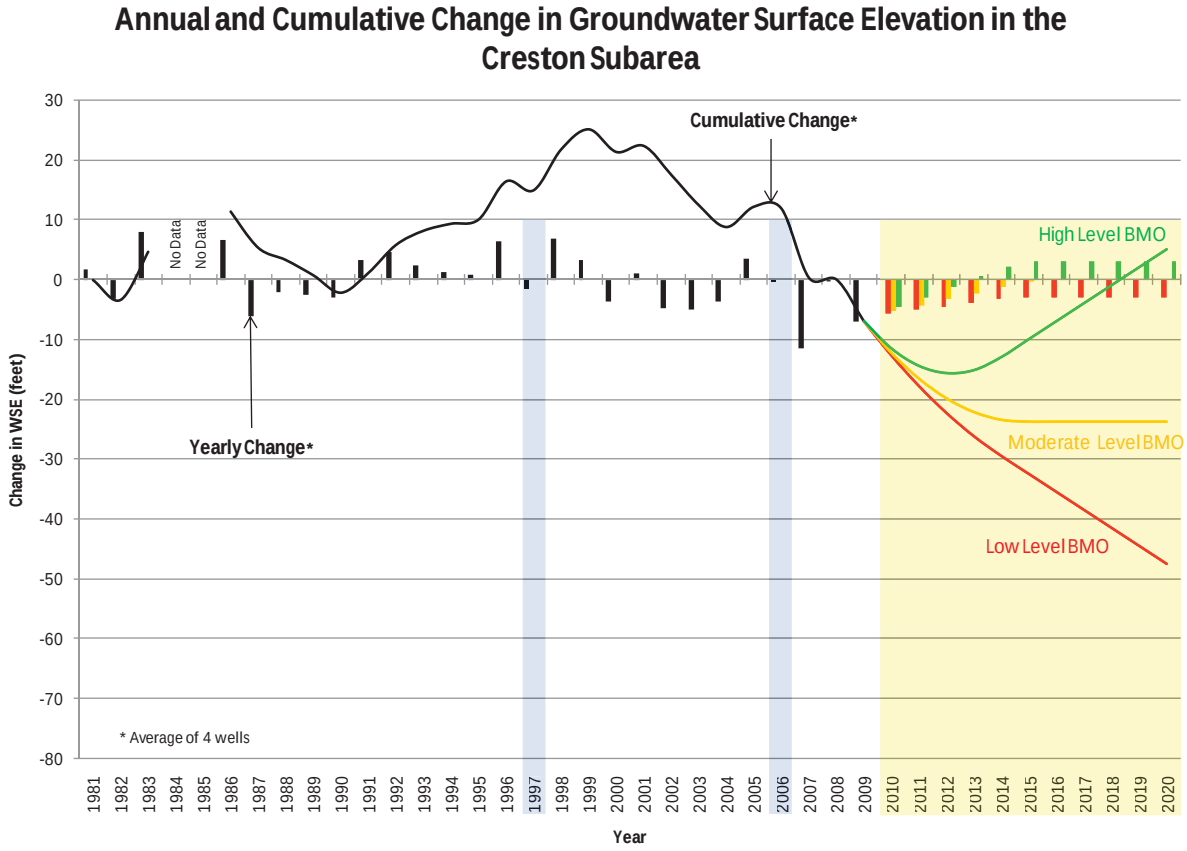

Figure 1. Composite Hydrograph of Four Selected Wells in the Creston Subarea

The average groundwater levels in the subarea appear to have peaked at about 1999. Since this time, groundwater levels have generally declined. This may be due in part to the increase in water demands between 1997 and 2006. During the 1997 to 2006 period, average groundwater levels have declined by less than five feet, but during the 2006 to 2009 period, the average groundwater levels declined by about 20 feet, so it appears that the increase in demands and the numerous dry years have contributed to the declining groundwater levels currently being experienced.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline of groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Creston Subarea met by groundwater increased by about 1,800 acre-feet during the 1997 to 2006 period as shown on Table 1. This information does identify when this increase occurred, but it is likely to have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about seven feet per year) during this period.

Table 1. Estimated Water Demands in the Creston Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE CRESTON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,936	0	0	37	2,338	12,311
Estimated 1997 Demand	(acre-feet)	8,600	0	0	27	1,880	10,507
Difference (2006 less 1997)	(acre-feet)	1,336	0	0	10	458	1,804
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The Creston Subarea stakeholders determined that an acceptable draft BMOs for groundwater levels in the Creston Subarea would include stopping the current rate of decline experienced in the last 10 years, and stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells) in the next five to ten years.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Creston Subarea Stakeholders to stabilize groundwater levels in the Creston Subarea. The potential benefit from these GMAs has not been quantified for the Creston Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Creston Subarea through the addition of new wells to the volunteer monitoring network. Additional wells would be needed in the northwest portion of the subarea near the Estrella Subarea where historic groundwater level decline has been the greatest.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the

Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users. The effectiveness of this GMA will be evaluated on an annual basis. Some of the specific water conservation activities identified include:

- Agricultural Water Conservation
- Rural Residential Water Conservation
    - Landscape Water Use
    - Consider controls on non-agricultural ponds

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of rural residential development in the subarea. Throughout much of the Basin, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. Any policies established would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- No net increase in water use resulting from additional rural residential development

The San Luis Obispo County Department of Planning and Building would likely be responsible for implementing this GMA.

GMA 4: Preventing export of groundwater from the Basin: This GMA includes identifying potential activities that result in exporting groundwater from the Basin. At this time, additional information is necessary to quantify the occurrence of groundwater pumping for export from the Basin.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

DRAFT

Summary of Basin Management Objective Workshop
For the Estrella Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Estrella Subarea were discussed and developed by stakeholders of Estrella Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Estrella Subarea that attended the Workshop are listed below:

Name	Affiliation
Joy Sprague	Rural Resident
Walter Heer	
Christopher Alakel	City of Paso Robles
Chuck Pritchard	Upper Salinas/Las Tablas Resource Conservation District (US/LT RCD)
Jerry Reaugh	Grower
Lisa Bodrogi	(Paso Robles Wine Country Alliance (PRWCA)
Joe Plummer	Grower
Debra Compton	Grower
Steve Carter	Grower
John Wallace	San Miguel CSD
Tom Zehnder	

Iris Priestaf recorded the information discussed by the Estrella Subarea Stakeholders. The Estrella Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives, but did not reach consensus on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Estrella Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Estrella Subarea are currently recorded at 50 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Estrella Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of six wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

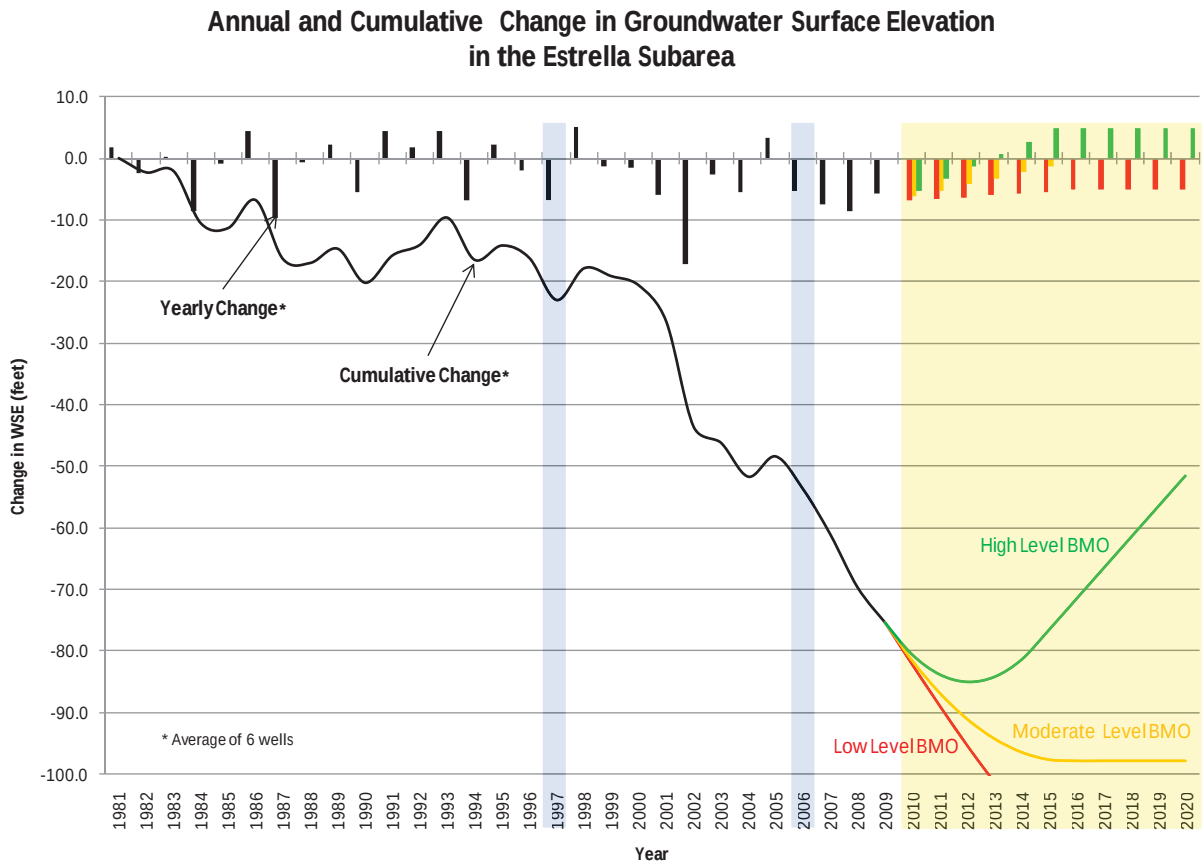

Figure 1. Composite Hydrograph of Six Selected Wells in the Estrella Subarea

Based on the composite hydrograph shown in Figure 1, the average groundwater levels in the Estrella Subarea have declined by about 20 feet between 1981 and 1997. Then, between 1997 and 2006 average groundwater levels have declined by an additional 30 feet. During this same period, water demands in the Estrella Subarea met by groundwater have increased by a total of about 6,300 acre-feet as shown on Table 1. Finally, from 2006 to 2009 the average groundwater levels declined by about 35 feet. During the 1981 to 2009 period, average groundwater levels in the Estrella Subarea declined by about 80 feet, in response to a combination of increasing in water demands that are met by groundwater and a series of dry years in the later years of the period.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Estrella Subarea met by groundwater increased by about 6,300 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands contributed to the significant decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (almost 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Estrella Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ESTRELLA SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	23,111	3,930	0	1,603	5,433	34,077
Estimated 1997 Demand	(acre-feet)	20,004	2,137	0	1,186	4,368	27,695
Difference (2006 less 1997)	(acre-feet)	3,107	1,793	0	417	1,065	6,382
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						
	1997 Municipal demand includes City of Paso Robles groundwater pumping from basin wells(1,911 acre-feet) and San Miguel (226 acre-feet)						
	Small community demands included in rural domestic demand						

Draft Basin Management Objectives

Three levels of BMOs were discussed by the Estrella Subarea stakeholders. There was consensus that groundwater level declines are a shared problem for the subarea, and that the severity of decline varies across the area. It was also identified that the proposed low-level BMO (essentially do-nothing) was unacceptable.

The medium level BMO of stabilizing groundwater levels was identified as a reasonable objective at this time, but there was concern about the cost and feasibility.

The high-level BMO of recovery of groundwater levels was identified as desirable by private domestic wells owner, but the group agreed that such an objective was over-reaching at this time.

Potential Groundwater Management Activities

The stakeholders reached consensus that there is no magic bullet that will solve the problem, but that the solution will likely involve a combination of activities such as additional water conservation, Nacimiento water supplies, a groundwater recharge program (e.g. using State Water Project or urban runoff), redistribution of pumping, and wastewater discharge/water recycling.

The following Groundwater Management Activities (GMAs) were identified by the Estrella Subarea Stakeholders to stabilize groundwater levels in the Estrella Subarea. The potential benefit from these GMAs has not been quantified for the Estrella Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase data collection and monitoring and reporting on groundwater conditions: It was determined that there is enough information to know that there is a problem, however, additional and better information is needed to further understand the problem.

The stakeholders recognize that this GMA does not directly result in changes in groundwater levels, but will help communicate condition to individuals and support implementation of groundwater management activities in the subarea. It was recognized that additional private wells need to be made part of the County well network on a voluntary basis. This is particularly true in specific areas within the subarea currently lacking wells in the water level monitoring network.

GMA 2: Increase water conservation education and implementation: The stakeholders recognized that additional conservation is needed. Some stakeholders felt that the amount of savings that can be achieved is limited. Other stakeholders felt that additional conservation in the agricultural sector could play a significant role in reducing groundwater demand and achieving the BMO of stabilizing water levels. There were several discussions about the potential additional savings from conservation, but consensus could not be reached about the potential savings that could be achieved by the different water use categories (urban, agricultural, and rural). During the conversations each group stated that they believed there was limited opportunity for additional gains from conservation in their demand type, but believed additional conservation could be achieved in other demand types.

GMA 3: Nacimiento Project Water: The stakeholder reached consensus regarding the use of Nacimiento Project Water help alleviate the groundwater decline problem, but it was also recognized as not being the sole solution.

Issues Lacking Consensus

The two primary issues lacking consensus in the subarea was the degree to which additional conservation could be implemented for urban, agricultural, and rural uses.

The Paso Robles Groundwater Basin has largely centralized management because of a lack of water districts or local water agencies, so there was no consensus about the agency or organization that would have the responsibility for prioritizing and implementing the identified groundwater management activities.

DRAFT

Summary of Basin Management Objective Workshop
For the San Juan Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the San Juan Subarea of the Paso Robles Groundwater Basin (Basin) were discussed and developed by stakeholders of San Juan Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the San Juan Subarea that attended the Workshop are listed below:

Name	Affiliation
Amy Gillman	5th District Legislative Assistant
Steve Sinton	Shandon
Randy Diffenbaugh	Shandon Advisory Committee
Susan Litteral	Natural Resource Conservation Service
Doug Felipponi	SJV FET
Mary Russell	Shandon

Susan Litteral recorded the information discussed by the San Juan Stakeholders.

The San Juan Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives and on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the San Juan Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the San Juan Subarea are currently recorded at 10 wells that are included in the groundwater monitoring network. Overall, groundwater levels have been fairly stable in the San Juan Subarea. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1 for the 1981 to 2009

period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

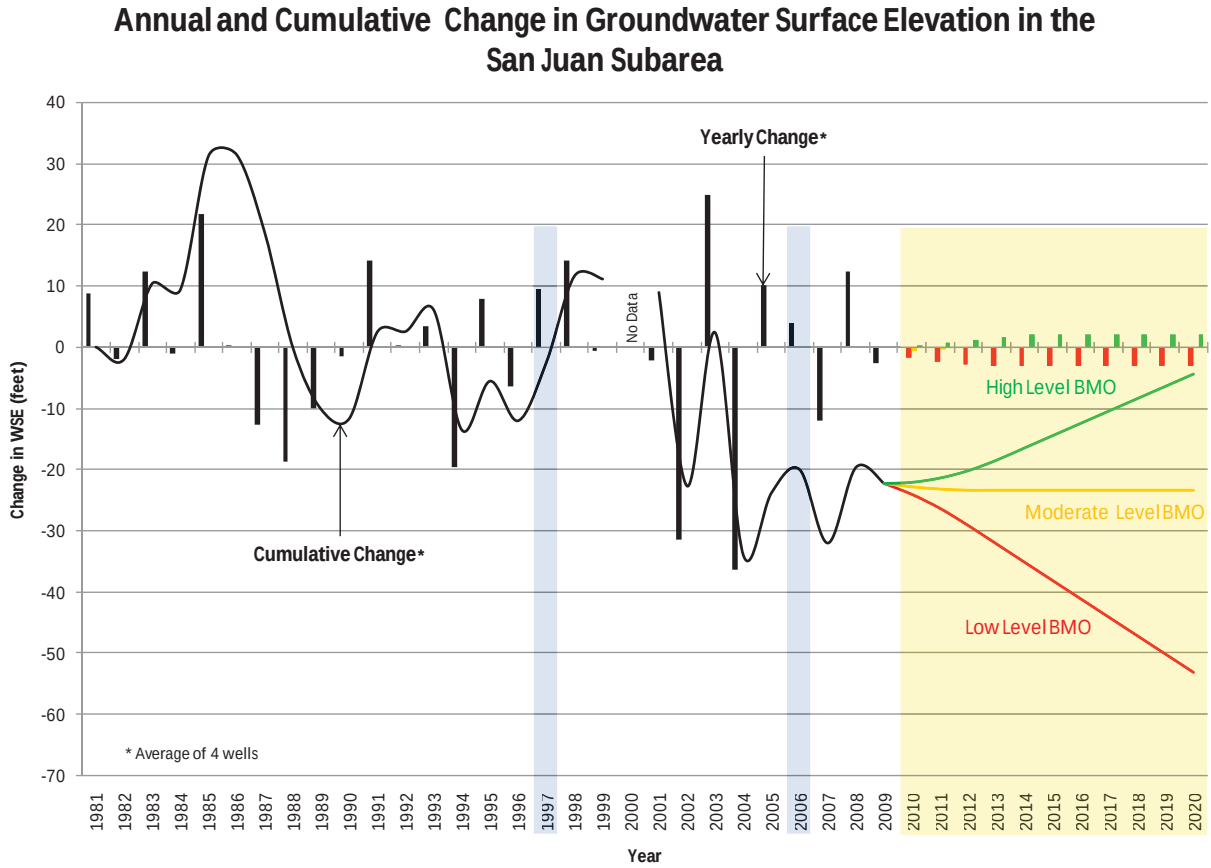

Figure 1. Composite Hydrograph of Four Selected Wells in the San Juan Subarea

Based on the composite hydrograph shown in Figure 1, the San Juan Subarea shows highly variable annual changes in groundwater levels. It appears that groundwater levels in the San Juan Subarea respond quickly to changes in hydrologic conditions, with average groundwater levels increasing or decreasing by as much as 35 feet in a single year.

During the 1981 and 1997 period, average groundwater levels changed considerably on a year-to-year basis, but there was no net significant difference in the cumulative groundwater levels at the end of the 16-year period. During the 1997 and 2006 period, the average groundwater levels in the San Juan Subarea declined by about 20 feet. Finally, during the 2006 to 2009 period, the average groundwater levels declined slightly (less than 5 feet). Overall, during the 1981 to 2009 period, average groundwater levels in the San Juan Subarea declined by about 25 feet.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater

levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

The stakeholders mentioned that the area is primarily planted with field crops, and very few permanent crops. The statement was made that the amount of annual plantings are based in part on the depth to groundwater, because greater depth to groundwater increases pumping costs, at some point it will become uneconomical to grow some crops. This pattern of behavior (not planting some crops when groundwater levels are low) may contribute to the recovery response in groundwater levels, and preventing long-term groundwater level declines in the subarea.

Water demands in the San Juan Subarea met by groundwater have increased by a total of about 740 acre-feet between 1997 and 2006 as shown on Table 1. Looking at just these two single years of estimated water demand data may not provide a clear picture of the annual variation in agricultural water demand in the subarea.

Table 1. Estimated Water Demands in the San Juan Subarea for 1997 and 2006

Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	5,347	0	0	0	105	5,452
Estimated 1997 Demand	(acre-feet)	4,628	0	0	0	84	4,712
Difference (2006 less 1997)	(acre-feet)	719	0	0	0	21	740
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. There was consensus among the stakeholders that groundwater levels fluctuate considerably, but that there was no real concern of long-term declining groundwater levels at this time. Because the subarea experiences periods of rising and falling groundwater levels, the stakeholders expect the cumulative change in average groundwater levels to fluctuate over time, but return to zero net change in groundwater levels (no change from 1981 levels) without implementation of large scale groundwater management activities.

Potential Groundwater Management Activities

Because of the nature of the subarea, and pattern of groundwater use, this subarea may not have the same need for Groundwater Management Activities (GMAs) as other subareas in the

Basin. The following GMA was identified by the San Juan Subarea Stakeholders to stabilize groundwater levels in the San Juan Subarea.

GMA 1: Continue monitoring and reporting on groundwater conditions: The stakeholders suggest continuing the groundwater level monitoring and reporting program. The existing monitoring network provides reasonable coverage for the subarea at this time based upon the current groundwater level conditions. Additional monitoring wells could be added, but are not considered as important as continuing to actively monitoring and reporting on groundwater levels to extend the historical period of record.

DRAFT

Summary of Basin Management Objective Workshop
For the Shandon Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Shandon Subarea of the Paso Robles Groundwater Basin were discussed and developed by stakeholders of the Shandon Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the Shandon Subarea that attended the Workshop are listed below:

Name	Affiliation
Mike Clay	Red Cedar Vineyard
Dennis Bowman	Green River Mutual Water
Greg Jaeger (South Gabilan)	Rural Resident
Sydney Wattles	Shandon Home-Owner
Keith Larson	City of Paso Robles
Frank Mecham	SLO County
Kate Twisselman	Shandon Advisory Committee
Raymond Twisselman	Shandon Resident
Les Diffenbaugh	Shandon Resident
Fritz Helzer	Shandon Hills Vineyard

Courtney Howard (San Luis Obispo County Public Works Department Staff) recorded the information discussed by the Shandon Subarea Stakeholders. One stakeholder from the South Gabilan Subarea attended the workshop and participated in the discussions of the Shandon Subarea stakeholders.

While not all of the Shandon Subarea stakeholders are experiencing the same magnitude of groundwater level decline or type of groundwater quality deterioration, they generally reached consensus on the level of Basin Management Objectives, and some of the Groundwater Management Activities. One of the biggest concerns was the cost of the GMAs identified, and their overall cost effectiveness at improving groundwater levels in the subarea.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Shandon Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Shandon Subarea are currently recorded at 18 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Shandon Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea (shown on Figure 1) for the 1981 to 2009 period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

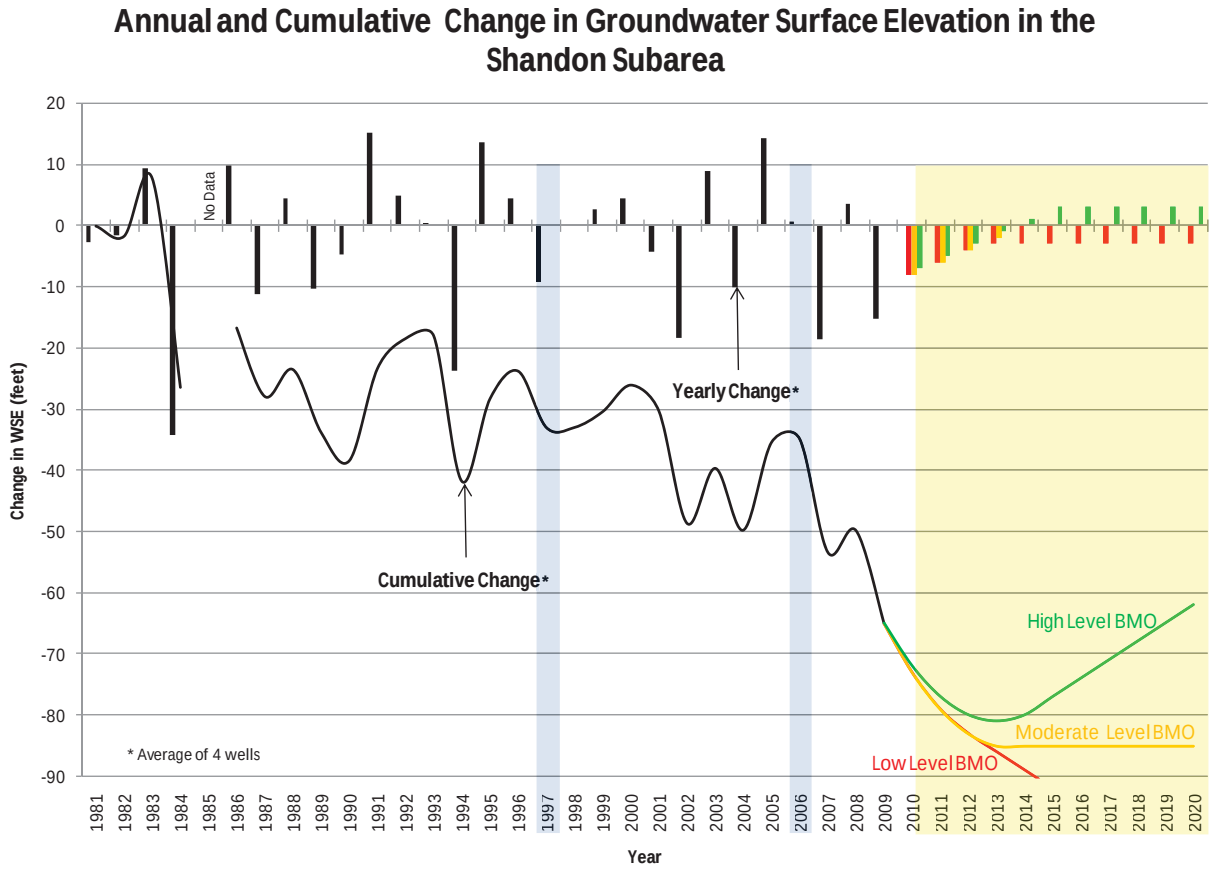

Figure 1. Composite Hydrograph of Four Selected Wells in the Shandon Subarea

Based on the composite hydrograph shown in Figure 1, the Shandon Subarea shows a wide range of annual changes in groundwater levels, with a general trend of declining groundwater levels.

During the 1981 to 1997 period, average groundwater levels in the Shandon Subarea have declined by about 33 feet. During the 1997 to 2006 period, average groundwater levels fluctuated annually, but resulted in very little net decline (about 2 feet) compared to 1997 levels. Finally, from 2006 to 2009 period, the average groundwater levels declined by about 30 feet. Overall, during the 1981 to 2009 period (28 years), average groundwater levels in the Shandon Subarea declined by about 65 feet (about 2.3 feet per year), in response to a combination of increasing in water demands that are met by groundwater, and in the later years of the period, a series of dry years.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Shandon Subarea met by groundwater increased by about 1,600 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Shandon Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE SHANDON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,896	0	0	69	1,205	11,170
Estimated 1997 Demand	(acre-feet)	8,566	0	0	51	969	9,586
Difference (2006 less 1997)	(acre-feet)	1,330	0	0	18	236	1,584
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The stakeholders were initially concerned that the only way to stop the declining groundwater levels was to force people to stop pumping. Initially, the discussions of the group suggested a 'survival of the fittest' approach to groundwater pumping where only those with the deepest wells and the ability to afford pumping would continue to pump as costs increased. The others would be put out of business or be forced to make changes to their water use requirements.

After continued discussions, it was generally agreed that stabilizing groundwater levels was an appropriate objective at this time, but there is a concern about the cost and feasibility of stabilizing groundwater levels.

Potential Groundwater Management Activities

The stakeholders reached consensus that there was no single activity that would solve the problem, but that the solution will likely involve a combination of activities. The following Groundwater Management Activities (GMAs) were identified by the Shandon Subarea stakeholders to stabilize groundwater levels in the Shandon Subarea. The potential benefit from these GMAs has not been quantified for the Shandon Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Groundwater Recharge and Banking Programs: The discussions did not focus on the details of this project or the approach, but did identify potential groundwater recharge or banking of either imported supplies or from storm water runoff as potential sources of groundwater recharge. One potential project that was discussed was an inflatable dam project such as was done along the Salinas River in Northern Monterey County. No additional details were provided on that potential project.

GMA 2: State Water Project supplies for Shandon: The community of Shandon has not used its 100 acre-feet of State Water Project water (SWP) to date. This project would include tying in to the Coastal Branch were it passes through Shandon to access the 100 acre-feet of supply. SWP supplies on the Coastal Branch are treated at the Polonio Pass Water Treatment Plant. This project would reduce municipal groundwater pumping in the Shandon area by the amount delivered from the SWP, thereby reducing groundwater pumping.

An alternative of this GMA would be to pursue additional SWP supplies that could also be delivered to Shandon. San Luis Obispo County has a contract allocation to additional SWP supplies that it has not used, and is not currently using. These supplies could be a potential source of water to the area. Additional capacity in Phase II of the Coastal Branch would be needed to deliver water in excess of the 100 acre-feet supply currently contracted to Shandon by the County. An investigation regarding the additional capacity of the Coastal Branch is currently being pursued by the District.

GMA 3: Formation of Irrigation District or Water District: The discussion focused on the potential need to form an irrigation district or water district to import surface water into the Paso Robles Groundwater Basin. Irrigation Districts/Water Districts are often formed to pursue large projects that benefit a larger group of water users. Such a district may be formed to

pursue a groundwater recharge or water banking project that would rely on imported surface water.

GMA 4: Increase water conservation education and implementation: The stakeholders recognized that additional conservation may result in a water savings, but were not sure if it would be cost effective. There was no objection to promoting conservation, and some discussions explored different conservation methods (such as alternative frost-control measures) since most growing operations are already on drip, and landscaping in Shandon is generally modest.

GMA 5: Precipitation Enhancement: This was brought up for discussion, but it was unclear whether this project would work for the Shandon area.

DRAFT

Summary of Basin Management Objective Workshop
For the Atascadero Subbasin

The draft Basin Management Objectives (BMOs) for groundwater levels in the Atascadero Subbasin were discussed and developed by stakeholders of Atascadero Subbasin at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Atascadero Subbasin that attended the Workshop are listed below:

Name	Affiliation
Della Barret	Resident (private well or AMCW)
Kathy Sweet	Resident (private well or AMCW)
Keith Larson	City of Paso Robles
Bob Roos	Resident (private well or AMCW)
Jackie Magill	Resident (private well or AMCW)
John Neil	Atascadero Mutual Water Company
John Hollenbeck	Resident (private well or AMCW)
Carrie Jones	Resident (private well or AMCW)
Jay Short	Templeton CSD
Susan Litteral	Resident (private well or AMCW)/NRCS

Jim Magill recorded the information discussed by the Atascadero Subarea Stakeholders. The Atascadero Subbasin Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Atascadero Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date. The changes in groundwater levels in the Atascadero Subbasin are currently recorded at 33 wells that are included in the groundwater monitoring network.

Groundwater Levels in the Atascadero Subbasin are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subbasin is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

Groundwater levels in the Atascadero Subbasin tend to have a greater range in annual response than other subareas, with average groundwater levels increasing or decreasing by up to 15 feet in single years. The overall trend of the average groundwater levels has remained relatively constant since the early 1980s with groundwater levels rising and falling in response to changing hydrologic conditions and increasing demands. The 2009 average groundwater levels are within ten feet of the 1981 levels as shown on Figure 1. Based on the pattern exhibited on this figure, a single wet year could return the average groundwater levels to the 1981 conditions. It is not clear how the increase in demands since the late 1990s likely contributes to the overall declining groundwater levels of about 30 feet during the 1997 to 2009 period.

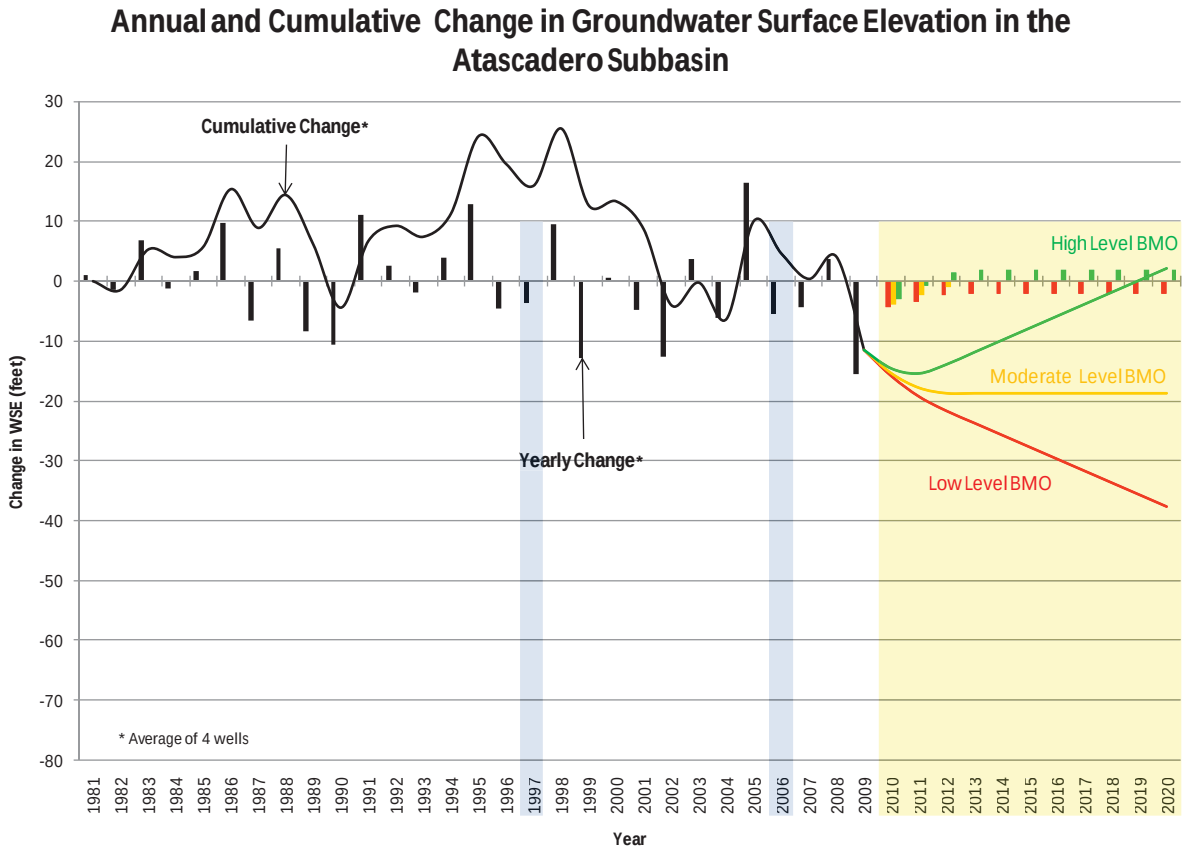

Figure 1. Composite Hydrograph of Four Selected Wells in the Atascadero Subbasin

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Atascadero Subarea met by groundwater increased by about 1,000 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period, likely contributed to the increased rate of groundwater level decline (about five feet per year) during this period.

Table 1. Estimated Water Demands in the Atascadero Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ATASCADERO SUBBASIN							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,348	11,735	0	430	2,032	15,545
Estimated 1997 Demand	(acre-feet)	1,023	11,376	0	300	1,800	14,499
Difference (2006 less 1997)	(acre-feet)	325	359	0	130	232	1,046

2006 Demand Assumptions: Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)

1997 Demand Assumptions: 1997 Demands form Paso Robles Groundwater Basin Study (Fugro, 2002)
Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.
1997 Municipal demand includes City of Paso Robles groundwater pumping from river wells(3,933 acre-feet)
Small community demands included in rural domestic demand

Draft Basin Management Objectives

The Atascadero Subbasin stakeholders determined that an acceptable draft BMO for groundwater levels in the Atascadero Subbasin would include stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells). This draft BMO had strong consensus among the participants.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Atascadero Subbasin Stakeholders to stabilize groundwater levels in the Atascadero Subbasin. The potential benefit from these GMAs has not been quantified for the Atascadero Subbasin (in terms of changes in groundwater

levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Atascadero Subbasin through the addition of new wells to the volunteer monitoring network.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis. Atascadero Mutual Water Company, City of Paso Robles and Templeton Community Services District collect water level data that is provided to the District for inclusion in the monitoring program.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users and impacts on groundwater level trends in the area. The effectiveness of this GMA will be evaluated on an annual basis.

This GMA had large consensus of the Atascadero Subbasin stakeholders. Some of the specific water conservation activities identified include:

- Municipal water purveyors have implemented some level of conservation to date. The effectiveness of these efforts can be tracked by the delivery volumes. Because municipal water demands compose the largest single demand type in the subbasin, there is the greatest opportunity for reduction in groundwater pumping. Based on 2006 municipal demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 880 acre-feet per year.
- Agricultural Water Conservation (opportunities for reductions in groundwater pumping resulting from agricultural conservation programs may be limited in the Atascadero Subbasin due to the comparatively small agricultural demand). Based on 2006 agricultural

demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 130 acre-feet per year.

- Rural Residential Water Conservation (opportunities for reductions in groundwater pumping resulting from rural residential conservation programs may be limited in the Atascadero Subbasin due to the comparatively small rural residential demand). Based on 2006 rural domestic demands in the Atascadero Subbasin, a 10% level conservation could result in a reduction in demand of about 200 acre-feet per year. Water conservation programs in the rural residential sector may focus on the following:
    - Landscape Water Use
    - Consider controls on non-agricultural ponds
    - Development of conservation outreach and incentive programs implemented by San Luis Obispo County

Responsibility for implementing certain components of this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District. The Atascadero Mutual Water Company, City of Paso Robles, and Templeton Community Services District are responsible for implementing water conservation programs within their service areas.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of water demand in the subbasin. In areas outside the jurisdiction of the cities of Atascadero and Paso Robles, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. The cities have implemented land use policies that limit water use rates and promote water conservation, such as limiting turf in new development. In addition, higher water rates paid by city water customers encourage efficient water use. Any policies established in areas where San Luis Obispo County has jurisdiction would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- Discretionary lots splits would require meters on the new well and the existing well
- No net increase in water use resulting from additional rural residential development
- Promote greywater use
- Minimize turf areas
- Meter new wells
- Offset water use
- Explore opportunities for residential rainwater harvesting

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building and the cities of Atascadero and Paso Robles.

DRAFT

GMA 4: Maximize the amount of Nacimiento Project Water in the Subbasin: This GMA includes utilizing the existing Nacimiento Project Water already acquired for use in the subbasin, and explore opportunities to utilize unassigned Nacimiento Project Water.

The San Luis Obispo County Flood Control and Water Conservation District would be one of the lead agencies responsible for implementing this GMA. Local water purveyors would be responsible for developing and implementing projects to acquire supplies from the Nacimiento Water Project.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building, and City of Atascadero would likely be the lead agencies responsible for implementing this GMA.

DRAFT

Summary of Basin Management Objective Workshop For the Bradley and North Gabilan Subareas

The draft Basin Management Objectives (BMOs) for groundwater levels in the Bradley and North Gabilan Subareas were discussed and developed by stakeholders at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Paso Robles City Council Chambers. The stakeholders from the subareas that attended the workshop are listed below:

Name	Affiliation
Robert Johnson	Monterey County Water Resources Agency
Keith Larson	City of Paso Robles
Christopher Alakel	City of Paso Robles
Courtney Howard	San Luis Obispo County

Courtney Howard recorded the information discussed by the stakeholders.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated every few years as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Bradley and North Gabilan Subareas are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Bradley Subarea are currently recorded at one well that is included in the groundwater monitoring network of Monterey County Water Resources Agency (MCWRA). This well is located near the Salinas River just north of the subarea boundary, and may not be representative of groundwater levels throughout the Bradley or North Gabilan Subareas. The lack of data prevents the development of groundwater level hydrographs, or composite hydrographs as developed for other subareas. The lone hydrograph available for these two subareas is shown in Figure 1.

The hydrograph shown in Figure 1 is for a well located near the Salinas River downstream of the confluence of the Salinas River and the Nacimiento River. It appears that groundwater levels in this well reflect the interaction of the Salinas River and the alluvial aquifer materials adjacent to the river. Flows

from the Salinas River, along with releases from Nacimiento Reservoir, help maintain groundwater levels in alluvial aquiver near the Salinas River.

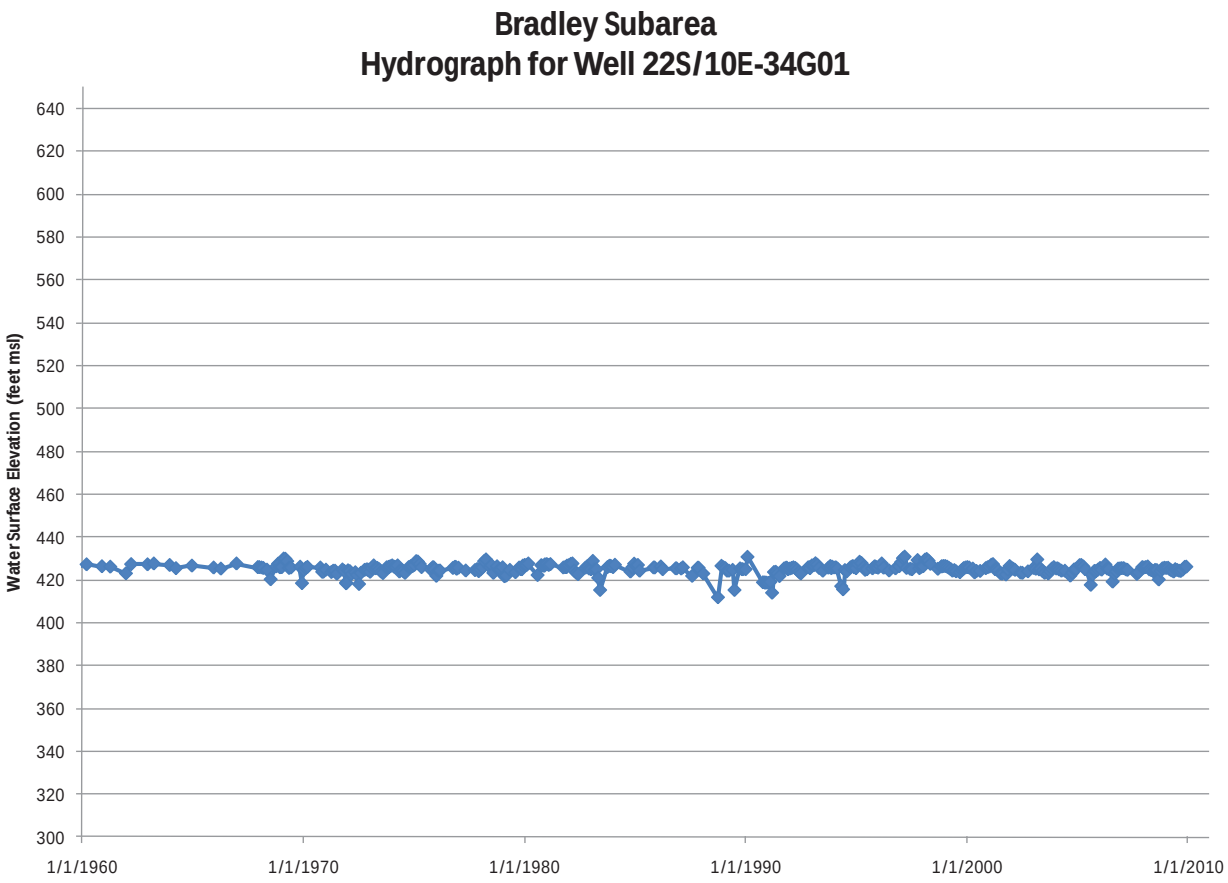

Figure 1. Well Hydrograph in the Bradley Subarea

At this time, we are not aware of any reports or anecdotal information that suggests groundwater levels in the Bradley Subarea or the North Gabilan Subarea are declining to the point of causing problems for local groundwater users.

Water demands in the Bradley Subarea met by groundwater have increased by total of about 1,000 acre-feet between 1997 and 2006 as shown on Table 1.

Table 1. Estimated Water Demands in the Bradley Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE BRADLEY SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	6,933	0	0	184	109	7,226
Estimated 1997 Demand	(acre-feet)	6,001	0	0	136	88	6,225
Difference (2006 less 1997)	(acre-feet)	932	0	0	48	21	1,001
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Water demands in the North Gabilan Subarea met by groundwater have increased by total of about 250 acre-feet between 1997 and 2006 as shown on Table 2.

Table 2. Estimated Water Demands in the North Gabilan Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE NORTH GABILAN SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	1,758	0	0	0	51	1,809
Estimated 1997 Demand	(acre-feet)	1,522	0	0	0	41	1,563
Difference (2006 less 1997)	(acre-feet)	236	0	0	0	10	246
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. As described above there is very little available information to support the development of very targeted BMOs. Based on the available information, the BMO for the Bradley Subarea and the North Gabilan Subarea are to maintain groundwater levels high. The lack of an extensive monitoring network in this part of the Basin will prevent more detailed analysis of this.

Potential Groundwater Management Activities

GMA 1: Continue monitoring and reporting on groundwater conditions: Continue and improve monitoring – look to add monitoring well near the SLO-Monterey county boundary between the Nacimiento River and the town of San Miguel

GMA 2: Consider reestablishing Cloudseeding Program: Consider benefits of re-establishing the cloud seeding program in the Nacimiento and San Antonio watersheds. Cloud seeding was conducted in the past by MCWRA, and is estimated to have increased outflow of Lake Nacimiento and San Antonio Reservoirs by about 20 percent.

Summary of Basin Management Objective Workshop
For the Creston Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Creston Subarea were discussed and developed by stakeholders of Creston Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Creston Subarea that attended the Workshop are listed below:

Name	Affiliation
Sue Luft	WRAC/Grower/RR
Karl Luft	Grower/RR
Sheila Lyons	Rural Resident
David Lyons	Rural Resident
Dana Merrill	Grower
Fritz Helzer	Grower
Claudia Engel	Creston AB
Pam Finley	Templeton AAG

Sue Luft recorded the information discussed by the Creston Subarea Stakeholders. The Creston Subarea Stakeholders generally reached consensus on most of the issues presented below.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Creston Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Creston Subarea are currently recorded at 13 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Creston Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to

represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

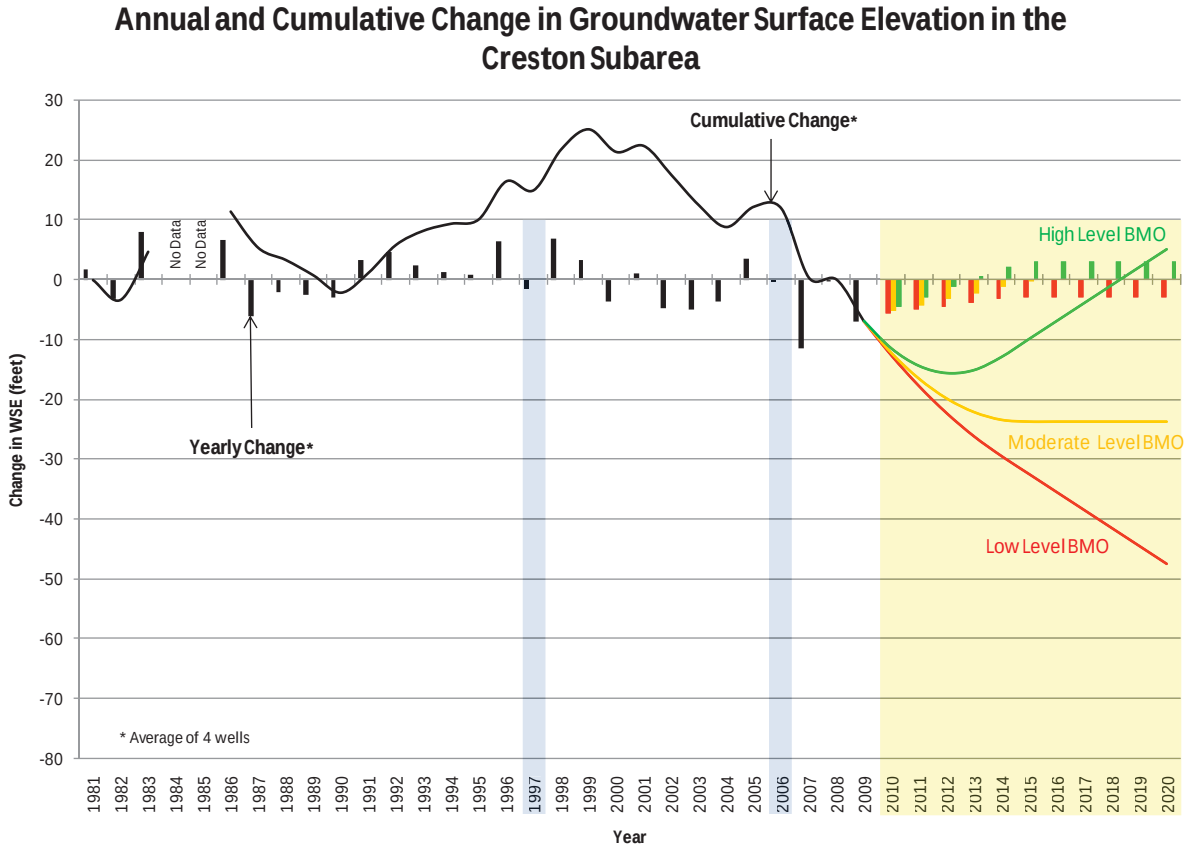

Figure 1. Composite Hydrograph of Four Selected Wells in the Creston Subarea

The average groundwater levels in the subarea appear to have peaked at about 1999. Since this time, groundwater levels have generally declined. This may be due in part to the increase in water demands between 1997 and 2006. During the 1997 to 2006 period, average groundwater levels have declined by less than five feet, but during the 2006 to 2009 period, the average groundwater levels declined by about 20 feet, so it appears that the increase in demands and the numerous dry years have contributed to the declining groundwater levels currently being experienced.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline of groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Creston Subarea met by groundwater increased by about 1,800 acre-feet during the 1997 to 2006 period as shown on Table 1. This information does identify when this increase occurred, but it is likely to have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about seven feet per year) during this period.

Table 1. Estimated Water Demands in the Creston Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE CRESTON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,936	0	0	37	2,338	12,311
Estimated 1997 Demand	(acre-feet)	8,600	0	0	27	1,880	10,507
Difference (2006 less 1997)	(acre-feet)	1,336	0	0	10	458	1,804
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The Creston Subarea stakeholders determined that an acceptable draft BMOs for groundwater levels in the Creston Subarea would include stopping the current rate of decline experienced in the last 10 years, and stabilizing groundwater levels at about the 2009 level as presented in the composite hydrograph (average of four wells) in the next five to ten years.

Potential Groundwater Management Activities

The following Groundwater Management Activities (GMAs) were identified by the Creston Subarea Stakeholders to stabilize groundwater levels in the Creston Subarea. The potential benefit from these GMAs has not been quantified for the Creston Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase monitoring and reporting on groundwater conditions: This GMA includes expanding the groundwater monitoring network in the Creston Subarea through the addition of new wells to the volunteer monitoring network. Additional wells would be needed in the northwest portion of the subarea near the Estrella Subarea where historic groundwater level decline has been the greatest.

Groundwater level measurements are currently taken by the County in the spring and fall of each year. Spring water levels will be used to track year-to-year changes and long-term trends in groundwater levels because they represent more stable conditions. Groundwater levels will be made available on a regular basis (semi-annually) within two months after most current readings, and will be included in the

Paso Robles Groundwater Basin Annual Report. This level of monitoring and reporting of groundwater levels should be sufficient for determining the effectiveness of the GMAs at this time. Additional monitoring and reporting may be needed at some future date.

While this GMA does not directly result in changes in groundwater levels, it will help communicate conditions to individuals and support implementation of groundwater management activities in the subarea.

The San Luis Obispo County Flood Control and Water Conservation District would likely be the lead entity of a cooperative group formed to collect, organize, and report on groundwater conditions in the Paso Robles Groundwater Basin on a regular basis.

GMA 2: Increase water conservation education and implementation: This GMA includes increasing the awareness of the impact of water conservation on reducing groundwater pumping. The effectiveness of the water conservation program will be difficult to verify for rural and agricultural areas without metering well production. The effectiveness of the GMA will be based on the changing behavior of individual water users. The effectiveness of this GMA will be evaluated on an annual basis. Some of the specific water conservation activities identified include:

- Agricultural Water Conservation
- Rural Residential Water Conservation
    - Landscape Water Use
    - Consider controls on non-agricultural ponds

Responsibility for implementing this GMA may include both the San Luis Obispo County Department of Planning and Building, and the San Luis Obispo County Flood Control and Water Conservation District.

GMA 3: Managing the growth and corresponding increase in water demands: This GMA includes identifying potential land use planning activities that may be used to reduce the rate of growth of rural residential development in the subarea. Throughout much of the Basin, land use planning responsibilities are the responsibility of the San Luis Obispo County Department of Planning and Building. Any policies established would be applied to the entire Basin, not just this subarea. This GMA may include:

- Building moratorium on lot splits and subdivisions
- No net increase in water use resulting from additional rural residential development

The San Luis Obispo County Department of Planning and Building would likely be responsible for implementing this GMA.

GMA 4: Preventing export of groundwater from the Basin: This GMA includes identifying potential activities that result in exporting groundwater from the Basin. At this time, additional information is necessary to quantify the occurrence of groundwater pumping for export from the Basin.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

GMA 5: Consider storm water management opportunities to increase local groundwater recharge: This GMA includes evaluating the feasibility of recharging storm water runoff in the streams and creeks of the Basin. The potential benefit (in groundwater recharge) has not been evaluated for this GMA at this time.

The San Luis Obispo County Flood Control and Water Conservation District and Department of Planning and Building would likely be the lead agencies responsible for implementing this GMA.

DRAFT

Summary of Basin Management Objective Workshop
For the Estrella Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Estrella Subarea were discussed and developed by stakeholders of Estrella Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on April 19 at the City of Paso Robles City Council Chambers. The stakeholders from the Estrella Subarea that attended the Workshop are listed below:

Name	Affiliation
Joy Sprague	Rural Resident
Walter Heer	
Christopher Alakel	City of Paso Robles
Chuck Pritchard	Upper Salinas/Las Tablas Resource Conservation District (US/LT RCD)
Jerry Reaugh	Grower
Lisa Bodrogi	(Paso Robles Wine Country Alliance (PRWCA)
Joe Plummer	Grower
Debra Compton	Grower
Steve Carter	Grower
John Wallace	San Miguel CSD
Tom Zehnder	

Iris Priestaf recorded the information discussed by the Estrella Subarea Stakeholders. The Estrella Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives, but did not reach consensus on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Estrella Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Estrella Subarea are currently recorded at 50 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Estrella Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of six wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

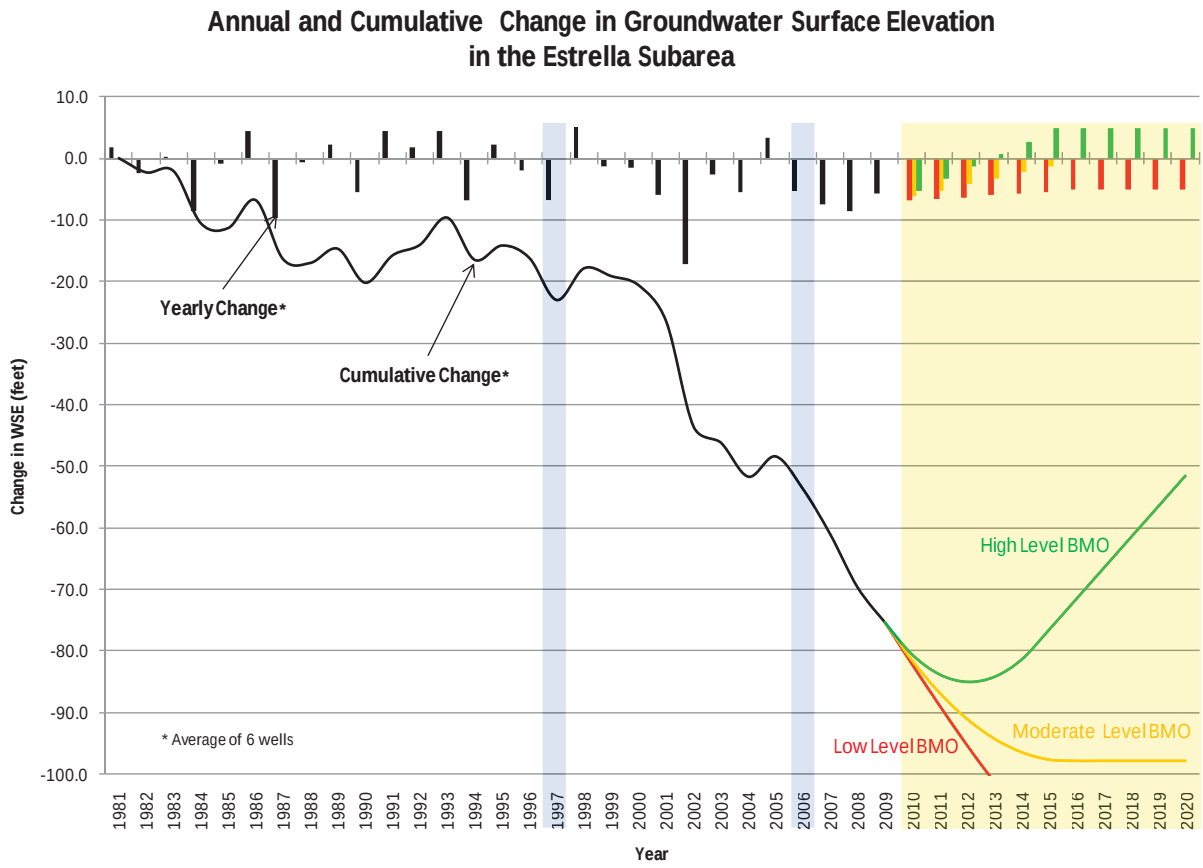

Figure 1. Composite Hydrograph of Six Selected Wells in the Estrella Subarea

Based on the composite hydrograph shown in Figure 1, the average groundwater levels in the Estrella Subarea have declined by about 20 feet between 1981 and 1997. Then, between 1997 and 2006 average groundwater levels have declined by an additional 30 feet. During this same period, water demands in the Estrella Subarea met by groundwater have increased by a total of about 6,300 acre-feet as shown on Table 1. Finally, from 2006 to 2009 the average groundwater levels declined by about 35 feet. During the 1981 to 2009 period, average groundwater levels in the Estrella Subarea declined by about 80 feet, in response to a combination of increasing in water demands that are met by groundwater and a series of dry years in the later years of the period.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Estrella Subarea met by groundwater increased by about 6,300 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands contributed to the significant decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (almost 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Estrella Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE ESTRELLA SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	23,111	3,930	0	1,603	5,433	34,077
Estimated 1997 Demand	(acre-feet)	20,004	2,137	0	1,186	4,368	27,695
Difference (2006 less 1997)	(acre-feet)	3,107	1,793	0	417	1,065	6,382
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						
	1997 Municipal demand includes City of Paso Robles groundwater pumping from basin wells(1,911 acre-feet) and San Miguel (226 acre-feet)						
	Small community demands included in rural domestic demand						

Draft Basin Management Objectives

Three levels of BMOs were discussed by the Estrella Subarea stakeholders. There was consensus that groundwater level declines are a shared problem for the subarea, and that the severity of decline varies across the area. It was also identified that the proposed low-level BMO (essentially do-nothing) was unacceptable.

The medium level BMO of stabilizing groundwater levels was identified as a reasonable objective at this time, but there was concern about the cost and feasibility.

The high-level BMO of recovery of groundwater levels was identified as desirable by private domestic wells owner, but the group agreed that such an objective was over-reaching at this time.

Potential Groundwater Management Activities

The stakeholders reached consensus that there is no magic bullet that will solve the problem, but that the solution will likely involve a combination of activities such as additional water conservation, Nacimiento water supplies, a groundwater recharge program (e.g. using State Water Project or urban runoff), redistribution of pumping, and wastewater discharge/water recycling.

The following Groundwater Management Activities (GMAs) were identified by the Estrella Subarea Stakeholders to stabilize groundwater levels in the Estrella Subarea. The potential benefit from these GMAs has not been quantified for the Estrella Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Increase data collection and monitoring and reporting on groundwater conditions: It was determined that there is enough information to know that there is a problem, however, additional and better information is needed to further understand the problem.

The stakeholders recognize that this GMA does not directly result in changes in groundwater levels, but will help communicate condition to individuals and support implementation of groundwater management activities in the subarea. It was recognized that additional private wells need to be made part of the County well network on a voluntary basis. This is particularly true in specific areas within the subarea currently lacking wells in the water level monitoring network.

GMA 2: Increase water conservation education and implementation: The stakeholders recognized that additional conservation is needed. Some stakeholders felt that the amount of savings that can be achieved is limited. Other stakeholders felt that additional conservation in the agricultural sector could play a significant role in reducing groundwater demand and achieving the BMO of stabilizing water levels. There were several discussions about the potential additional savings from conservation, but consensus could not be reached about the potential savings that could be achieved by the different water use categories (urban, agricultural, and rural). During the conversations each group stated that they believed there was limited opportunity for additional gains from conservation in their demand type, but believed additional conservation could be achieved in other demand types.

GMA 3: Nacimiento Project Water: The stakeholder reached consensus regarding the use of Nacimiento Project Water help alleviate the groundwater decline problem, but it was also recognized as not being the sole solution.

Issues Lacking Consensus

The two primary issues lacking consensus in the subarea was the degree to which additional conservation could be implemented for urban, agricultural, and rural uses.

The Paso Robles Groundwater Basin has largely centralized management because of a lack of water districts or local water agencies, so there was no consensus about the agency or organization that would have the responsibility for prioritizing and implementing the identified groundwater management activities.

DRAFT

Summary of Basin Management Objective Workshop
For the San Juan Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the San Juan Subarea of the Paso Robles Groundwater Basin (Basin) were discussed and developed by stakeholders of San Juan Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the San Juan Subarea that attended the Workshop are listed below:

Name	Affiliation
Amy Gillman	5th District Legislative Assistant
Steve Sinton	Shandon
Randy Diffenbaugh	Shandon Advisory Committee
Susan Litteral	Natural Resource Conservation Service
Doug Felipponi	SJV FET
Mary Russell	Shandon

Susan Litteral recorded the information discussed by the San Juan Stakeholders.

The San Juan Subarea Stakeholders generally reached consensus on the level of Basin Management Objectives and on the Groundwater Management Activities.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the San Juan Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the San Juan Subarea are currently recorded at 10 wells that are included in the groundwater monitoring network. Overall, groundwater levels have been fairly stable in the San Juan Subarea. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea is shown on Figure 1 for the 1981 to 2009

period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

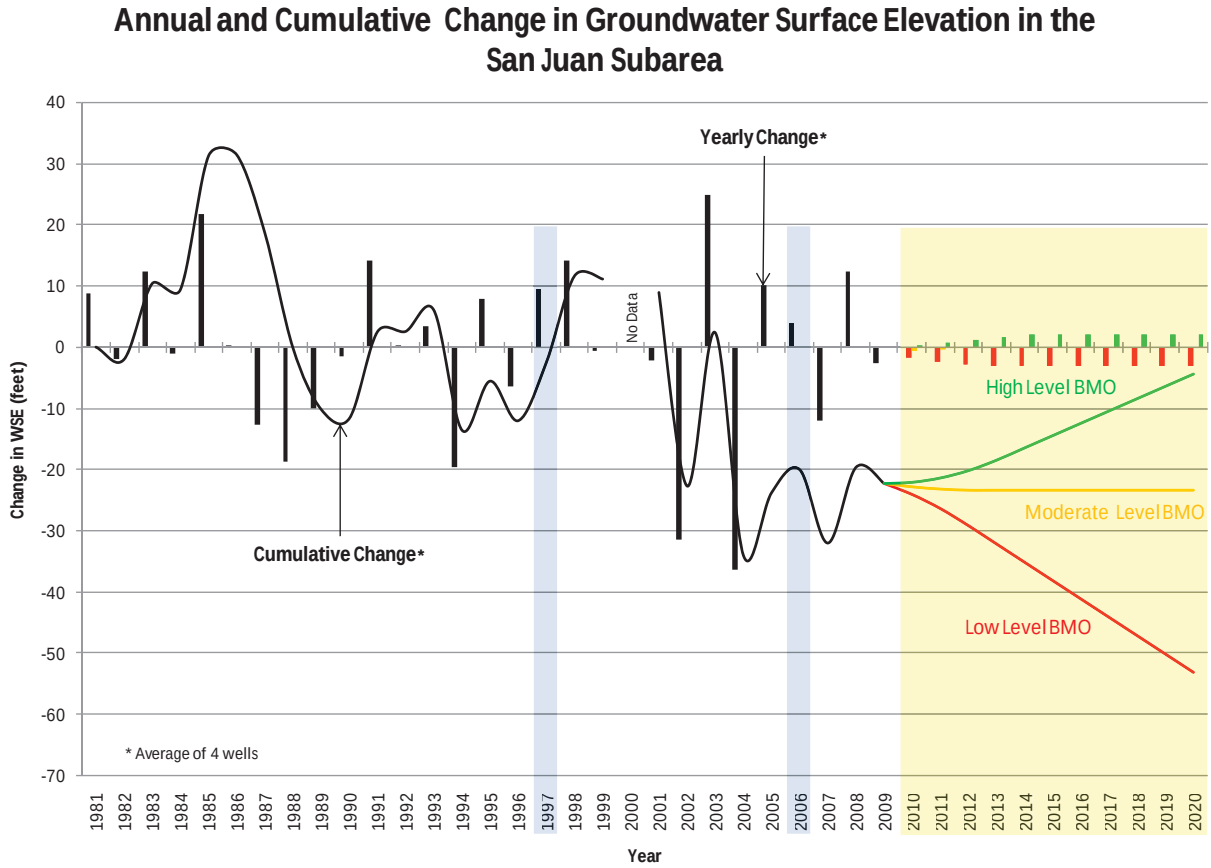

Figure 1. Composite Hydrograph of Four Selected Wells in the San Juan Subarea

Based on the composite hydrograph shown in Figure 1, the San Juan Subarea shows highly variable annual changes in groundwater levels. It appears that groundwater levels in the San Juan Subarea respond quickly to changes in hydrologic conditions, with average groundwater levels increasing or decreasing by as much as 35 feet in a single year.

During the 1981 and 1997 period, average groundwater levels changed considerably on a year-to-year basis, but there was no net significant difference in the cumulative groundwater levels at the end of the 16-year period. During the 1997 and 2006 period, the average groundwater levels in the San Juan Subarea declined by about 20 feet. Finally, during the 2006 to 2009 period, the average groundwater levels declined slightly (less than 5 feet). Overall, during the 1981 to 2009 period, average groundwater levels in the San Juan Subarea declined by about 25 feet.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater

levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

The stakeholders mentioned that the area is primarily planted with field crops, and very few permanent crops. The statement was made that the amount of annual plantings are based in part on the depth to groundwater, because greater depth to groundwater increases pumping costs, at some point it will become uneconomical to grow some crops. This pattern of behavior (not planting some crops when groundwater levels are low) may contribute to the recovery response in groundwater levels, and preventing long-term groundwater level declines in the subarea.

Water demands in the San Juan Subarea met by groundwater have increased by a total of about 740 acre-feet between 1997 and 2006 as shown on Table 1. Looking at just these two single years of estimated water demand data may not provide a clear picture of the annual variation in agricultural water demand in the subarea.

Table 1. Estimated Water Demands in the San Juan Subarea for 1997 and 2006

Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	5,347	0	0	0	105	5,452
Estimated 1997 Demand	(acre-feet)	4,628	0	0	0	84	4,712
Difference (2006 less 1997)	(acre-feet)	719	0	0	0	21	740
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The different levels of BMOs were discussed at the workshop. There was consensus among the stakeholders that groundwater levels fluctuate considerably, but that there was no real concern of long-term declining groundwater levels at this time. Because the subarea experiences periods of rising and falling groundwater levels, the stakeholders expect the cumulative change in average groundwater levels to fluctuate over time, but return to zero net change in groundwater levels (no change from 1981 levels) without implementation of large scale groundwater management activities.

Potential Groundwater Management Activities

Because of the nature of the subarea, and pattern of groundwater use, this subarea may not have the same need for Groundwater Management Activities (GMAs) as other subareas in the

Basin. The following GMA was identified by the San Juan Subarea Stakeholders to stabilize groundwater levels in the San Juan Subarea.

GMA 1: Continue monitoring and reporting on groundwater conditions: The stakeholders suggest continuing the groundwater level monitoring and reporting program. The existing monitoring network provides reasonable coverage for the subarea at this time based upon the current groundwater level conditions. Additional monitoring wells could be added, but are not considered as important as continuing to actively monitoring and reporting on groundwater levels to extend the historical period of record.

DRAFT

Summary of Basin Management Objective Workshop
For the Shandon Subarea

The draft Basin Management Objectives (BMOs) for groundwater levels in the Shandon Subarea of the Paso Robles Groundwater Basin were discussed and developed by stakeholders of the Shandon Subarea at the Paso Robles Groundwater Basin Management Plan BMO Workshop held on May 10 at the Shandon High School Gymnasium. The stakeholders from the Shandon Subarea that attended the Workshop are listed below:

Name	Affiliation
Mike Clay	Red Cedar Vineyard
Dennis Bowman	Green River Mutual Water
Greg Jaeger (South Gabilan)	Rural Resident
Sydney Wattles	Shandon Home-Owner
Keith Larson	City of Paso Robles
Frank Mecham	SLO County
Kate Twisselman	Shandon Advisory Committee
Raymond Twisselman	Shandon Resident
Les Diffenbaugh	Shandon Resident
Fritz Helzer	Shandon Hills Vineyard

Courtney Howard (San Luis Obispo County Public Works Department Staff) recorded the information discussed by the Shandon Subarea Stakeholders. One stakeholder from the South Gabilan Subarea attended the workshop and participated in the discussions of the Shandon Subarea stakeholders.

While not all of the Shandon Subarea stakeholders are experiencing the same magnitude of groundwater level decline or type of groundwater quality deterioration, they generally reached consensus on the level of Basin Management Objectives, and some of the Groundwater Management Activities. One of the biggest concerns was the cost of the GMAs identified, and their overall cost effectiveness at improving groundwater levels in the subarea.

Basin Management Objectives are intended to provide quantifiable and measureable targets so that progress towards improved groundwater management can be tracked. BMOs are being developed for subareas within the Paso Robles Groundwater Basin (Basin) to represent the differing groundwater conditions and necessary management activities.

Groundwater Management Activities (GMAs) are intended to identify the steps or actions taken to meet the BMOs. It should be recognized that both BMOs and GMAs should be evaluated and updated routinely (every few years) as additional information is collected, or in response to changing conditions.

Groundwater Levels in the Shandon Subarea are affected by:

- Annual hydrologic conditions
- Changes in water demands that are met with groundwater

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. These wells are used to track the changes in groundwater level trends through time at a specific location, or across an area for a specific date.

The changes in groundwater levels in the Shandon Subarea are currently recorded at 18 wells that are included in the groundwater monitoring network. Based on the groundwater level data collected in the Shandon Subarea, there has been a general decline in groundwater levels observed and recorded at selected wells located throughout the subarea since the 1960s. The rate of decline changes through time in response to changing hydrologic conditions and changes in the amount of local groundwater pumping. The composite hydrograph of four wells (currently in the monitoring network) was selected to represent the conditions in the subarea (shown on Figure 1) for the 1981 to 2009 period. These wells will be used as an indicator to how groundwater levels in the subarea are changing over time.

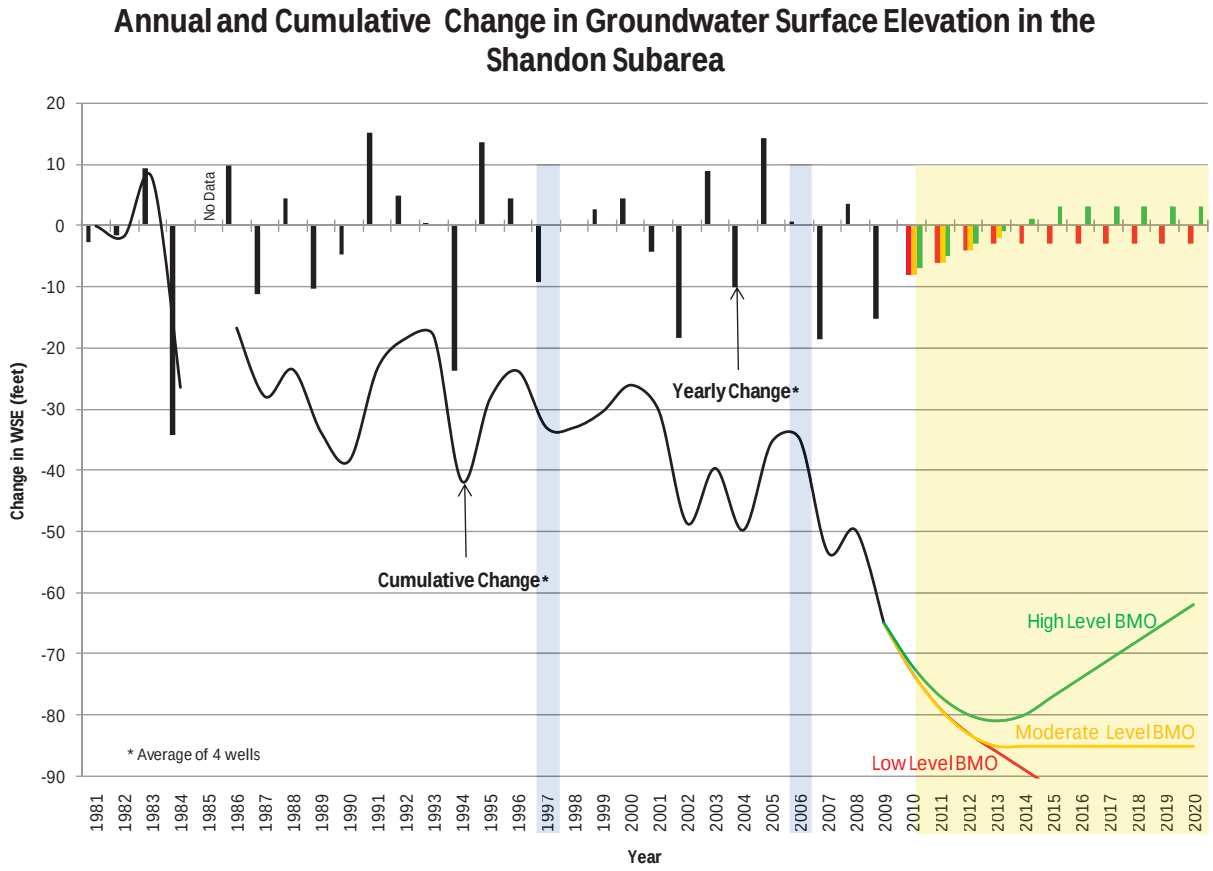

Figure 1. Composite Hydrograph of Four Selected Wells in the Shandon Subarea

Based on the composite hydrograph shown in Figure 1, the Shandon Subarea shows a wide range of annual changes in groundwater levels, with a general trend of declining groundwater levels.

During the 1981 to 1997 period, average groundwater levels in the Shandon Subarea have declined by about 33 feet. During the 1997 to 2006 period, average groundwater levels fluctuated annually, but resulted in very little net decline (about 2 feet) compared to 1997 levels. Finally, from 2006 to 2009 period, the average groundwater levels declined by about 30 feet. Overall, during the 1981 to 2009 period (28 years), average groundwater levels in the Shandon Subarea declined by about 65 feet (about 2.3 feet per year), in response to a combination of increasing in water demands that are met by groundwater, and in the later years of the period, a series of dry years.

The 2010 to 2020 period included on Figure 1 shows potential range of changes in groundwater levels in the subarea under different levels of BMOs. Low level BMOs would be expected to result in a continuing decline or groundwater levels similar to those experienced during the 1997 to 2009 period. The moderate level BMO would eventually result in no change in groundwater levels (stabilized groundwater levels). The high level BMO would result in improvement of groundwater levels over time. These projected groundwater levels are intended to show the differences in groundwater levels based on target groundwater levels (BMOs) selected for the subarea, and the magnitude of the GMAs implemented. Additional analysis is needed to quantify the result (in terms of groundwater levels) due to the implementation of GMAs in the subarea.

Water demands in the Shandon Subarea met by groundwater increased by about 1,600 acre-feet during the 1997 to 2006 period as shown on Table 1. This increase in demands may have contributed to the slight decline of groundwater levels during this period. These higher demands, along with drier conditions during the 2006 to 2009 period likely contributed to the increased rate of groundwater level decline (about 10 feet per year) during this period.

Table 1. Estimated Water Demands in the Shandon Subarea for 1997 and 2006

GROUNDWATER DEMAND BY DEMAND TYPE FOR 1997 AND 2006 FOR THE SHANDON SUBAREA							
Groundwater Demand		Demand Type					
		Agricultural	Municipal	Small Community	Small Commercial	Rural Domestic	TOTAL
2006 Demand	(acre-feet)	9,896	0	0	69	1,205	11,170
Estimated 1997 Demand	(acre-feet)	8,566	0	0	51	969	9,586
Difference (2006 less 1997)	(acre-feet)	1,330	0	0	18	236	1,584
2006 Demand Assumptions:	Based on Evaluation of Paso Robles Groundwater Basin Pumping Water Year 2006 (Todd, May 2009)						
1997 Demand Assumptions:	1997 Demands from Paso Robles Groundwater Basin Study (Fugro, 2002)						
	Distribution of agricultural demands based on crop acreages from 1997 DWR land use survey for San Luis Obispo County.						

Draft Basin Management Objectives

The stakeholders were initially concerned that the only way to stop the declining groundwater levels was to force people to stop pumping. Initially, the discussions of the group suggested a 'survival of the fittest' approach to groundwater pumping where only those with the deepest wells and the ability to afford pumping would continue to pump as costs increased. The others would be put out of business or be forced to make changes to their water use requirements.

After continued discussions, it was generally agreed that stabilizing groundwater levels was an appropriate objective at this time, but there is a concern about the cost and feasibility of stabilizing groundwater levels.

Potential Groundwater Management Activities

The stakeholders reached consensus that there was no single activity that would solve the problem, but that the solution will likely involve a combination of activities. The following Groundwater Management Activities (GMAs) were identified by the Shandon Subarea stakeholders to stabilize groundwater levels in the Shandon Subarea. The potential benefit from these GMAs has not been quantified for the Shandon Subarea (in terms of changes in groundwater levels), so it has not been determined if implementation of the GMAs will result in stabilized groundwater levels.

GMA 1: Groundwater Recharge and Banking Programs: The discussions did not focus on the details of this project or the approach, but did identify potential groundwater recharge or banking of either imported supplies or from storm water runoff as potential sources of groundwater recharge. One potential project that was discussed was an inflatable dam project such as was done along the Salinas River in Northern Monterey County. No additional details were provided on that potential project.

GMA 2: State Water Project supplies for Shandon: The community of Shandon has not used its 100 acre-feet of State Water Project water (SWP) to date. This project would include tying in to the Coastal Branch were it passes through Shandon to access the 100 acre-feet of supply. SWP supplies on the Coastal Branch are treated at the Polonio Pass Water Treatment Plant. This project would reduce municipal groundwater pumping in the Shandon area by the amount delivered from the SWP, thereby reducing groundwater pumping.

An alternative of this GMA would be to pursue additional SWP supplies that could also be delivered to Shandon. San Luis Obispo County has a contract allocation to additional SWP supplies that it has not used, and is not currently using. These supplies could be a potential source of water to the area. Additional capacity in Phase II of the Coastal Branch would be needed to deliver water in excess of the 100 acre-feet supply currently contracted to Shandon by the County. An investigation regarding the additional capacity of the Coastal Branch is currently being pursued by the District.

GMA 3: Formation of Irrigation District or Water District: The discussion focused on the potential need to form an irrigation district or water district to import surface water into the Paso Robles Groundwater Basin. Irrigation Districts/Water Districts are often formed to pursue large projects that benefit a larger group of water users. Such a district may be formed to

pursue a groundwater recharge or water banking project that would rely on imported surface water.

GMA 4: Increase water conservation education and implementation: The stakeholders recognized that additional conservation may result in a water savings, but were not sure if it would be cost effective. There was no objection to promoting conservation, and some discussions explored different conservation methods (such as alternative frost-control measures) since most growing operations are already on drip, and landscaping in Shandon is generally modest.

GMA 5: Precipitation Enhancement: This was brought up for discussion, but it was unclear whether this project would work for the Shandon area.

DRAFT