

**CALAVERAS COUNTY MONITORING PLAN
PORTIONS OF THE EASTERN SAN JOAQUIN GROUND
WATER SUBBASIN**

**FOR THE
CALIFORNIA STATEWIDE GROUNDWATER ELEVATION
MONITORING PROGRAM
(CASGEM)**

PREPARED FOR

CALAVERAS COUNTY WATER DISTRICT

PREPARED BY:

**DUNN ENVIRONMENTAL, INC.
5060 Robert J. Mathews Pkwy, Suite 2
El Dorado Hills, CA 95762**

DE Project No.: 154-01

**November 21, 2012
Revision 0**



Table of Contents

1	INTRODUCTION.....	2
1.1	SCOPE AND PURPOSE.....	2
1.2	MONITORING PLAN OBJECTIVES	2
2	REGIONAL SETTING AND BACKGROUND	4
2.1	HYDROLOGY	4
2.2	HYDROGEOLOGY.....	4
3	CASGEM MONITORING PLAN.....	6
3.1	MONITORING AREA.....	6
3.2	PRE-CASGEM GROUND WATER MONITORING.....	6
3.3	MONITORING WELL NETWORK AND RATIONALE	7
3.4	DATA GAPS	7
3.5	REFERENCE POINT MONITORING ELEVATIONS.....	9
3.6	STATIC WATER LEVEL MEASUREMENTS	9
3.7	SEMIANNUAL MONITORING SCHEDULE	10
3.8	WATER LEVEL DATA REPORTING.....	10
4	REFERENCES	12

LIST OF FIGURES

Figure 1	Location Map	3
Figure 2	Monitoring Well Network and September 2012 Contour Map.....	8

APPENDICES

APPENDIX A	TABLE A-1 MONITORING WELL NETWORK DETAIL
APPENDIX B	REPRESENTATIVE FIELD DATA SHEET

1 INTRODUCTION

1.1 SCOPE AND PURPOSE

This monitoring plan has been designed and formatted to comply with the monitoring plan requirements provided in the California Statewide Groundwater Elevation Monitoring Program (CASGEM). The CASGEM program, created in response to Senate Bill SBX7 6, is a statewide ground water level monitoring program established to monitor long term water level trends. Ground water levels in ground water basins, defined in Bulletin 118 published by the Department of Water Resources (DWR), will be monitored by monitoring entities with eventual upload to the CASGEM website. The information collected for this program can be used by public and private agencies in future ground water studies.

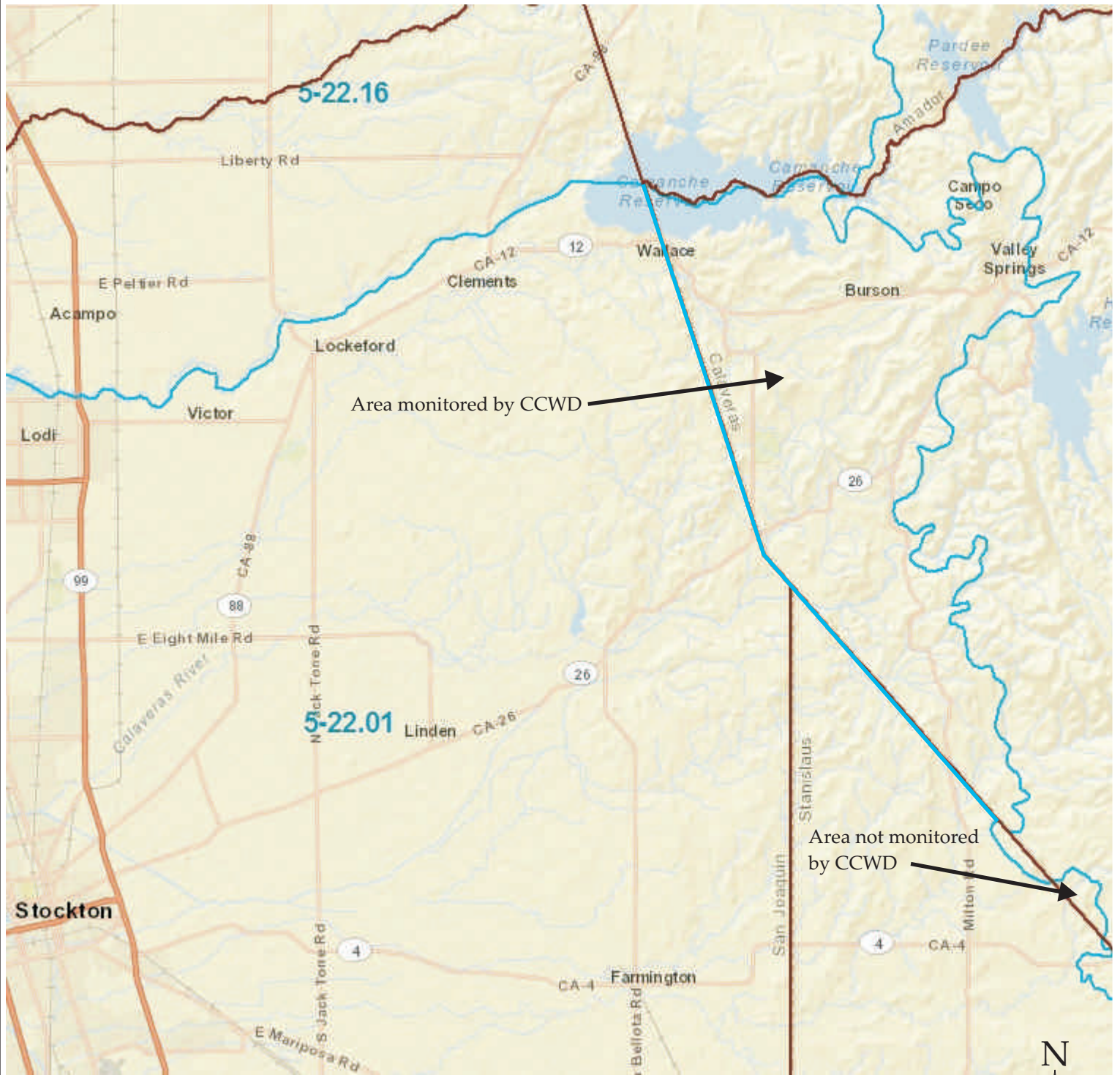
Calaveras County Water District (CCWD) has been designated as the monitoring entity for the specific areas in Calaveras County that lie within the East San Joaquin Groundwater Basin designated by DWR. Refer to Figure 1 for a depiction of the area.

1.2 MONITORING PLAN OBJECTIVES

The primary objectives for CCWD as a Monitoring Entity in implementing the CASGEM program are to:

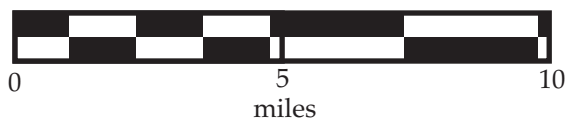
- Collect semi-annual ground water levels from a selected monitoring well network
- Upload ground water levels to the CASGEM website after data quality steps have been completed.
- Maintain and update the monitoring well network plan documents including additions and removals from the well network

The primary objectives of the statewide DWR CASGEM program are to organize Monitoring Entities and their coverage areas, provide a water level database upload and storage location for Monitoring Entities, review Monitoring Entity monitoring plans and well networks and to consider collecting water levels for portions of Bulletin 118 basins not covered by a Monitoring Entity.



LEGEND

 Eastern San Joaquin Subbasin Outline



Map adapted from CASGEM GIS Map Viewer



DATE: 11/13/2012
SCALE: AS SHOWN
PROJECT NO: 154-01
DRAWN: CT
CHECKED: PFD
FIGURE: 1

LOCATION MAP
CALAVERAS COUNTY WATER DISTRICT
CALAVERAS COUNTY, CALIFORNIA

2 REGIONAL SETTING AND BACKGROUND

2.1 HYDROLOGY

The Eastern San Joaquin Groundwater Subbasin (Subbasin 5-22.01) is bounded by the Modesto, Delta-Mendota and Tracy subbasins to the south, southwest and west and by the Solano, South American and Cosumnes subbasins to the northwest and north. The subbasin covers 707,000 acres of the San Joaquin, Stanislaus and Calaveras counties.

The San Joaquin River and its major tributaries, the Stanislaus River, Calaveras River and Mokelumne Rivers, are the surface drainage features for the subbasin. The San Joaquin River flows to the north and eventually discharges in the San Francisco Bay.

Annual precipitation over the subbasin area ranges from 11 inches to the southwest and 25 inches to the northeast.

2.2 HYDROGEOLOGY

As per the published background references, the predominant water-bearing units in the entire Eastern San Joaquin subbasin are, from oldest to youngest, the Valley Springs Formation, the Mehrten Formation, the Laguna Formation, Flood Basin deposits, the Modesto/Riverbank Formations and recent Alluvium. For the portion of the subbasin in Calaveras County, the predominant water bearing formation is the Valley Springs Formation and with limited supply from the Mehrten Formation.

The recharge and water bearing soil and geologic formations within the subbasin are described further as follows:

- Significant soil horizons have been identified with significant permeabilities that may act as good recharge sources to ground water.
- Older Alluvium consists of loosely to moderately compacted sand, silt and gravel deposited in alluvial fans during the Pliocene and Pleistocene. These units are moderately permeable, however, due to the shallow nature, ground water quality impacts from agriculture or other man-made activities are common.
 - Alluvial and Tertiary Sand and Gravel erosional and depositional Sequences – As documented throughout the Sierra Foothills and of significance hydrogeologically are the erosional and depositional sequences that contain significant sand and gravels from historical

channel deposition within the laterally confined alluvial basins. These sequences are considered significant recharge sources.

MEHRTEN FORMATION

The Miocene Age Mehrten Formation is described as fluvial, alluvial, and mudflow deposits derived mainly from andesitic volcanic rocks. The Mehrten Formation outcrops discontinuously along the eastern edge of the Sacramento Valley. Surface geologic mapping, provided in the Calaveras County Water District Phase II Groundwater Management Study report prepared by WRIME in June 2005, identified limited outcrops of the Mehrten Formation on the extreme western edge of the CCWD area. Based on the surface geologic mapping, the Mehrten Formation is not a significant water bearing formation for the CCWD basin; other than the potential interconnection with Tertiary Sand and Gravels identified above.

VALLEY SPRINGS FORMATION

The Valley Springs Formation, Oligocene in age, contains stream channel and alluvial deposits derived mainly from rhyolitic volcanic rocks including some white, welded tuffs and ash flows. A rhyolitic conglomerate is located as a basal contact with the underlying Ione Formation. Limited, discontinuous sandstone units and lenses have been identified in the Valley Springs Formation, which provide localized aquifer storage and aquifer recharge areas.

GROUND WATER FLOW

Primarily within the Valley Springs Formation and as depicted on Figure 1, the general ground water flow direction is to the west and southwest with distinct high and low water table conditions in specific areas.

Overdraft conditions have been documented historically for the Eastern San Joaquin Groundwater Subbasin. According to the DWR Bulletin 118 description, ground water levels in Eastern San Joaquin County have displayed a continuous water level decline with an average rate of 1.7 feet decline per year. Limited, recent ground water levels collected in the CCWD area have confirmed the declining trend in water levels in Calaveras County.

3 CASGEM MONITORING PLAN

3.1 MONITORING AREA

The Calaveras County Water District (CCWD) is the monitoring entity for the Calaveras County portion of the Eastern San Joaquin Subbasin. The subbasin is bounded to the west by the San Joaquin county border and to the north by the Amador County border and Mokelumne River. The eastern edge of the subbasin extends from slightly east of Valley Springs, through Jenny Lind and south to Milton; refer to Figure 1. The Bulletin 118 basin includes one small area slightly north of Highway 4 and southeast of Milton. CCWD does not have monitoring wells in this area and does not propose to monitor water levels for this area. Water level measurements will be collected for the larger area noted above and depicted on Figure 2. In Calaveras County, the subbasin forms a generally triangular shape and will be referenced as the CCWD area through the rest of this plan.

3.2 PRE-CASGEM GROUND WATER MONITORING

The DWR has not completed water level monitoring in the CCWD portion of the basin. CCWD, during the development of the ground water management plan, did complete ground water level collection for a network across the subbasin in Calaveras County. Water levels were collected on a semi-annual basis. Water levels are recorded for some wells as early as 2001.

During investigation efforts completed from 2009 through 2011, the United States Geological Survey (USGS) completed two multi-completion nested monitoring wells in the CCWD basin. These wells were used for water quality and age dating analyses. During the USGS monitoring efforts, the multi-completion wells were outfitted with pressure transducers to monitor water levels. Water levels for the southernmost wells, 12G1-4, ranged from 120 to 127 feet below ground surface. Observations during the investigation indicated that water levels declined from 6 to 22 feet in October 2010 but returned to approximate May 2010 levels by spring 2011. For the northernmost wells, 36A1-3, water levels ranged from 123 to 133 feet below ground surface. Observations during the investigation indicated that water level declines were less than observed in 12G1-4, except for the deep well, 36A3, which declined 8 feet. Water levels recovered by spring 2011.

Additional efforts are progressing to assess the location of significant ground water recharge influence areas within the basin which will lead to additional water quality monitoring from other wells in the network. These monitoring wells will be used in the proposed CASGEM monitoring well network provided in Appendix A, Table A-1.

3.3 MONITORING WELL NETWORK AND RATIONALE

The monitoring well network for the CCWD is comprised of 16 monitoring, domestic, irrigation and observation wells as depicted on Figure 2. In order to select wells, the CCWD area was split into five separate areas of aquifer interest. These areas of interest were identified for potential recharge areas and for spatial coverage.

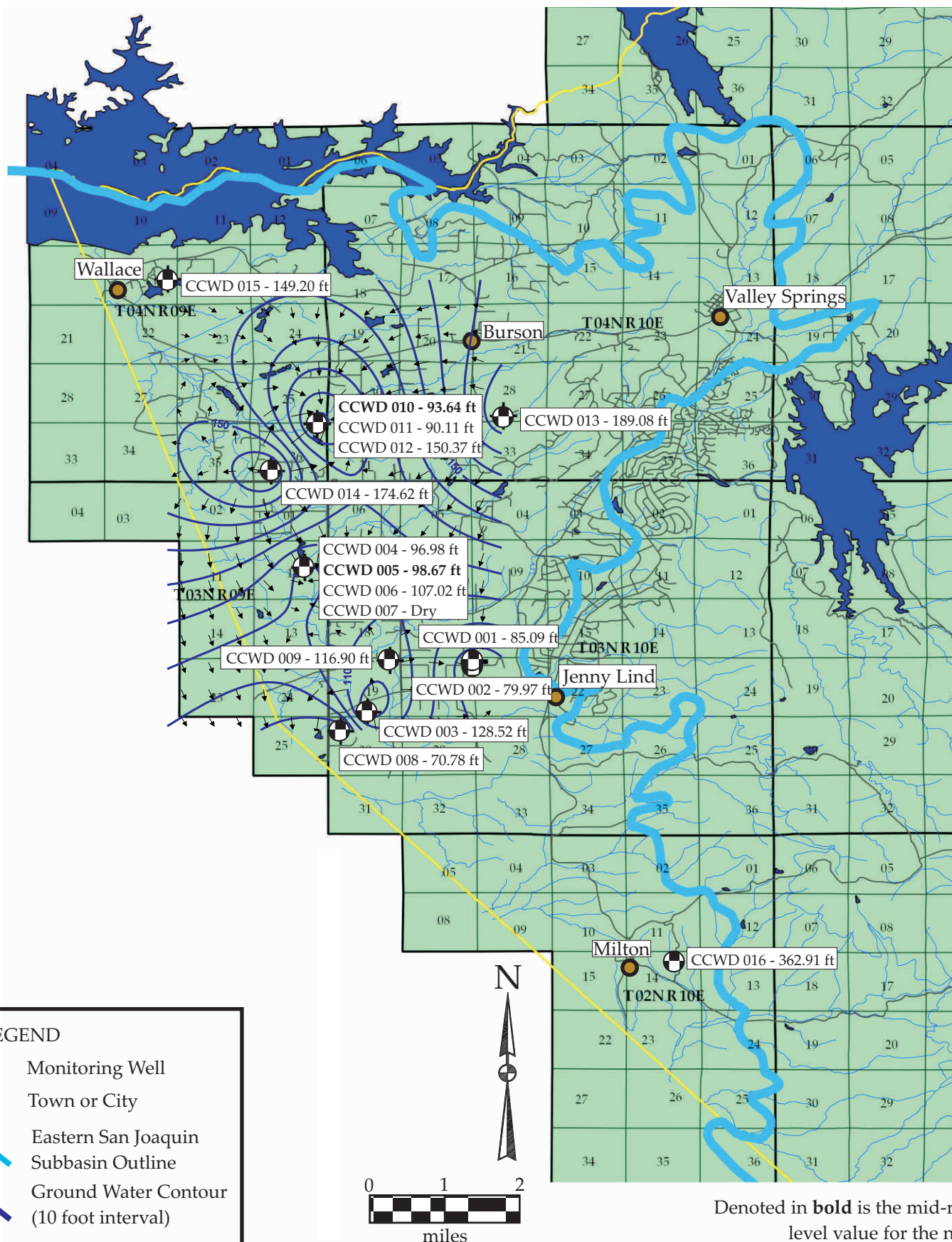
An attempt was made to identify well pairs, defined as one shallow well and one deep well within close proximity to one another, in order to determine water level trends for deep and shallow wells in the CCWD basin and determine unconfined, semiconfined or confined aquifer conditions. Some wells are shown as well pairs. Attempts may be made in the future to identify additional supplemental wells for well pairs. Refer to Appendix Table A-1 for well specifics including coordinates, well depth and known depth interval of screens. Initial groundwater elevations are provided on Figure 2 along with a contour map for September 2012.

In the future, for comparison purposes water quality samples may be collected from selected wells in the monitoring network to approximate water age by using Tritium and Carbon-14 analyses. Samples will be collected based on the well location in the network, well depth, screen lengths and water level information. Under consideration at this time of sampling is the upgradient and easternmost well, CCWD 013. A sample may be collected also from well CCWD 001 and CCWD 008 as these wells are the furthest downgradient.

3.4 DATA GAPS

Adequate coverage has been established; but additional wells may be needed in the future if existing well owners decide to opt out of the monitoring well network after it has been established. Changes to the monitoring well network will be submitted to the DWR CASGEM system and web site as appropriate for updates to this Plan.

Currently, data gaps exist on the eastern edge of the CCWD area and between Jenny Lind and Milton. The majority of the monitoring wells in the current monitoring network are privately owned irrigation or domestic wells. Extensive efforts were made to acquire additional private wells to the east, but access permission was not granted by individual well owners.



3.5 REFERENCE POINT MONITORING ELEVATIONS

Wells that are listed on the monitoring well list were assessed during a site visit prior to monitoring. During this site visit, the well was inspected, an access port determined and a reference point established. The reference point for the majority of the wells was the Top of PVC Casing. Additional details including approximate location (latitude/longitude) are provided in the CASGEM system and Appendix A, Table A-1.

The inspection of the well included the well seal, well pad, monument, accessibility and any other pertinent details that may affect the feasibility of the well for a monitoring point. During the site visit, the reference point was established, photographed and measured. The reference point location is in proximity to the access port, and may be the access port, for the well.

The location and ground surface elevation has been measured with a handheld GPS device and the difference between ground surface and the reference point will be determined with a tape measure. If a reference point elevation or location must be altered or changed, the new elevation will be determined in a similar manner.

3.6 STATIC WATER LEVEL MEASUREMENTS

Pre-field preparation will include contacting the well owners, preparing field paper work and equipment. Water level sounder operation and decontamination shall be verified.

On approach to the monitoring location site, a visual inspection to assess proper security and surface well seal conditions should be made.

- The access point should be assessed for a secured cap then removed.
- Verification that the well pump is not operating, if present, should be made.
- After removing the well cap, the water level measurement shall be collected using a clean electronic sounding tape.
- A Solinsttm graduated tape sounder or a Powerstm sounder will be used.

Prior to monitoring, the sounding tape will be inspected for wear or stretching. The tape will be decontaminated with a distilled water rinse and wiped down with a paper towel. On a frequent basis, a non-phosphate soap and a distilled water mixture will be used to further clean the water level sounder. After the phosphate wash, the sounder will be rinsed with distilled water. The sounder will be checked to ensure operation and that a complete circuit is made prior to taking a water level measurement.

After decontamination and initial checks, the tape will be lowered carefully, to avoid snagging on pumps, until the water surface is reached and the circuit completed.

- The tip of the finger, fingernail or alligator clamp will be used to mark the depth to water from the reference point, verification will be made three times (repeated measurements) prior to recording the value on the field data sheet. Before recording the value, the measurement goal of 0.05 foot when comparing the last two measurements should be achieved.

Additional observations, such as active or recent pump use, well conditions, difficulty in obtaining water levels or other details will be included on the field data sheets. Standard DWR questionable measurement or no measurement codes will be used, as required. Refer to Appendix B for a representative monitoring field data sheet.

As the tape is removed from the well, a paper towel will be used to remove any residue observed. The sounder will be rinsed with distilled water upon removal at a minimum; additional cleaning efforts will be made as noted above.

To ensure data accuracy and validity, ground water levels collected will be compared to previous monitoring events. These comparisons will be used to ensure that data collected under CASGEM are consistent with previous seasonal water level measurements. Water level trends will be observed but not evaluated prior to upload. Water level data that is not consistent with historic values may be collected in a separate event or flagged with an “other” questionable measurement code (QM-6) prior to upload.

3.7 SEMIANNUAL MONITORING SCHEDULE

Monitoring wells will be monitored on a semiannual basis, during the first and third quarters of each year. Water levels will be collected for the entirety of the monitoring well network within one or two field days, not to be spaced more than one week apart.

For the monitoring well U2, CCWD 016, located at the Rock Creek Landfill, data will be updated once it has become available online or data is provided by the Calaveras County Public Works Department. Refer to Table A-1 for specific well information.

3.8 WATER LEVEL DATA REPORTING

The CCWD monitoring network ground water levels will be submitted to the DWR’s Online CASGEM Submittal System semiannually, by January 1 and July 1 of each year. The water level reporting effort for each well should include the following information:

- CCWD well identification number
- Observation date
- Reference location and measurement point elevation
- Depth to water

- Measurement device and serial number
- Measurement quality codes
- Decontamination procedure and quality assurance steps (repeat measurements)
- Data validation through comparisons for consistency with previous seasonal measurements prior to CASGEM upload

4 REFERENCES

- Department of Water Resources, California's Groundwater Bulletin 118 Update 2003, October 2003.
- Department of Water Resources, Groundwater Elevation Monitoring Guidelines, December 2010.
- Metzger, L.F., Izbicki, J.A., and Nawikas, J.M., 2012, Test drilling and data collection in the Calaveras County portion of the Eastern San Joaquin Groundwater Subbasin, California, December 2009–June 2011: U.S. Geological Survey Open-File Report 2012-1049, 26 p.
- Water Resources and Management Engineering, Inc., Camanche/Valley Springs Area Hydrogeologic Assessment, July 2003.
- Water Resources and Management Engineering, Inc., Phase II Groundwater Management Study, June 2005.

APPENDIX A

MONITORING WELL NETWORK DETAIL TABLE

TABLE A-1
MONITORING WELL NETWORK DETAIL
CALAVERAS COUNTY WATER DISTRICT
MONITORING PLAN NOVEMBER 2012

Local Well Designation	State Well Number	Well Log Available	RP Elevation	GS Elevation	Well Use	Well Status
CCWD 001	03N10E21D	Yes	273.5	272	Residential	Active
CCWD 002	03N10E21	Yes	273.5	272	Irrigation	Active
CCWD 003	03N10E19Q	Yes	273.7	273	Residential	Active
CCWD 004*	03N09E12G01	Yes	229.2	230	Observation	Active
CCWD 005*	03N09E12G02	Yes	229.2	230	Observation	Active
CCWD 006*	03N09E12G03	Yes	229.2	230	Observation	Active
CCWD 007*	03N09E12G04	Yes	229.2	230	Observation	Active
CCWD 008	NA	No	229.7	229	Residential	Active
CCWD 009*	NA	Yes	195.2	194	Residential	Active
CCWD 010*	04N09E36A01	Yes	222.1	223	Observation	Active
CCWD 011*	04N09E36A02	Yes	222.1	223	Observation	Active
CCWD 012*	04N09E36A03	Yes	222.1	223	Observation	Active
CCWD 013	NA	Yes	404.6	404.1	Observation	Active
CCWD 014*	04N09E36N	Yes	398.71	398	Residential	Active
CCWD 015	04N09E15	Yes	240	240	Observation	Active
CCWD 016	NA	Yes	520.66	520.66	Observation	Active

*Historic Data available for CCWD 004, 005, 006, 007, 009, 010, 011, 012 and 014.

TABLE A-1
MONITORING WELL NETWORK DETAIL
CALAVERAS COUNTY WATER DISTRICT
MONITORING PLAN NOVEMBER 2012

Local Well Designation	Latitude [N]	Longitude [W]	Well Completion Type	Total Well Depth
CCWD 001	38.104167	120.890278	Single Well	240
CCWD 002	38.103611	120.890278	Single Well	260
CCWD 003	38.091389	120.916667	Single Well	300
CCWD 004*	38.127222	120.932222	Part of a nested/multi-completion well	435
CCWD 005*	38.127222	120.932222	Part of a nested/multi-completion well	365
CCWD 006*	38.127222	120.932222	Part of a nested/multi-completion well	230
CCWD 007*	38.127222	120.932222	Part of a nested/multi-completion well	110
CCWD 008	38.086667	120.923333	Single Well	Unknown
CCWD 009*	38.104167	120.911111	Single Well	240
CCWD 010*	38.162778	120.929167	Part of a nested/multi-completion well	390
CCWD 011*	38.162778	120.929167	Part of a nested/multi-completion well	350
CCWD 012*	38.162778	120.929167	Part of a nested/multi-completion well	135
CCWD 013	38.164722	120.883056	Single Well	276
CCWD 014*	38.151111	120.940556	Single Well	360
CCWD 015	38.198611	120.966111	Single Well	340
CCWD 016	38.0385166	120.8432893	Single Well	180

*Historic Data available for CCWD 004, 005, 006, 007, 009, 010, 011, 012 and 014.

TABLE A-1
MONITORING WELL NETWORK DETAIL
CALAVERAS COUNTY WATER DISTRICT
MONITORING PLAN NOVEMBER 2012

Local Well Designation	Associated Basin	County	Initial Groundwater Elevation	Screen Interval Top	Screen Interval Bottom
CCWD 001	5-22.01-Eastern San Joaquin	Calaveras	85.09	176	196
CCWD 002	5-22.01-Eastern San Joaquin	Calaveras	79.97	NA	NA
CCWD 003	5-22.01-Eastern San Joaquin	Calaveras	128.52	240	300
CCWD 004*	5-22.01-Eastern San Joaquin	Calaveras	96.98	415	435
CCWD 005*	5-22.01-Eastern San Joaquin	Calaveras	98.67	355	365
CCWD 006*	5-22.01-Eastern San Joaquin	Calaveras	107.02	210	230
CCWD 007*	5-22.01-Eastern San Joaquin	Calaveras	Dry	90	110
CCWD 008	5-22.01-Eastern San Joaquin	Calaveras	70.78	NA	NA
CCWD 009*	5-22.01-Eastern San Joaquin	Calaveras	116.90	140	240
CCWD 010*	5-22.01-Eastern San Joaquin	Calaveras	93.64	370	390
CCWD 011*	5-22.01-Eastern San Joaquin	Calaveras	90.11	250	270
CCWD 012*	5-22.01-Eastern San Joaquin	Calaveras	150.37	115	135
CCWD 013	5-22.01-Eastern San Joaquin	Calaveras	189.08	256	276
CCWD 014*	5-22.01-Eastern San Joaquin	Calaveras	174.62	275	355
CCWD 015	5-22.01-Eastern San Joaquin	Calaveras	149.20	150	340
CCWD 016	5-22.01-Eastern San Joaquin	Calaveras	362.91†	160	180

† GWE from September 2011

APPENDIX B

REPRESENTATIVE FIELD DATA SHEET

REPRESENTATIVE FIELD DATA SHEET
CALAVERAS COUNTY WATER DISTRICT
MONITORING PLAN NOVEMBER 2012

Well ID	Date	Time	RP Elevation	GS Elevation	DTW	GWE (RP-DTW)	Measurement Code	Comments
CCWD 001								
CCWD 002								
CCWD 003								
CCWD 004								
CCWD 005								
CCWD 006								
CCWD 007								
CCWD 008								
CCWD 009								
CCWD 010								
CCWD 011								
CCWD 012								
CCWD 013								
CCWD 014								
CCWD 015								
CCWD 016								

NM-#: No Measurement Code; 0 - measurement discontinued, 1 - pumping, 2 - pump house locked, 3 - tape hung up, 4 - can't get tape in casing, 5 - unable to locate well, 6 - well has been destroyed, 7 - special, 8 - casing leaky or wet, 9 - temporarily inaccessible

QM-#: Questionable Measurement Code; 1 - caved or deepend, 1 - pumping, 2 - nearby pump operating, 3 - casing leaky or wet, 4 - pumped recently, 5 - air or pressure gauge measurement, 6 - other, 7 - recharge operation at or nearby well, 8 - oil in casing