Midcoast Groundwater Study Phase III, San Mateo County, California

Report prepared for:

County of San Mateo
Planning and Building Department

Prepared by:
Mark Woyshner
Barry Hecht
Jason Parke
Travis Baggett

Balance Hydrologics, Inc.

June 2010

A report prepared for:

County of San Mateo Planning and Building Department
Steve Monowitz
455 County Center, 2nd Floor
Redwood City, California 94063
(650) 363-4161
SMonowitz@co.sanmateo.ca.us

Midcoast Groundwater Study Phase III, San Mateo County, California

 Project No. 209093
by:

Mark Woyshner, MScEng
Principal Hydrologist/Hydrogeologist

Barry Hecht, PG, CEG, CHg
Senior Principal

Jason Parke
Assistant Hydrologist/Geologist

Travis Baggett
Hydrologist/Meteorologist

Balance Hydrologics, Inc.®

800 Bancroft Way, Suite 101
Berkeley, California 94710-2800
(510) 704-1000
office@balancehydro.com

REGISTERED GEOLOGIST
BARRY HECHT
NO. 50
CERTIFIED
HYDROGEOLOGIST
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
BARRY HECHT
No. 1245
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

June 4, 2010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF FIGURES (CONTINUED)

APPENDICES

1. INTRODUCTION

San Mateo County 'Midcoast' extends from northern Half Moon Bay to Devils Slide along Highway 1. It encompasses the communities of Montara, Moss Beach, Seal Cove, Princeton, El Granada, and Miramar. Domestic water is supplied to the southern part of the region by Coastside County Water District (CCWD), providing services from Half Moon Bay to Princeton, and by Montara Water and Sanitary District (MWSD) on the north, servicing Montara and Moss Beach. Private wells are scattered through both service districts and outlying areas. With the exception of CCWD, which meets much of its demand through long-term contractual agreements with San Francisco Public Utilities Commission, the source of domestic water is from local surface water and groundwater resources. The carrying capacity of the local resources may be considered as the population that can be sustained using conservation measures during an extended drought without undue stress to valued natural habitats.

The San Mateo County Board of Supervisors seeks to identify the groundwater yield that may be safely taken from the Midcoast aquifers. County staff has requested a multi-phased technical report that may be used at the basin/watershed planning level, including aquifer management alternatives that could lead to the development of a Groundwater Management Plan (GMP). A GMP could be used to guide and respond to effects of groundwater development on public health and natural resources, and may lead to expedited and smoother permitting and have tangible benefits and cost savings programs.

Balance Hydrologics (Balance) prepared a comprehensive literature and data review as a Phase I of the Midcoast Groundwater Study (Woyshner and others, April 2002). Kleinfelder subsequently executed Phase II of the study (Clark and others, October 2008), which included depth-to-water measurements and pump tests in selected wells and a water balance assessment by subarea. The water balance model consisted of two principal components: 1) Monthly water balances were performed for the record of rainfall from 1958 to 2005 to estimate percolation and runoff from published soil properties and evapotranspiration averages; and 2) Annual totals of percolation and runoff were used to estimate subarea groundwater storage and groundwater level using aquifer properties. Water levels from monitoring wells were used to calibrate the model. The model approach was similar to the water balances assembled for the Draft Montara-Moss Beach Water Well EIR (Hecht and others, 1989) and the El Granada Groundwater Investigation Report (Laduzinsky, Hecht, and Woyshner, 1988).

The Phase II water balance model was applied to the following sub-basins:

- El Granada Sub-basin (Subareas #7 and #8);
- Arroyo de en Medio Sub-basin (Subareas #4, #5, and #6); results were extended to the Frenchmans Creek Sub-basin (Subareas #1, #2, and #3); and
- Moss Beach Sub-basin (Subareas #12, #13, #14, #15, #19 and #20).

The water balance for the El Granada Sub-basin was the least complex and utilized the most data for calibration and verification, followed by Arroyo de en Medio. The Moss Beach water balance was more complex and subjectively calibrated and validated. Findings from water balance of the El Granada Sub-basin were generally consistent with findings from a water balance assessment in the El Granada Groundwater Investigation Report (Laduzinsky, Hecht, and Woyshner, 1988).

Based on water balance results, the Phase II study concludes the following: a) the Midcoast aquifers have a considerable groundwater surplus in above average rainfall years but can have a deficit in dry and very dry years; b) the marine terrace subareas appear to be in long-term hydrologic balance and should remain in long-term balance with a moderate increase in water extractions; c) current pumping rates have lowered the water table to near sea level during dry years, and potentially below sea level during very dry years, posing risks of saltwater intrusion; and, d) increased pumping over long periods of time, especially during drier years, will increase the amount of time that the water table falls near or below sea level; and this increases the risk of saltwater intrusion.

The Phase II study recommends the following programs: a) long-term stream gaging, b) long-term monitoring of subarea index wells, c) improve and expand the information in the County's well database, and d) enhance monitoring in subareas with marginal groundwater production. Stream gaging and groundwater monitoring is needed to calibrate and further refine the water balance models.

1.1 Purpose and Objectives of the Phase III Study

The purpose of Phase III was to collect data as a follow-up to the Phase II report and as baseline information needed to potentially develop a groundwater management plan. Data collection was paramount in Phase III, given that water year 2009 was the third year with drier-than-normal rainfall, providing an opportunity to document multi-year drought conditions as they develop. Specific monitoring objectives included:

- Obtaining supplemental hydrologic data during the dry season of 2009 and interpreting how drier-than-normal rainfall during water years 2007, 2008, and 2009 has affected groundwater conditions on the Midcoast, and how the observations relate to the findings of the water balance models developed during Phase II of the study;
- Identifying locations and methods for collecting the data needed to document how stream flows affect the water balance model;
- Analyzing the relationship between groundwater levels and riparian and wetland habitats;
- Identifying available additional data and analyses needed to provide the baseline information required to develop a groundwater management plan.

1.2 Commencement of Work

The San Mateo County Resource Conservation District (RCD) adopted Resolution No. 2009-1 on May 21, 2009, which designated authority to the executive director to contract with San Mateo County to coordinate and manage the collection of data for Phase III of the Midcoast Groundwater Study. We developed a scope of work in collaboration with Kellyx Nelson, executive director of the RCD, and Steve Monowitz, Long Range Planning Manager of the San Mateo County Planninm and Building Department. A scoping meeting was held on July 28, 2009 and field work began promptly in August 2009.

1.3 Acknowledgments

Kellyx Nelson, Executive Director of the San Mateo Resource Conservation District, in addition to administering the study at the RCD, provided collegial guidance on potential stakeholder objectives for managing groundwater on the Midcoast, and assisted with valuable community outreach in our search for wells to monitor.

Clemens Heldmaier, General Manager of the Montara Water and Sanitation District, and Jeff Page, Superintendent of Water Operations provided assistance with access and monitoring of MWSD wells, offered historic groundwater and surface-water monitoring records for use in the study, assisted with locating the three Pillar Point Marsh piezometers, and made useful suggestions on locations of domestic wells not in use.

Joe Guistino, Superintendent of Operations for the Coastside County Water District, provided access and assistance with our measurements and datalogger installations in the three of their inactive wells, and provided useful data on the wells.

Lori Carraway, Vice President of Millennium Housing, granted access to the Pillar Ridge Manufactured Home Community (PRMHC) water supply wells. Paul Bowman, PRMHC manager provided assistance with our measurements and datalogger installation in their inactive Codo well. Lisa Ketcham, President of the Pillar Ridge Homeowners Association, provided useful information on the wells and their history.

Phone conversations with driller Jim Wilkinson, well tester Steve Simms, well tester Richard Henry, local geologist Charlie Kissick, and local geologist Vic Abadie provided useful local information and possible locations of inactive wells. Steve Simms had much of his well test data in computer files and kindly provided summaries of his records on short notice.

We appreciate the well owners who volunteered their wells for monitoring use during this study, as well as the Half Moon Bay Review and Coastsider.com for quickly publishing our 'call for wells' request.

David Lea provided access to the Upper Denniston Creek Gage through Cabrillo Farms property.

Jie He (Annie), GIS/IT Analyst for San Mateo County Planning & Building Department provided GIS file from the phase II groundwater study.

The acknowledgments of individual persons listed above or throughout this document, and any organizations with which these individuals are affiliated, does not imply their endorsement or approval of the document, its findings, conclusions or recommendations.

2. MONITORING DATA

The Phase III analysis included collecting new rainfall, streamflow, and groundwater data. The duration of our data collection was very brief – from the end of dry season 2009 into wet season 2010 – and did not fully capture the amount of recharge during water year 2010, nor did it capture the streamflow and groundwater recession of dry season 2010. We supplement our data with longer-term data from other sources.

2.1 Rainfall Stations

We collected rainfall data from two sources: Montara and Half Moon Bay airport. National Oceanic and Atmospheric Administration measures rainfall at Half Moon Bay Airport (NCDC Station 43714) for a period of record from 1948 to present. Montara Water and Sanitary District operates a real-time rain gage at their Alta Vista Road water treatment and storage facility. Real-time data are available at www.balancehydro.com/mwsd. Monthly total for the period of record for both stations are presented in Appendix A.

2.2 Stream Gaging

At the commencement of this Phase III study, there were few stream gaging stations on the Midcoast:

- The closest long-standing station is the U.S. Geological Survey station on Pilarcitos Creek at Half Moon Bay (Station No. 11162630). It has a period of record from 1967 to present. Pilarcitos Creek has a 27.1 square mile watershed above the station and drains not only the south slopes of Montara Mountain, which has similar lithology to the west slopes draining to the Midcoast, but also includes large areas of its watershed to the south with quite different geology. Its watershed is heavily regulated by Pilarcitos and Stone Dams, with significant diversions upstream of the gage for both agricultural and municipal water supply. Since 2007, the San Francisco Public Utilities Commission (SFPUC) has released summer flows to support habitat. With adjustments for the above, we used data from this station in addition to the rainfall records to interpret current drought conditions on the Midcoast.

- MWSD has recently started gaging baseflow in Daffodil Canyon and the North Fork of Montara Creek (since dry-season baseflow 2007) as part of their California Coastal Commission certification of their public works plan phase 1 that includes pumping of their production well on Alta Vista Road. MWSD also has gaged Martini Creek from November 2003 to April 2009. Cal-Am previously measured flow in Montara Creek at the Montara Point lighthouse old weir (during water years 2003 and 2004).

- Balance Hydrologics with the RCD has recently started gaging Lower Denniston Creek below Capistrano Road and Lower Deer Creek at Avenue Albambra (since February 2008), as part of a State-funded project currently frozen due to State budget issues. We have continued gaging the creeks through the budget crisis. Sporadic flow measurements were also conducted at various points along Denniston Creek by Earth Sciences Associates on 3/16/1989, 6/20/1990, and 3/30/1992 (LSCE & ESA, 1992).

We installed six additional stream gaging stations on the Midcoast and reoccupied the Martini Creek station. At each station we installed a staff plate (style C) and a Solinst Levelogger, and used standard U.S. geological survey gaging methods to gage the stream. In all, we collected data from eleven stations (Figure 6):

1. Martini Creek above Old San Pedro Trail;
2. Upper Daffodil Canyon at Old San Pedro Trail;
3. Lower Daffodil Canyon at Highway 1;
4. Montara Creek North Fork at Riviera Street;
5. Montara Creek at Montara Point Lighthouse;
6. San Vicente Creek at Fitzgerald Marine Reserve;
7. Upper Denniston Creek below reservoir;
8. Lower Denniston Creek at Prospect Way;
9. Upper Deer Creek at Ferdinand Avenue;
10. Lower Deer Creek at Avenue Alhambra; and
11. Arroyo de en Medio at Third Avenue.

Daffodil Canyon, Denniston Creek and Deer Creek had paired stations potentially to evaluate recharge to the terrace aquifer. The difference in flow between the two stations established if the stream reach is significantly losing water to the aquifer or gaining water. The daily mean discharge gaging record for each station is tabulated in Appendix B for the full period of gaging record, generally about September 1, 2009 to January 8, 2010. Flows records were plotted in Figures 7 through 11.[1]

2.3 Groundwater Monitoring

One of the key project objectives was to evaluate the current condition of groundwater on the Midcoast through the following means:

1. Monitoring groundwater levels in inactive wells during dry-season baseflow 2009;
2. Comparing our monitoring data with other monitoring data from previous years; and
3. Evaluating historic pump test results from local drillers and pump experts.

2.3.1 Existing groundwater monitoring programs

The State Water Resouces Control Board Groundwater maintains a website called GeoTracker (www.geotracker.swrcb.ca.gov), which posts environmental monitoring data for regulated facilities in California. Data can be downloaded for the following types of sites: a) leaky Underground Storage Tank (LUST) cleanup sites; b) other cleanup sites; c) land disposal sites; d) military sites; e) permitted undergroiund storage tank (UST) facilities; f) Monitoring wells; g) Department of Toxic Substances Control (DTSC) cleanup sites; and h) permitted DTSC hazardous waste sites. There are six open LUST site assessments posting data from the past 14 years:

- Neighborhood Gas Mart, Montara (2004 to date)
- Coast Wholesale Florist, Montara (1999 to date)
- Mannon Property, Moss Beach (2007 to date)
- KN Property II, Moss Beach (2004 to date)
- San Mateo Co. Dept. of Public Works, El Granada (2003 to date)
- El Granada Market, El Granada (1996 to date)

[1] Readers should carefully note that all data from these stations are considered preliminary and subject to revision, particularly the six new gaging stations. It normally takes several years of flow measurements to develop a reasonably accurate stage to discharge rating for a new station, and to understand the hydraulics of the station and seasonal characteristics of flow.

A map showing the locations of these sites and charts showing depth-to-water in the shallow monitoring wells installed at each site are found in Appendix D.

Another source of online groundwater data is the California Department of Water Resources (DWR) water data library (www.water.ca.gov/waterdatalibrary). Three wells with long-term groundwater elevation data to date were located in the Midcoast:

- 5S/6W-10J1 in the Airport Subarea near Pillar Ridge Manufactured Home Park (1953 to 1991 when the well was abandoned);
- 5S5W/19H1 in the Frenchmans Terrace Subarea near Frenchmans Creek (1978 to date);
- 5S/5W-20E1 in upper Frenchmans Terrace Subarea (1974 to date).

A map of the well locations and charts of groundwater elevations are found in Appendix E.

2.3.2 Search for inactive wells to monitor

We implemented five separate searches to identify inactive wells suitable for measuring depth-to-water, potentially installing a datalogger. Inactive wells are wells that are not pumped and thus generally reflect the static groundwater level local to the well. If a well is pumped, then the water level in a well is drawn down when the pump is on, and thus, when a depth-to-water measurement made, it may not accurately reflect the static groundwater level.

- We first attempted to identify which Phase II monitoring wells would be suitable for continued monitoring. We prepared a letter for Kleinfelder to send to the owners of the wells tested in Phase II of the study. Unfortunately, all of the wells monitored in Phase II were domestic wells with pumps in them and in use. We did, though, measure depth-to-water in two of the wells at a time when they were temporarily not being used. Domestic wells are typically fitted with an access port in which depth-to-water may be measured, but the standard port size is of too small a diameter to install a conventional datalogger and, therefore, we did not install dataloggers in the wells monitored in Phase II of the project. In addition, installing dataloggers and measuring depth-to-water in domestic wells are sometimes not possible because of obstruction by and potential entanglement with electrical wires in the well supplying power to the pump.
- The Half Moon Bay Review and Coastsider.com ran articles, prepared by the RCD, reporting our 'call for wells' to be used for monitoring groundwater levels. Most of those who responded owned domestic wells in active use, and which -- like the

Phase II monitoring wells -- were not suitable for monitoring. We did, though, identify two wells from responding well owners which proved good candidates to measure depth-to-water. One of the homeowners had taken depth-to-water measurement since 1999.

- We then employed a third approach as number and coverage of wells still was not sufficient to meet project goals. We matched the County's well permit database with their database of undeveloped parcels, and developed a list of wells on vacant lots. We sent a letter to each of the well owners requesting access to their inactive well so as to monitor depth-to-water and to potentially install a datalogger. Of the replies, many of the wells were unsuitable for various reasons, such as:
  - the well cap was glued on, fairly common for inactive wells in urban areas;
  - the well was located in a high-water table (wetland) area that would likely not significantly respond to rainfall variability;
  - the well was in use; or
  - the well was inaccessible.

  We did identify three wells from this search which proved suitable for measuring, and for which we were able to obtain access to install a datalogger and measure depth-to-water.

- We also queried Montara Water and Sanitary District, Coastside County Water District, and Pillar Ridge Manufactured Home Community staff requesting use of their monitoring wells and any inactive water-supply wells. We installed dataloggers in several of their wells and acquired historic data from their records. Three piezometers[2] were previously installed (spring 1989) as a cluster at the north end of Pillar Point Marsh (LSCE and ESA, 1991). We installed dataloggers in each piezometer. There was also an inactive well on the Airport property in which we measured depth-to-water.

- Extensive word of mouth advertising and personal appeals, distribution lists, public meetings (including publicly noticed meetings of the Midcoast Community Council, Montara Water and Sanitary District, and RCD).

We developed five maps to illustrate the results of the search for wells to monitor:

- Figure 1 shows all wells monitored during the study, and stream gages;

- Figure 2 shows the locations of inactive wells that we monitored with dataloggers;

[2] A piezometer is similar to a well except it has a very short segment of perforated casing open to the aquifer, which measures hydraulic head at a given depth. A well has a long segment of perforated casing that averages the head across that segment. Piezometers are commonly installed in clusters of 2 or 3 at different depths. These 'nested' piezometers measure vertical hydraulic gradient, which identifies the vertical direction of flow and is used in Darcy's Law to calculate specific discharge. The piezometer nest at Pillar Point March has shown upward gradients, indicating artesian groundwater conditions.

- Figure 3 shows the locations of inactive wells monitored by depth to water measurements only;

- Figure 4 shows the locations of inactive wells with cap glued on and not monitored, but may be used for future monitoring; and,

- Figure 5 shows the locations of wells considered, but found to be in use and not monitored.

Results of the groundwater monitoring are illustrated by Midcoast subarea in Figures 12, 13, and 14. Comparisons to historic data to show recent trends are illustrated in Figures 16 and 17 and in Appendix C for water district production wells.

We also contacted local drillers, well and pump experts, and groundwater professionals to query their ideas and to acquire summaries of their historic pump-test records. In general, they consider groundwater conditions on the Midcoast unconstrained by the current drought to date, and believe that well site selection largely accounts for low yields and well failures. In addition, wells often develop lower yields with time from mineral precipitation and accumulation of fines on the well perforations and in the annulus, which would require an acid treatment ("scrub"), other renovation treatment or re-drilling. Well tester Steve Simms had much of his well re-test data in computer files and kindly provided summaries of his records on short notice (Table 3). Figures 20, 22 and 23 illustrate the data summarized. We believe the data support their inferences.

2.4 Previously Reported Monitoring Data

Phase I of the Midcoast Groundwater Study (Woyshner and others, 2002) was a literature and data review for the Midcoast, and in it sources of groundwater elevation and streamflow data were identified in the following reports:

- Seasonal ground-water elevations for 34 wells in the Montara area, January, August, October, and November 2001 (Hedlund, 2002 masters thesis)

- Long-term monitoring depth-to-groundwater in MWSD wells (DWR, 1999)

- Continuous stream-gaging on San Vicente and Denniston Creeks, August 1998 through October 1999; monthly streamflow measurements at gage and several points downstream, including Hwy 1 and mouth; spot measurements on Martini Creek. Ground-water elevation measurements every four hours in two monitoing wells, July 1999 through July 2000. Monthly measurements at 5 monitoring wells. (Hydrofocus, 1998 through 2000)

- Water-level elevations in 26 wells and interpolated contours in Half Moon Bay Airport/ Pillar Point Marsh Basin, 1987 to 1992; water levels lower during drought and recover with near-normal rainfall. Surface flow measurements on Denniston Creek to estimate ground-water recharge through stream-bed (29 ac-ft per day). Vertical gradients below Pillar Point Marsh from nested piezometers, 1989 to 1992; consistently artesian throughout drought. Water-level elevation in DWR monitoring well (5S/6W-10J1), 1953 to 1991. Water-level elevations in CCWD monitoring wells, 1976 to 1986. Groundwater contour maps generated for drought years. Rapid rises in water levels following periods of substantial rainfall suggest that the basin recharges relatively quickly, and that water-level elevations in the basin are largely related to recharge conditions. (LSCE & ESA, 1992, 1991, 1987).

- Pillar Point Marsh water level in 30 shallow bore holes (24 to 60 inches deep). Monitoring well records from recently established monitoring wells (M1 to M7). (Flint, 1978, 1977)

- Eleven bore holes, ranging in depths from 35 to 140 feet, were drilled in the Airport Terrace, sampled and logged; monitoring wells installed and depth-to-water measured. (Lowney-Kaldveer Associates, 1974)

Further details are provided in the Phase I document, as well as related information on reported hydrogeologic properties and references of other regional reports.

3. DISCUSSION OF DATA

3.1 Status of Current Drought

Annual rainfall and runoff are listed in Table 2 for water years 1987 to 2010. This table shows data as far back as the last significant multi-year drought (1987 to 1992), when the annual rainfall ranged from 62 percent of mean to 91 percent of mean, and the mean annual discharge from Pilarcitos Creek (measured at Half Moon Bay) ranged from 15 to 57 percent of the concurrent long-term mean.[3] This drought was more severe than current conditions. Any consecutive three years during this drought was drier than the current drier than normal water years 2007 to 2009. The average of the annual percent of mean rainfall and runoff values is illustrated in Figure 15 to compare the previous drought with the current drought. The current composite average is 69 percent of mean, while it was 56 percent of mean for the previous drought. We note as a matter of context, that significant changes in water use since the previous drought are not included in this comparison.

Other historic data describing the current drought include:

1. Regional well yield and specific capacity data since 1991;
2. Streamflow in Martini Creek, Montara Creek, Denniston Creek, and Arroyo de en Medio;
3. Groundwater levels in the Airport Aquifer collected from wells during the previous drought (LSCE & ESA, 1987, 1991, 1992);
4. Static groundwater levels in MWSD wells in the Airport Aquifer, Wagner Valley, Portola, and Montara Knob;
5. Shallow groundwater levels in monitoring wells at Leaky Underground Storage Tank (LUST) remediation sites; and
6. Long-term monitoring at established DWR monitoring wells.

Table 5 summarizes the data describing the current drought conditions on the Midcoast.

[3] Period of record began in 1951.

Significantly lower dry-season baseflows in streams is a known indicator of severe drought conditions. To the extent that baseflow conditions are known on the Midcoast, data suggest a moderate drought and sufficient recharge to date, when compared to the previous drought of 1987 to 1992:

- On Martini Creek, baseflows during the summer of 2009 were higher than in 2007 and similar to water year 2004 (Figure 18). Wetter-than-normal rainfall years 2005 and 2006 sustained higher baseflows.
- On Montara Creek, baseflows were also similar to water year 2004 but lower than wetter-than-normal water year 2003 (Figure 19).
- On Denniston Creek, baseflow was higher than in 1990 (Table 4). Groundwater levels in the Airport Aquifer, to which Denniston Creek recharges, were also higher than measured during the previous drought (Figure 16).
- Arroyo de en Medio dried back during the summer of 2009 with shallow groundwater levels within the bed sediments, and in the vicinity of the creek our depth-to-water measurements were similar to previous measurements going back to 1999 (Figure 17).

Long-term monitoring of groundwater elevations in DWR monitoring wells illustrate responses to seasonal rainfall and antecedent conditions (Appendix E). At the height of the 1987 to 1992 drought, groundwater level decline was equal to (in the Airport Subarea) and exceeded (in the Frechmans Terrace Subarea) the decline during the extreme 2-year drought of 1976 to 1977. Groundwater levels declined during 2007 to similar lows but have since recovered moderately.

Results of regional well yield tests[4] (since water year 1991) vary from year to year and, unlike groundwater levels that readily respond to seasonal rainfall (Appendix E), the trend in tested well yields can lag up to a 2-years from antecedent rainfall (Figure 20 and 21). Mineral precipitation/dissolution on well perforations may be one physical mechanism that accounts for this lag, as noted in conversations with local driller Jim Wilkinson and local well tester Steve Simms. Hydrologic lag following wetter-than-normal years may also account for a lag. The effect of wetter-than-normal water years 2005 and 2006 would potentially carry over to moderate well yields through the drier than normal water years 2007 and 2008, which is consistent with our gaging Apanolio Creek (Owens and others, 2001).

[4] The well yield tests were for home sales and were re-tests of existing wells, previously permitted by the County.

Results of the well yield tests are positively skewed[5] and vary regionally[6] (Table 3). Of the areas tested, El Granada had the highest percentage of wells that tested less than 2.5 gallons per minute (gpm)[7] and the lowest median specific capacity. Montara and Miramar had the lowest percentage of wells with a yield less than 2.5 gpm, and Miramar had the highest median specific capacity. Specific capacity is a measure of yield per unit drawdown and a higher number represents better yield. Given this data, one might expect disproportionally more reports of low yielding wells coming from El Granada than other areas on the Midcoast, potentially during 2010 and 2011. We note that beyond this statistical summary, we did not analyses the data for specific subset or individual wells characteristics, nor did we relate the data to local hydrogeologic conditions. In this regard, these data are considered preliminary and subject to review.

Some evidence of slightly lower groundwater levels were measured in shallow monitoring wells at LUST remediation sites (Appendix D). In general, groundwater levels continue to fluctuate off of dry-season lows from adequate recharge, but at the sites in Montara, Wagner Valley, and Lower Moss Beach, and to less so at the El Granada site, dry-season levels were slightly lower than pre-drought years. Water levels were generally unchanged in the Airport (Princeton) area.

MWSD periodically measures static (non-pumped) depth-to-groundwater in their production wells, in addition to the pumped groundwater level. Data going back to 2003 is illustrated in Appendix B. Static 2009 levels in the Airport Aquifer were higher, when compared to pre-drought levels; static levels in the Portola wells were generally unchanged; and static levels in the Wagner, Drake and Alta Vista wells were lower.

3.2 Data Implications by Subarea

Our monitoring efforts focused on the following groundwater subareas, as directed by the County and based on findings from the Phase II report:

---

[5] Skewness characterizes the degree of asymmetry of a distribution around its mean. A positive skew indicates a distribution with an asymmetric tail extending toward more positive values. A negative skew indicates a distribution with an asymmetric tail extending toward more negative values.

[6] Data were available from domestic wells in Montara, Moss Beach, El Granada, and Miramar, largely in marine terraces. The data were not identified by study subarea, nor were there data for the Airport Aquifer.

[7] San Mateo County requires 2.5 gallons per minute to permit a new well.

- Miramar Terrace (#4)
- El Granada Terrace (#7)
- El Granada Uplands (#8)
- Airport Terrace (#9)
- Lower Moss Beach (#12)
- Portola (#16)
- Upper Moss Beach (#19)
- Montara Terrace (#22)
- Seal Cove (#24)

Table 1 lists by subarea the number of wells found for monitoring through our various searches. We identified wells a) that were not in use (not pumped) during the study, and b) to which we were granted access by the owner. Monitoring wells at LUST sites with current data and DWR monitoring wells are also included in Table 1. Groundwater level data were collected for all of the proposed subareas with the exception of Seal Cove. Monitoring methods and results by subarea are summarized with interpretive notes in Table 6. During our field work, we also noted wells on vacant lots as seen from the roadside.

We recommend for several subareas a 'local groundwater recharge program', particularly areas located at reasonable distance from stream channel recharge. Elements of such a program might include a) upgradient ponds, b) small road-side detention/recharge ponds, c) permeable pavement, d) small-scale roof runoff capture and recharge, and e) large-scale rainfall harvesting and conjunctive use programs.

3.2.1 El Granada

The Phase II study concluded that the El Granada Sub-basin is currently in long-term equilibrium with groundwater levels fluctuating significantly from year-to-year. The water balance model indicated that a) the sub-basin is overdrafted during dry and critically dry years but recharges readily during wet years; b) groundwater levels decline severely after two or more consecutive dry years and a prolonged decline in groundwater may induce salt-water intrusion; and, c) at buildout, the frequency of below (or near) sea-level groundwater levels would increase 24 percent.

Most of the wells offered by residents for monitoring were actively in use and, therefore, not monitored during Phase III (Figure 5). Two wells were inactive (Figure 3) but located near wetlands. Groundwater levels in these wells were extremely shallow (Figure 14), indicating no drought impacts. Though not being pumped, these wells were deemed not suitable for the current purpose of water balance calibration, given that the local high groundwater levels may be perched on a local low-permeability bed or horizon.

Five shallow monitoring wells are located at the El Granada Market LUST site, at the corner of Avenue Alhambra and Sonora Avenue (Appendix D). Monitoring data, available since water year 1996, show slightly lower levels during drought years 2007 through 2009 but not substantially, and seasonal recharge was normal (Appendix D6). The locations of the wells are suitable to monitor for potential sea-water intrusion, and minimum groundwater elevations were above mean sea level (Table D1), which indicates the condition for sea-water intrusion does not currently exist.

Deer Creek is the largest stream in El Granada, flowing from the uplands and across the terrace. The Upper Deer Creek gage, located at the mouth of the canyon, flowed continuously through dry-season 2009, while Lower Dear Creek was wet with no flow until the October 13th storm when flow resumed (Figure 8). Baseflow in Deer Creek provided significant recharge between the two gages to the El Granada Terrace from the east branch of the creek.[8] There is also substantial recharge from the stock pond upstream of the upper Dear Creek gage, approximately 80 acre-feet per year during a dry year and 160 ac-ft/yr for a year of normal rainfall (Laduzinsky and others, 1988).

---

[8] Along San Mateo County Midcoast, reference evapotranspiration during September and October averages 2.5 to 3.3 inches per month (Snider, 1999), or about an average of 0.1 inches per day. With roughly 2,200 feet of stream riparian corridor at an average width of 50 feet between the two gages, the estimated evapotranspiration is roughly 5 gallons per minute. The difference in average flow as seen in Figure 8 is roughly 30 gallons per minute. Therefore, groundwater recharge is estimated at 25 gallons per minute, or roughly 3 acre-feet per month.

The El Granada terrace was identified from historic pump test data (Table 3) as the most likely subarea from which low well yield would be reported, particularly during or just following a multi-year drought.

In summary, groundwater levels during the recent drought have declined to non-alarming levels and recharge is evident. Future accounts of lower well yields might be anticipated. Groundwater levels monitored near wetland/riparian areas at the north portion of El Granada appear unaffected by the drought. Additional monitoring wells at distance from stream courses are needed, as is a local recharge program. Gaging Deer Creek successfully quantified baseflow during 2009 and should continue during baseflow 2010. Results could be used to calibrate the water balance model performed during the Phase II study. A sub-basin groundwater flow model would assist groundwater management.

3.2.2 Miramar and Frenchmans Creek

The Phase II study inferred that Arroyo de en Medio and Frenchmans Creek Sub-basin had conditions and drought responses similar to the El Granada Sub-basin, and at buildout, the frequency of below (or near) sea-level groundwater levels would increase 18 percent in the Miramar Subarea.

During the Phase III study, two inactive wells were offered by residents for monitoring. One well was located at the end of Third Avenue in Miramar, next to Arroyo de en Medio (Figure 3). The homeowner has used the well infrequently for landscape irrigation but did not use it during the study. The homeowner has also measured depth to water in the well since water year 1999 and kindly offered the data for use in the study (Figure 17). The other well offered for monitoring during the study was located in upper Miramar Terrace (Figure 4) but it could not be monitored because the cap was glued on. The well location is suitable to monitor groundwater levels at distance from Arroyo de en Medio.

Arroyo de en Medio through its Miramar reach was dry in August 2009, at first visit. We installed a drive-point piezometer in the streambed to a depth of 9.98 feet and monitored water level with a datalogger. We also gaged the stream when flows returned (Figure 6). The location of the stream/shallow-groundwater gage was at the end of Third Avenue adjacent to the monitored homeowners well.

Arroyo de en Medio through its Miramar Reach was dry until after 10 inches of rain fell within the watershed (Figure 9). Groundwater levels near the arroyo (Figure 14) were similar to past measurements since 1999 (Figure 17), and from visual estimates it appears that a hydraulic gradient exists from the creek to the well.[9] These data suggest that groundwater levels in the vicinity of the arroyo during dry-season 2009 are supported by recharge from the arroyo. We suspect that Arroyo de en Medio provides significant recharge to the terrace and it typically dries back through its Miramar Terrace reach during the dry-season with the shallow water table present within the channel sediments several feet below the bed. Further monitoring would confirm recharge trends from the arroyo.

Reviewing historic pump test data (Table 3), the Miramar Terrace had a low percentage of wells with a yield less than 2.5 gpm. It has the highest median specific capacity, which is consistent with the geologic origin of the fan and terrace sediments, weathered coarsed-grained granitic rock.

In Frenchmans Terrace, data were available from two DWR long-term monitoring wells, with records commencing in 1974 and 1978 (Appendix E). Both wells are located south of the creek with one well near the creek. Seasonal groundwater fluctuation is greater in the well located in the upper terrace and at distance from the creek. Data showed a decline in groundwater elevations during 2007, equal to the depth of the 1987 to 1992 drought and to the depth of the extreme 2-year 1976-77 drought, but still well above sea level. Since 2007, however, groundwater elevations have recovered somewhat, presumably due to recharge. Recharge from Frenchmans Creek would be expected to moderate seasonal fluctuations and provide a hydraulic floor to groundwater level decline during drought years.[10] Recharge benefits would diminish at distance from the creek and at higher topographic elevations; here, well pumping would likely show greater drawdown effects, and drought constraints would be first identified.

---

[9] Figure 14 plots depth-to-water in the drive point piezometer located in the creek and in the well located about 50 from the creek. Surveying the difference in elevation between the two reference points from which depth-to-water are measured would confirm the hydraulic gradient. From visual estimates of the reference point elevation difference, the hydraulic gradient is downward and creek loses water to the aquifer during the dry season. Further monitoring would confirm any seasonal trends.

[10] For a specific segment of Frenchmans Creek, recharge may be confirmed by monitoring hydraulic head in clustered piezometers, or in the creek and in a well at distance from the creek, to calculate hydraulic gradient and the direction of flow.

In summary, in addition to groundwater recharge from direct rainfall, Miramar and Frenchmans terraces appear to receive significant recharge from Arroyo de en Medio, Frenchmans Creek, and ostensibly other minor drainages, continuing into the dry season and supporting local groundwater levels. Current groundwater storage in proximity to the creeks appears have not exceeded previous drought levels. Additional groundwater monitoring is needed at distance from the creeks. One inactive well volunteered by a homeowner in upper Miramar would serve for this purpose. Additional gaging of Arroyo de en Medio is needed to quantify persistence of baseflows, with results used to calibrate a water balance model. A sub-basin water balance model and a groundwater flow model would assist groundwater management.

3.2.3 Airport

The Phase II study concluded that the Airport Subarea is in long-term equilibrium but did not conduct a drought analysis.

We found many inactive wells were available for monitoring in the Airport Terrace:

- We installed dataloggers in 6 inactive wells that were reasonably distributed across the subarea, and at a three-level piezometer nest at the north end of Pillar Point Wetland (Figure 2).
- Water level data were available from MWSD and CCWD production wells (Appendix C).
- Data were available from LUST site shallow monitoring wells since WY2003 (Appendix D).
- Data were available from a DWR monitoring well from 1953 to 1991(Appendix E).
- We also measured depth-to-water in 1 inactive well near the Pillar Ridge Manufactured Home Park (Figure 3) and 1 domestic well in use in Princeton (Figure 5).

Monitoring data indicate that groundwater storage was not as depleted as during previous droughts and storm recharge appeared normal during dry-season 2009 relative to pre-drought conditions. The nested piezometers showed artesian groundwater at Pillar Point Marsh and wells west of the airport runway showed shallow groundwater (Figure 13), which is consistent with reports at the Big Wave site (Christopher A. Joseph & Associates, October 2009).

Groundwater was high in the Airport Aquifer when compared to the previous drought, 1987 to 1992 (Figure 16). Static (not pumped) groundwater levels in MWSD wells were higher than pre-drought levels (Appendix C). LUST site groundwater levels (in Princeton) were within a normal range (Appendix D).

Previous investigations identified that baseflows in Denniston Creek provide significant recharge to the Airport Terrace through the dry season (LSCE & ESA, 1992, 1991, 1987). During dry-season 2009, baseflows were gaged in Denniston Creek at two stations (Figure 6). The upper station was located at the canyon mouth below the reservoir, and the lower station was located below Capistrano Road at Princeton. Similar to findings during the previous drought, we observed a net loss of flow in the creek (Figure 10), which can be attributed to groundwater recharge and evapotranspiration.[11] In addition, flows were compared to measurements taken in 1990, during the previous drought. Denniston Creek flowed continuously through dry-season 2009, with higher flows than were recorded during the scattered measurements made throughout the previous drought. The measurement with lowest flow was taken in June 1990 (Table 4); lower flows and drier conditions in general would have persisted through the dry season of 1990. This comparison of the 2009 flow data with 1990 measurements suggests that the current drought is less severe than the previous drought. Baseflows in 2009, however, were significantly lower than during 2008 (Table 4).

In summary, groundwater storage was not as depleted as during previous droughts and storm recharge appeared normal during dry-season 2009 relative to pre-drought conditions. Groundwater recharge from Denniston Creek through the Airport Terrace is significant during the dry season. The agricultural irrigation ponds at the northeast portion of the Airport Subarea, filled from diversion of flow in San Vicente Creek, also should provide recharge to that portion of the Airport Subarea. Groundwater levels at Pillar Point Marsh support normal marsh conditions and conditions potentially enabling sea-water intrusion were not observed. Additional analysis should include developing dry-season groundwater contour maps to compare with those reported during the 1987 to 1992 drought (LSCE & ESA, 1992, 1991, 1987).

---

[11] Along San Mateo County Midcoast, reference evapotranspiration during September and October averages 2.5 to 3.3 inches per month (Snider, 1999), or about an average of 0.1 inches per day. With roughly 1 mile of stream riparian corridor at an average width of 130 feet between the two gages, the estimated evapotranspiration is roughly 30 gallons per minute. The difference in average flow as seen in Figure 10 is roughly 50 gallons per minute. Therefore, groundwater recharge is estimated at 20 gallons per minute, or roughly 3 acre-feet per month.

Wells are available for continued monitoring and reported subsurface information are available for the sub-basin. A water balance model, drought analysis, and a groundwater flow model would assist groundwater management. Gaging Denniston Creek would greatly assist calibration of the models. In addition, the Airport Terrace is an ideal location for regional reference evapotranspiration (ETo) monitoring. California Irrigation Management Information System (CIMIS) only estimates ETo for the Midcoast and measured ETo would assist with calibration of all water balance models on the Midcoast.[12]

3.2.4 Moss Beach

The Phase II study concluded that a) Lower Moss Beach is in long-term equilibrium and not overdrafted during dry and critically dry years with current groundwater draws; b) additional groundwater may be available for pumping without inducing salt-water intrusion; c) Upper Moss Beach and Dean Creek Subareas are in long-term equilibrium, overdrafted during dry years and droughts, and recharges readily during wet years; and at buildout, Upper Moss Beach would not be in long-term equilibrium.

Two inactive wells were offered by well owners in the Lower Moss Beach Subarea for monitoring during the Phase III study (Figure 2). One well was near San Vicente Creek and one well was near the Seal Cove subarea. In the Upper Moss Beach Subarea, no inactive wells were volunteered but we measured depth-to-water in a well in use when the residence was out of town for a few days (Figure 5). In lower Sunshine Valley (Dean Creek), depth-to-water was measured in an inactive well near wetlands (Figure 3). Data from LUST site shallow monitoring wells were available for Lower Moss Beach since WY2005 and for Upper Moss Beach since WY2007 (Appendix D).

San Vicente Creek was gaged at Fitzgerald Marine Reserve (Figure 6). San Vicente Creek through its Lower Moss Beach reach was dry during the dry season and developed some flow following the October 13th storm (Figure 9). Dean Creek was dry with few isolated pools near its mouth during the dry season. Groundwater levels near San Vicente Creek were shallow and were generally unchanged and groundwater levels near the wetland in lower Sunshine Valley appeared normal (Figure 13).

[12] A recent study of low flows on lower Pilarcitos Creek (Parke and Hecht, 2010) also identifies lack of local evapotranspiration data as a major limitation to assessing streamflow losses affecting steelhead habitat on that stream. ETo data collected for the Airport Subarea would benefit the entre Midcoast.

Similar to Arroyo de en Medio, San Vicente Creek and Dean Creek through the Lower Moss Beach seem to typically dry back annually during the dry season with a shallow water table present within bed sediments. Groundwater levels data during collected during baseflow 2009 appeared reasonable and recharge normal when compared to previous years and other similar stations on the Midcoast. Visual estimates suggest that San Vicente Creek provides significant recharge to Lower Moss Beach Terrace.[13]

At a distance from the creeks, dry-season shallow groundwater levels in LUST site monitoring wells were slightly lower than pre-drought years (Appendix D), and recharge appeared normal. Groundwater levels measured in upper Moss Beach were also not unusually low relative to the higher ground surface elevation (Figure 23).

In summary, in addition to recharge by direct rainfall, San Vicente Creek and Dean Creek seem to provide significant recharge to Lower Moss Beach that persist into the dry season and support groundwater level. Limited data suggest that current groundwater storage in proximity to the creeks is not alarmingly low. Additional groundwater monitoring is needed, particularly at distance from the creeks and in Upper Moss Beach. Additional gaging of San Vicente Creek is needed to quantify baseflow persistence, and results could be used to calibrate the Moss Beach Sub-basin water balance model performed during the Phase II study. A closer look at gaging Dean Creek is justified. A groundwater flow model would assist groundwater management, and developing a local recharge program, particularly for Upper Moss Beach, would benefit local groundwater-storage evaluation and drought readiness.

3.2.5 Montara and Ocean View Farms

This area includes the Montara Terrace (22) and Ocean View Farms occupying the agricultural, coastal-terrace portion of the Martini Uplands subareas (23). The Phase II study concluded that Montara Subarea is in long-term equilibrium with wide swings from year to year between surplus and deficit, overdrafted during dry years and droughts, varied localized conditions, significant risk of localized well interference, and limited opportunity for additional pumping.

---

[13] Comparing the depth-to-water in the MWSD inactive well located next to San Vicente (Figure 13) with when there was flow in the creek (Figure 9) suggest a downward flow gradient. Installing a staff plate in the creek (similar to our installation on Arroyo de en Medio) and surveying the difference in elevation between the two reference points from which stage and depth-to-water are measured would confirm the hydraulic gradient. From visual estimates, the hydraulic gradient appears downward and creek loses water to the aquifer during the dry season. Further monitoring would confirm any seasonal trends.

During the Phase III study, one inactive well was offered for monitoring in the Montara Subarea (Figure 2), and two wells in use were volunteered (Figure 5). During our field work, several wells were noted on vacant lots that could potentially be used for future monitoring. Data from LUST site shallow monitoring wells located at the Neighborhood Gas Mart on Cabrillo Highway were available since WY2004 (Appendix D).

Two MWSD monitoring wells on Ocean View Farms terrace, north of Montara were monitored (Figure 2). One well is centrally located on the terrace at Cabrillo Highway, and the other is at the mouth of Daffodil Canyon, which would be influenced by recharge from the canyon. Baseflow was gaged on Martini Creek above Old San Pedro Trail, and at two locations on Daffodil Canyon, at the canyon mouth and at Cabrillo Highway (Hwy 1) (Figure 6). The Martini Uplands Subarea (#23) is relatively unaffected by urbanization. This subarea is especially useful as a 'control' for ongoing effects of urbanization, and of the role of agriculture in maintaining active recharge during drought years. The Ocean View farm area was recommended as a potential site for groundwater supply (DWR, 1999).

In addition to recharge from direct rainfall and from agricultural irrigation, Daffodil Canyon may provide some recharge to the terrace, as may Martini Creek, but recharge was limited crossing Ocean View terrace (Figure 8), presumably owing to channel incision. Channel incision of Lower Montara Creek is incised to bedrock, nearly precluding recharge to Montara Terrace Subarea. Further upstream, unincised segments of Montara Creek may provide recharge to the west terrace area. Given the proximity to these streams and their relative lower bed elevations, Montara Terrace receives little stream recharge, with perhaps the exception of Kanoff Creek on the north; recharge from direct rainfall and from roadside ditches is important for groundwater storage in the Montara Terrace.

Groundwater levels at the LUST site in Montara (Appendix D) were at similar depth to levels at Ocean View Farms terrace (Figure 12), and clearly above sea level. Groundwater levels at the LUST site were lower than pre-drought levels but storm recharge appears operative (Appendix D). Further inland on Montara Terrace, groundwater levels were deeper (Figure 12) but acceptable given the higher topography. Pumped levels were 20+ feet deeper (Figure 23) but still well above sea level.

In summary, stream recharge is somewhat limited in the Ocean View Farms but clearly much more limited in the Montara Terrace Subunit, with the notable exception of areas near Kanoff Creek on the north and unincised segments of Montara Creek on the east. Given the importance of groundwater recharge from direct rainfall, it is possible that developing storm recharge programs would benefit local groundwater supplies. From available data, groundwater storage during 2009 does not show meaningful depletion, but not without variable local groundwater conditions (see discussion for such areas in Hecht and others, 1989; Woyshner and Hecht, 1999; Hedlund, 2002). Additional groundwater monitoring wells are needed, especially in the upper portion of the terrace. A sub-basin groundwater flow model would also assist groundwater management.

3.2.6 Portola and Wagner Valley

Wagner and Portola Valleys are the headwater drainages of Montara Creek. The valleys are part of a larger unit, including Montara Knob, which is one of the most important recharge and groundwater production parts of the Midcoast. These sub-units are the source of much of the water developed by MWSD.

The Phase II study concluded that Portola Sub-basin is in long-term equilibrium with wide swings year-to-year between surplus and deficit, overdrafted during dry years and droughts, varied localized conditions, and limited opportunity for additional pumping.

MWSD operates three low-yielding production wells in Portola and two higher-yielding production wells in Wagner Valley (Appendix C). We monitored their Park Well, located at the corner of Date Street and Harte Street, next to Montara Creek, and near the mouth of Wagner Valley, downstream of the Coast Wholesale Florist in-stream reservoir (Figure 2). The well is permitted for backup water supply and was not pumped during the study. We also monitored an inactive well, located upland from Montara Creek and in the lower Portola Valley (Figure 2), in addition to the MWSD's presently inactive Portola #2 well in upper Portola (Figure 3). Data were also available since water year 1999 from shallow monitoring wells at a LUST site in Upper Wagner Valley.

Static levels in the MWSD Portola wells were generally unchanged from previous years (Appendix C), and the depth-to-groundwater in the Portola monitored wells seemed reasonable when compared to other stations (Figure 12). These limited data suggest that seasonal groundwater recharge is operative and groundwater storage in the Portola Subarea is currently not significantly depleted from previous wet year levels.

In Wagner Valley, static 2009 levels in MWSD production wells were lower when compared to pre-drought levels since 2003 (Appendix B). Shallow groundwater in LUST monitoring wells was lower than pre-drought years but recharging from winter rains (Appendix D). The Park well at the outlet of Wagner Valley showed high water levels, seemingly recharged by Montara Creek. These data suggest that the stream valley alluvium continues to recharge during the drought, but recharge to the underlying the bedrock aquifer may have been limited.

Montara Creek was gaged at its mouth at Point Montara Lighthouse (Figure 6). Montara Creek flowed throughout the dry season of 2009, with baseflows similar to water year 2004 but lower than wetter-than-normal water year 2003 (Figure 19). These data suggest a level of equilibrium at the watershed scale.

In summary, baseflows on main stem Montara Creek below the Coast Wholesale Florist reservoir and related nearby wells appear not to be significantly depleted by the current drought, nor do the wells monitored in Potola Valley. Additional groundwater monitoring and a local recharge program are justified. In upper Wagner Valley, drought effects were observed as lower seasonal groundwater levels. The valley alluvium shows recharge but in the underlying fractured bedrock recharge may have been limited.

3.2.7 Seal Cove

Seal Cove was not considered in the Phase II study. We were unsuccessful in locating a well to monitor in the Seal Cove Subarea. The County might consider installing a dedicated monitoring well for long-term groundwater monitoring. One well, however, was offered by a well owner for monitoring in the Lower Moss Beach Subarea, just north of Seal Cove (Figure 2). Depth-to-water was acceptable and showed recharge from the October 13 event (Figure 13). Given the variable hydrogeologic conditions of the Purisima Formation underlying the Seal Cove Subarea and its proximity to the Seal Cove fault, variable local groundwater conditions likely occur within the subarea. Enhancing local recharge would benefit available groundwater supplies, and would likely also help sustain wetlands in lowlands surrounding this ridgetop terrace.

4. CONCLUSIONS

Through a variety of methods to contact well owners on Midcoast San Mateo County in a 'call for wells' campaign, we identified 20 wells that were not in use. Fourteen wells were suitable for monitoring with a continuous-recording datalogger, and 'spot' manual depth-to-water measurements were conducted in the other six wells. Monitoring well data were also gathered from three California Department of Water Resources (DWR) monitoring wells, from shallow monitoring wells at Leaky Underground Storage Tank (LUST) remediation sites, and from Montrara Water and Sanitary District and Coastside County Water District wells records. We also gaged flow at 11 stations on Midcoast streams – Martini Creek, Daffodil Canyon, Montara Creek, San Vicente Creek, Denniston Creek, Deer Creek, and Arroyo de en Medio. Three of the streams had paired gaging stations to assess baseflow recharge to the underlying terrace. Findings of our surface water and groundwater monitoring efforts are reported for the monitoring period September 2009 through February 2010, principally to assess baseflow during the third year of drier-than-normal rainfall and early winter recharge.

Rainfall and runoff records indicate that the drought that began in water year 2007 is currently less severe the previous multi-drought from water years 1987 to 1992, or any consecutive three years of that drought. Sparse but valuable long-term groundwater monitoring data from DWR monitoring wells show water level decline during the previous drought was equal to (in the Airport Subarea) and exceeding (in the Frechmans Terrace Subarea) the decline during the extreme 2-year drought of 1976 to 1977. Groundwater level decline during 2007 was equally low but had since recharged moderately. Baseflow gaging confirmed flows during 2009 are similar to drier-than-normal water year 2004 but not as low as during the previous drought or during the 1976 to 1977 drought.

Groundwater recharge from streams is significant and generally provides a hydraulic floor to water-level decline during the dry season, moderating seasonal fluctuation. Streams on the Midcoast generally have a considerable depth of alluvium that allows storage of groundwater recharge. We recorded significant recharge through the terrace reaches of Denniston Creek and Deer Creek. Arroyo de en Medio, San Vicente Creek, and Dean Creek remained dry during the dry season while having a shallow water table present within bed sediments. The gaging stations on these streams showed flow following the first major winter storm, which occurred on October 13, 2009.

Wells near creeks showed water levels related to stream recharge and monitoring wells at distance from stream courses and at higher elevations such as in Montara and Upper Moss Beach had deeper water levels. These areas largely rely on recharge from direct rainfall. Pumping from wells at distance for creeks generally show greater drawdown effects, and in these local areas drought constraints should be first identified. Limited data show marginally lower groundwater levels than pre-drought levels in upland areas. Groundwater storage seems adequate but not without local variability.

Groundwater data indicate that wetland areas and the Pillar Point Marsh appear to have been unaffected by the drought. This is evidenced by high groundwater in wetland areas and artesian conditions at the marsh. Groundwater elevation data indicate that conditions for sea-water intrusion have not developed. The most convincing data are from the piezometers located in the Pillar Point Marsh and wells in the Granada Terrace near the coast.

5. RECOMMENDATIONS

A groundwater monitoring program should be part of protecting and managing any aquifer system which is a primary source of water supply. San Mateo County has tried on more than one occasion to implement a monitoring program for the Midcoast.[14] The set of wells and stream gages that were emplaced for this study can -- with some refinement -- serve as the core of such a monitoring program. If so, the present study has shown that additional wells are needed in areas of poor coverage, in areas of limited recharge, and in areas of variable groundwater condition, particularly in upper terrace areas, such as Montara Subarea, Upper Moss Beach, El Granada, Miramar, and Seal Cove. Developing storm recharge programs for these areas would benefit local groundwater supplies – such as recharge from rooftop runoff and from storm-water ponds, particularly from late-season storms, as well as rainwater harvesting.

A sub-basin water balance model and multi-year drought analysis was developed in the Phase II study for El Granada, Moss Beach and Miramar Sub-basins. The Phase II study appropriately recommended additional monitoring and model calibration. A water balance model and drought analysis should also be developed for the other sub-basins. The water balance models would be a better predictive tool if further calibrated with a focused stream gaging program and long-term monitoring of key wells. These data could also support an adaptive management program. A subset of rain and stream gages and wells can be readily equipped to provide web-based real-time data, providing an effective tool to better understand, track, and respond to changing groundwater conditions, making the Midcoast's water supply more reliable, resilient, and also better known to the community that it sustains..

One of the main constraints to an effective water-balance model is lack of local evapotranspiration data. At present, evapotranspiration is estimated from state publications based on data collected at sites in different settings. The Airport Terrace is an ideal location for regional reference evapotranspiration (ETo) monitoring. The California Irrigation Management Information System (CIMIS) should operate a station here to measure ETo for the Midcoast,

---

[14] A specific monitoring program was adopted as a mitigation measure during approval of the 1989 Montara-Moss Beach water well EIR. County staff made two initial but unsuccessful attempts to implement the program during the subsequent years. Similar recommendations were developed as part of the 1992 Airport Aquifer and 1988 El Granda investigations.

which would assist with calibration of all water balance calculations as well as guide stream, wetland, and lagoonal habitat management on the Midcoast and South Coast.

A conceptual model for each sub-basin and a groundwater flow model would assist groundwater management. We have provided the beginnings of this process in this report, helping to identify and simulate drought-year conditions as essential basin objectives, and a reasonable common first step towards developing a groundwater management plan. This would be an effective next step in the Midcoast ground planning.

5.1 Specific Recommendations by Subarea (discussed in Section 3.2)

- Additional monitoring wells at distance from stream courses are needed in El Granada. Gaging Deer Creek successfully quantified baseflow during 2009 and should continue during baseflow 2010. Results could be used to calibrate the water balance model performed during the Phase II study. A sub-basin groundwater flow model would assist groundwater management. A local recharge program would benefit local groundwater supplies.

- Additional groundwater monitoring is needed in the Arroyo de en Medio Terrace and Frenchmans Terrace, especially at distance from the creeks. Additional gaging of Arroyo de en Medio is needed to confirm groundwater recharge trends and to quantify persistence of baseflows, with results used to calibrate a water balance model.

- A water balance model, drought analysis, and a groundwater flow model would assist groundwater management of the Airport Terrace. Additional analysis should include developing dry-season groundwater contour maps to compare with those reported during the 1987 to 1992 drought (LSCE & ESA, 1992, 1991, 1987). Gaging Denniston Creek would greatly assist calibration of the models. In addition, the Airport Terrace is an ideal location for regional reference evapotranspiration (ETo) monitoring, which would assist with calibration of all water balance models on the Midcoast.

- Additional groundwater monitoring is needed in Moss Beach, particularly at distance from the creeks and in Upper Moss Beach. Additional gaging of San Vicente Creek is needed to confirm groundwater recharge trends and quantify baseflow persistence;

results could be used to calibrate the Moss Beach Sub-basin water balance model performed during the Phase II study. A closer look at gaging Dean Creek is justified. A calibrated groundwater flow model would assist groundwater management, and developing a local recharge program, particularly for Upper Moss Beach, would benefit local groundwater-storage evaluation and drought readiness.

- Developing storm recharge programs would benefit local groundwater supplies in the Montara and Ocean View Farms terraces. Additional groundwater monitoring wells are needed, especially in the upper portion of Montara Terrace. A sub-basin groundwater flow model would also assist groundwater management.

- Additional groundwater monitoring and a local recharge program are justified in Portola and Wagner Valley.

- Installation of a dedicated monitoring well in the Seal Cove Subarea would provide local groundwater data and assist groundwater management of this subarea.

6. LIMITATIONS

This report was prepared in general accordance with the accepted standard of practice existing in Northern California at the time the investigation was performed. No other warranties, expressed or implied, are made. It should be recognized that interpretation and evaluation of subsurface conditions is a difficult and inexact art. Judgment leading to conclusions and recommendations presented above were based on existing information and personnel communications which in total represent an incomplete picture of the site. More extensive studies, including those recommended above, can reduce some of the uncertainties associated with this study.

Balance Hydrologics has prepared this report for the client's exclusive use on this particular groundwater study. Analyses and information included in this report are intended for use at the watershed scale and for the planning purposes described above. Analyses of channels and other water bodies, rocks, earth properties, topography and/or environmental processes are generalized to be useful at the scale of a watershed, both spatially and temporally. Information and interpretations presented in this report should not be applied to specific projects or sites without the expressed written permission of the authors, nor should they be used beyond the particular area to which we have applied them.

This study was conducted partly to help calibrate work done by others, which has not been independently verified. Our conclusions and any implied or inferred recommendations are based on a limited range of surface water and groundwater data in a region of relatively complex geology. They are limited to planning purposes and should not be used for design or site-specific work. If readers are aware of additional data, observations, conditions, or forthcoming changes to the bases of our decisions, please let us know at the first opportunity, such that this report may be promptly revised.

7. REFERENCES

California Department of Water Resources, 1999, Montara water supply study for Montara Sanitary District, San Mateo County, California: California Department of Water Resources, Central District staff report, June 1999, 57 p.

Earth Science Associates and Luhdorff & Scalmanini, 1987, Half Moon Bay Airport/Pillar Point Marsh ground water basin, phase I study report: Consulting report prepared for Coast side County Water District and Citizens Utility Company of California, 18 p.

Charlotte Hedlund, 2003, Hydrogeology and geochemistry of the northern groundwater basin, San Mateo County, California: San Francisco State University, Department of Geosciences, Masters of Science in Applied Geosciences.

Christopher A. Joseph & Associates, 2009, Big Wave Wellness Center and Office Park draft environmental report: Consulting report prepared for San Mateo County Planning and Building Department, October 2009, ?? p. + 11 appendices.

Flint, P.S., 1977, Environmental study of the Pillar Point Marsh, San Mateo County, California, part I baseline data: Consulting report for Coastside County Water District, Half Moon Bay, California.

Flint, P.S., 1978, Environmental monitoring study of the Pillar Point Marsh, San Mateo County, California, part II progress report, January 1977 – February 1978: Consulting report for Coastside County Water District, Half Moon Bay, California, 20 p.

Hecht, B., O'Connor, M., Renshaw, D., and Petersen, T., 1989, Draft Montara-Moss Beach water well EIR: Kleinfelder & Associates consulting report in association with Balance Hydrologics, Inc., Thomas Reid Associates and Diane Renshaw, Biologist, to the San Mateo County Department of Environmental Management, 157 p. + 4 appendices.

Hydrofocus, Inc., 2000, Unpublished project files of streamflow gaging on San Vicente Creek and Denniston Creek and of groundwater modeling of the Airport Aquifer: Consulting services for ETOP Properties, San Francisco, CA., sponsored by POST.

Kleinfelder & Associates, 1988, El Granada ground-water investigation report: *see* Laduzinsky and others, 1988

Kleinfelder & Associates, 1989, Draft Montara-Moss Beach Water Well EIR: *see* Hecht and others, 1989

Kleinfelder & Associates, 2008, San Mateo County midcoast groundwater study, Phase II, San Mateo County, California: Consulting report prepared for the San Mateo County Planning Services Department, 83 p., 20 plates + 2 appendices.

Laduzinsky, D., Hecht, B., and Woyshner, M., 1988, El Granada ground water investigation report: Kleinfelder & Associates, consulting report prepared for the San Mateo County Planning Department, 53 p. + 14 plates and 3 appendices.

Lowney-Kaldveer Associates, 1974, Ground water investigation, Denniston Creek vicinity, San Mateo County, California: Consulting report for Coastside County Water District, 12 p. + 3 appendices.

Luhdorff & Scalmanini Consulting Engineers and Earth Sciences Associates, 1991, Half Moon Bay Airport/Pillar Point Marsh ground water basin, phase I study report: Consulting report prepared for Citizens Utility Company of California and Coast side County Water District, 25 p. + 2 appendices

Luhdorff & Scalmanini Consulting Engineers and Earth Sciences Associates, 1992, Half Moon Bay Airport/Pillar Point Marsh ground-water basin report, Phase II: Supplemental data prepared for Citizens Utility Company of California and Coast side County Water District, 31 p.

Owens, J., Porras, G., and Hecht, B., 2001, Sediment-transport reconnaissance of the Pilarcitos Creek Watershed, San Mateo County, California, WY 2000: Balance Hydrologics, Inc., project number 99092, consulting report prepared for Pilarcitos Creek Advisory Committee and the San Mateo County Resource Conservation District, 17 p. + tables and figures.

Snider,R.L., 1999, Reference Evapotranspiration Map of California: California Irrigation Management Information System (CIMIS), wwwcimis.water.ca.gov/cimis/info.jsp

Woyshner, M.R., and Hecht, B., 1999, Preliminary feasibility assessment of ground water in the Martini Creek, McNee Ranch and Upper Montara Creek area – Interim status report: Balance Hydrologics, Inc., consulting report prepared for the Montara Sanitary District. 10 p. + 8 appendices

Woyshner, M.R., Hedlund, C., and Hecht, B., 2002, San Mateo County midcoast aquifers: literature and data review: Balance Hydrologics, Inc., consulting report prepared for the San Mateo County Planning Department, 23 p. + 1 appendix.

Woyshner, M., Parke, J., Hecht, B., and Porras, G., 2005, Drilling and testing of Montara Water and Sanitary District's Well 2004-4, APN 036-180-030 - well completion report, San Mateo County, California: Balance Hydrologics, Inc, Consulting report prepared for Montara Water and Sanitary District, 92 p., 3 tables, 15 figs., and 4 appendices.

TABLES

Table 1. Summary of well search for monitoring groundwater levels, Midcoast Groundwater Study Phase III, San Mateo County, CA.

	Groundwater Subarea[1]	Of special interest by County	Unused wells instrumented with dataloggers	Unused wells with depth-to-water measurement only	Unused wells with cap glued on	Wells in use	LUST sites with current data	DWR monitoring wells
1	Frenchmans Terrace							
2	Frenchmans Uplands							2
3	Frenchmans Stream Valley							
4	Miramar Terrace	yes		1	1			
5	Arroyo de en Medio Uplands							
6	Arroyo de en Medio Stream Valley							
7	El Granada Terrace	yes		1		4	1	
8	El Granada Uplands	yes		1		2		
9	Airport Terrace	yes	7	1	1	5	1	1
10	Denniston Uplands							
11	Dennistion Stream Valley							
12	Lower Moss Beach	yes	2	1		1		
13	San Vicente Uplands							
14	San Vicente Stream Valley							
15	Dean Creek (Sunshine Valley)					2		
16	Portola	yes	1	1		1		
17	Montara Knob							
18	Lower Montara Creek						1	
19	Upper Moss Beach	yes				1	1	
20	Lighthouse							
21	Wagner Valley (Upper Montara Stream Valley)		1				1	
22	Montara Terrace	yes	1			2	1	
23	Martini Uplands (Daffodil Cyn. and Ocean View Farms)		2					
24	Seal Cove	yes						
25	Mavericks							
	TOTAL		14	6	2	18	6	3

Notes:

1. Subareas as defined in the phase II study with the exception to Seal Cove and Mavericks, which was added for this phase III study.

Table 2. Annual rainfall and runoff records from previous drought to present, Midcoast San Mateo County, California.

Water Year	Rainfall at HMB [1] (inches)	Percent of Mean	Rainfall at Montara [2] (inches)	Percent of Mean	Average Percent of Mean Rainfall (rainfall)	Mean Annual Dicharge Pilarcitos Creek [3] (cfs)	Percent of Mean Runoff (runoff)	Average Percent of Mean (rainfall x runoff)
1987	18.16	68%	--	--	68%	5.65	35%	52%
1988	20.17	76%	--	--	76%	2.56	16%	46%
1989	24.51	92%	--	--	92%	8.13	51%	72%
1990	16.45	62%	--	--	62%	2.38	15%	38%
1991	20.76	78%	--	--	78%	4.72	30%	54%
1992	24.19	91%	--	--	91%	9.18	57%	74%
1993	33.22	125%	--	--	125%	16	100%	113%
1994	--	--	--	--	--	2.29	14%	--
1995	34.62	130%	--	--	130%	22	138%	134%
1996	31.88	120%	--	--	120%	24.4	153%	136%
1997	26.70	100%	--	--	100%	21	131%	116%
1998	50.20	189%	--	--	189%	50.8	318%	253%
1999	29.59	111%	--	--	111%	25	156%	134%
2000	31.80	120%	--	--	120%	21	131%	125%
2001	22.85	86%	--	--	86%	7.57	47%	67%
2002	--	--	33.85	105%	105%	11.3	71%	88%
2003	--	--	28.79	89%	89%	13.6	85%	87%
2004	23.86	90%	31.05	96%	93%	11.3	71%	82%
2005	37.29	140%	43.86	136%	138%	21.3	133%	136%
2006	35.38	133%	48.45	150%	141%	42.9	268%	205%
2007	18.78	71%	24.45	76%	73%	7.02	44%	59%
2008	20.41	77%	24.99	77%	77%	12.1	76%	76%
2009	20.48	77%	23.75	73%	75%	10.2	64%	70%
2010 (through May)			32.08	99%	99%			
Mean	26.6	--	32.36	--		16.0	--	--

Notes:

1. NOAA NCDC Station 43714 at Half Moon Bay, San Mateo County, CA, 1948 to present.
2. Montara Water and Sanitary District Alta Vista water treatment and storage facility, Montara, CA, 2001 to present.
3. USGS Station 11162630 Pilarcitos Creek at Half Moon Bay, San Mateo County, CA, 1967 to present.
4. Multi-year droughts are highlighted in yellow.

Table 3. Summary of results from domestic water-well yield tests for home resale, 1991 through 2009, Midcoast San Mateo County, California.

	Montara	Moss Beach	Princeton	El Granada	Miramar	All Wells
Number of wells tested	57	29	1	115	13	215
Number of wells with yield < 2.5 gpm	3	4	0	40	1	48
Percentage of wells with yield < 2.5 gpm	5%	14%	n/a	35%	8%	22%
Average standing water level (feet)	72.2	56.9	n/a	49.2	25.3	54.7
Maximum standing water level (feet)	256	203	n/a	210	66	256
Median standing water level (feet)	62	55	n/a	34.5	20	41
Minimum standing water level (feet)	6	7	n/a	1	6	1
Standard Deviation (feet)	47.5	48.6	n/a	42.8	16.7	45.3
Average Specific Capacity (gpm/ft)	0.365	0.471	n/a	0.443	1.384	0.502
Maximum Specific Capacity (gpm/ft)	2.275	3.000	n/a	8.250	5.000	8.250
Median Specific Capacity (gpm/ft)	0.250	0.115	n/a	0.043	1.167	0.115
Minimum Specific Capacity (gpm/ft)	0.021	0.005	n/a	0.003	0.040	0.003
Standard Deviation (gpm/ft)	0.437	0.702	n/a	1.004	1.334	0.931
Skew	2.464	2.321	n/a	5.048	1.769	4.281

Notes:

1. Data Source: Simms Plumbing and Water Equipment, Pescadero, California
2. Standing water level is the depth to water in the well prior to pumping.
3. Specific capacity, Cs is the tested well yield divided by the drawdown, expressed as gallons per minute per foot of drawdown.
4. The cause for lower yield than when initially drilled and tested may potentially be related to mineral precipitation and fine sediment interference in filter pack and casing perforations of the well, as well as a lower groundwater level.

Table 4. Comparison of Denniston Creek baseflow to previous drought
Midcoast Groundwater Study Phase III, San Mateo County, CA

	Lower Denniston Creek			Upper Denniston Creek	
	Sep-09 (gpm)	Sep-08 (gpm)	6/20/1990[1] (gpm)	Sep-09 (gpm)	6/20/1990[1] (gpm)
Instantaneous flow measuement	--	--	0	--	35
Mean daily flow	8	99	--	43	--
Maximum daily flow	102	237	--	196	--
Minimum daily flow	1	33	--	0	--

Notes
1. The 1990 baseflow measurement, on June 20, was made notably earlier in the season, and would be expected to have higher flows solely on that basis. Additionally, major rains during the last week of May 1990 could easily have been a source of recharge.

2. Instantaneous measurements along Denniston could potentially have been affected by pumping from near-creek wells.

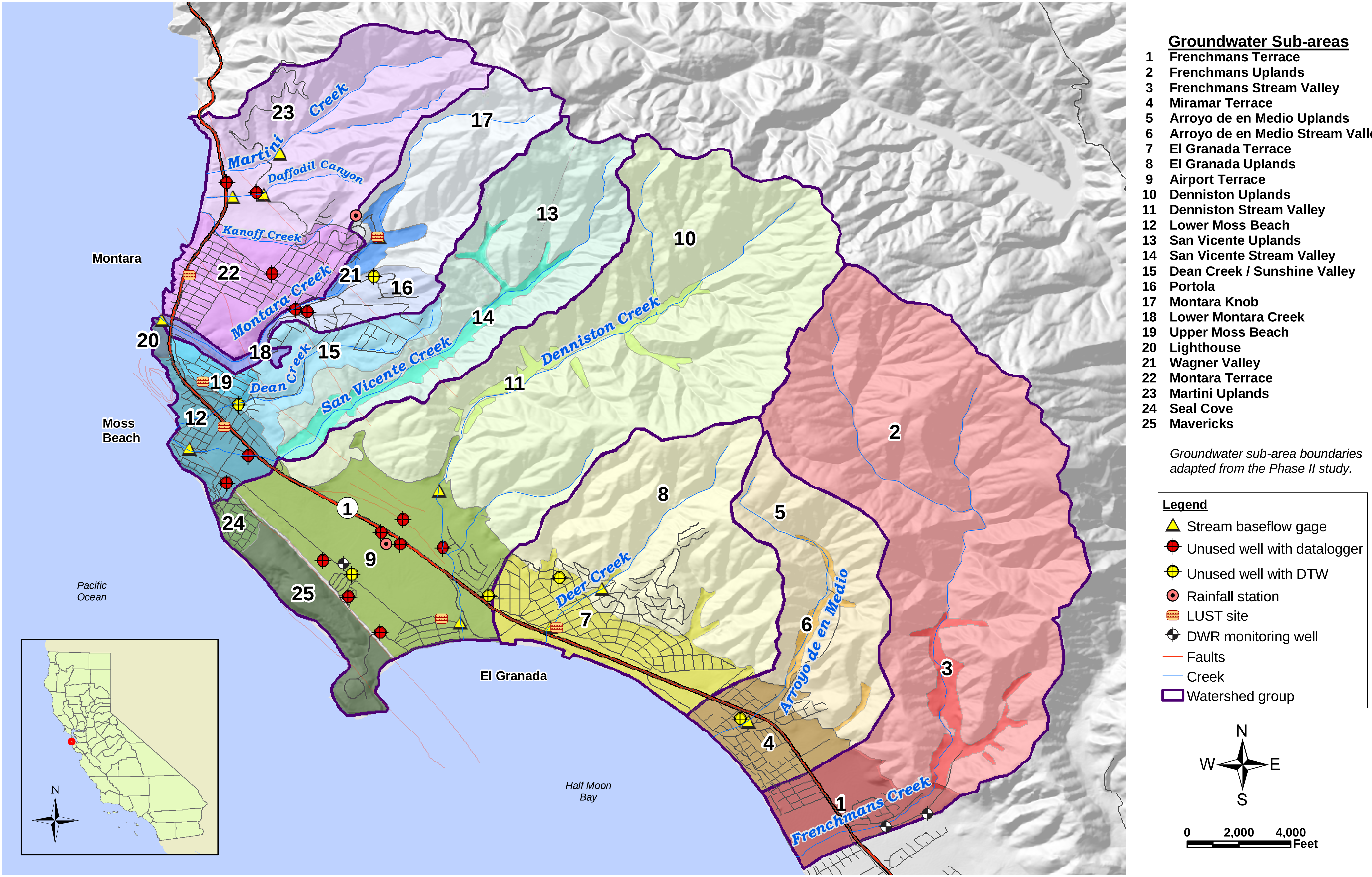
Table 5. Summary of data describing current drought conditions, 2007-2010 Midcoast Groundwater Study Phase III, San Mateo County, California.	
Regional rainfall and runoff	Composite average of annual rainfall and runoff from 2007 to 2009 was 69 percent of normal, relative to 56 percent during the previous drought, 1987 to 1992 (Table 2, Figure 15).
Regional well yield and specific capacity	Tested well yields (Figure 20) and well specific capacities (Figure 21) varied from year-to-year within a similar range going back to 1991. A 2-year lag is noted from antecedent rainfall. Regional variability is noted (Table 3) and skewed by few higher yielding wells (Figure 22).
Airport Aquifer and Denniston Creek	Denniston Creek baseflow during water year 2009 was significantly lower than baseflow 2008 but high when compared to baseflow 1990 (Table 4). Similarly, groundwater was high in the Airport Aquifer when compared to the previous drought, 1987 to 1992 (Figure 16).
MWSD production wells *(Airport, Wagner Valley, Portola, and Montara Knob)*	Static 2009 levels in the Airport Aquifer were higher, when compared to pre-drought levels; static levels in the Portola wells were generally unchanged, but lower in the Wagner, Drake and Alta Vista wells (Appendix C).
Arroyo de en Medio *Miramar Terrace)*	Recent depth-to-water measurements in a well next to Arroyo de en Medio indicated groundwater levels similar to past measurements going back to 1999 (Figure 17).
Martini Creek *(Martini Uplands)*	Baseflows 2009 were similar to pre-drought years (Figure 18).
Montara Creek *(Lower Montara Creek)*	Baseflows 2009 were similar to pre-drought years (Figure 19).
Leaky Underground Storage Tank (LUST) sites (Montara Terrace, Moss Beach, Airport, and El Granada)	In general, recent depth-to-water measurements in shallow monitoring wells in Montara, Moss Beach, and El Granada were slightly lower than pre-drought years but recharging normally from winter rains (Appendix D). Water levels were generally unchanged in the Airport (Princeton).
DWR monitoring wells (Frenchmans Terrace, Airport)	Long-term monitoring of groundwater levels illustrate responses to seasonal rainfall and antecedent conditions (Appendix E). At the height of the 1987 to 1992 drought, groundwater level decline was equal to and exceeding decline during the extreme 2-year drought of 1976 to 1977. Groundwater level decline during 2007 was equally low but has since recharged.

Table 6. Summary of methods and results by subarea, Midcoast Groundwater Study Phase III, San Mateo County, CA.

	Groundwater Subarea[1]	Of Special Interest by County	Monitoring Methods	Results	Interpretation
1	Frenchmans Terrace	--	Data from 2 DWR long-term monitoring wells since 1974 and 1978.	Groundwater level decline during 2007 was equal to the depths of the 1987 to 1992 drought and the extreme 2-year 1976-77 drought but has recharged through 2009 (Appendix E).	Recharge from Frenchmans Creek appeared to provide a hydraulic floor to groundwater level decline during the dry season and drought years. At distance from the creek are more affected by drought.
2	Frenchmans Uplands	--	Not monitored	--	--
3	Frenchmans Stream Valley	--	Not monitored	--	--
4	Miramar Terrace	yes	Baseflow in Arroyo de en Medio and depth-to-water in a well near Arroyo de en Medio. Well in upper Miramar Terrace could be monitored if glued cap replaced.	Arroyo de en Medio through its Miramar Reach was dry until after 10 inches of rain fell within the watershed (Figure 9). Groundwater levels near the arroyo (Figure 14) were similar to past measurements since 1999 (Figure 17).	Arroyo de en Medio through its Miramar Reach typically dries back annually during the dry-season with the water table present within channel bed sediments. During baseflow 2009, local groundwater levels affected by stream recharge appeared normal.
5	Arroyo de en Medio Uplands	--	Not monitored	--	--
6	Arroyo de en Medio Stream Valley	--	Not monitored	--	--
7	El Granada Terrace	yes	Baseflow in Deer Creek at Avenue Alhambra. Depth-to-water in 2 unused wells near wetlands. Data from LUST site shallow monitoring wells since WY1996.	Lower Dear Creek was wet with no flow during baseflow 2009 until the October 13th storm when flow resumed (Figure 8). Dry-season groundwater levels at LUST site monitoring wells were slightly lower than pre-drought years; recharge was normal (Appendix D). Groundwater levels near wetlands appear normal (Figure 14).	Baseflow in Deer Creek provided significant recharge to the El Granada Terrace. Groundwater storage during 2009 have declined to non-alarming levels during the drought.
8	El Granada Uplands	yes	Baseflow in Deer Creek at mouth of canyon.	Upper Deer Creek flowed through dry-season 2009 (Figure 10).	Baseflows in Deer Creek were reasonable relative to other watersheds.
9	Airport Terrace	yes	Baseflow in Denniston Creek at canyon mouth and at Princeton. Dataloggers in 6 unused wells reasonably distributed and a piezometer nest at Pillar Point Wetland. Depth-to-water in 1 unused well and 1 domestic well in use. Data from MWSD and CCWD production wells. Data from LUST site shallow monitoring wells since WY2003. Data from DWR monitoring well 1953 to 1991. Long-term rain station.	Denniston Creek flowed through dry-season 2009 with higher flows than baseflow 1990 (Table 4); baseflows 2009, however, were significantly lower than during 2008. Groundwater was high in the Airport Aquifer when compared to the previous drought, 1987 to 1992 (Figure 16). Static (not pumped) groundwater levels in MWSD wells were higher than pre-drought levels (Appendix C). Piezometers showed artesian groundwater at Pillar Point Marsh and west basin wells showed shallow groundwater (Figure 13). LUST site groundwater levels (in Princeton) were within a normal range (Appendix D).	Groundwater storage was not as depleted as during previous droughts and recharge appeared normal during dry-season 2009 relative to pre-drought conditions. Baseflow in Denniston Creek provided recharge to the Airport Terrace through the dry season. Groundwater was shallow and ponding prevalent along Seal Cove fault to Pillar Point Marsh. Conjunctive use opportunities may potentially extend the east portion of the aquifer.
10	Denniston Uplands	--	Not monitored	--	--
11	Denniston Stream Valley	--	Not monitored	--	--
12	Lower Moss Beach	yes	Baseflow in San Vicente Creek at Fitzgerald Marine Reserve. Datalogger in a well near San Vicente Cr. and one near Seal Cove subarea. Data from LUST site shallow monitoring wells since WY2005.	San Vicente Creek through its Lower Moss Beach reach was dry during the dry season and developed some flow with the October 13th storm (Figure 9). Groundwater levels near the creek were shallow and generally unchanged (Figure 13). Dry-season shallow groundwater levels in LUST site monitoring wells were slightly lower than pre-drought years (Appendix D); recharge appeared normal. Groundwater levels near wetlands appeared normal (Figure 14).	Similar to Arroyo de en Medio, San Vicente Creek through its Lower Moss Beach reach would typically dries back annually during the dry-season with the water table present within channel bed sediments. Groundwater levels during baseflow 2009 appeared to have not exceeded previous drought levels. San Vicente Creek seems to provide significant recharge to Lower Moss Beach Terrace.
13	San Vicente Uplands	--	Not monitored	--	--
14	San Vicente Stream Valley	--	Not monitored	--	--
15	Dean Creek (Sunshine Valley)	--	Depth-to-water in an unused well near wetlands.	Dean Creek dry with few isolated pools near its mouth during the dry season and groundwater levels near wetlands appear normal (Figure 14).	Similar to San Vicente Creek, Dean Creek provides significant groundwater recharge to shallow groundwater, with variable local groundwater conditions in underlying bedrock.
16	Portola	yes	Datalogger in 1 unused well. Depth-to-water from 1 unused well. Data from 3 MWSD production wells.	Static levels in the MWSD Portola wells were generally unchanged from previous years (Appendix C). Groundwater levels in monitored wells seemed normal with normal storm recharge (Figure 12).	Groundwater storage and recharge appeared not to be significantly depleted by the drought.
17	Montara Knob	--	Not monitored	--	--
18	Lower Montara Creek	--	Baseflow in Montara Creek at Montara Point lighthouse.	Baseflows 2009 are similar to pre-drought years (Figure 19).	--
19	Upper Moss Beach	yes	Depth-to-water in a used well when residence temporarily unoccupied. Data from LUST site shallow monitoring wells since WY2007.	Recent measurements of shallow groundwater levels were generally unchanged (Appendix D). Bedrock wells show deeper water levels. 711 Etheldore St. well failed during 2009.	Variable local groundwater conditions. Local recharge limited to primarily storms, and enhancing recharge from rainfall would benefit groundwater supplies.
20	Lighthouse	--	Not monitored	--	--
21	Wagner Valley (Upper Montara Stream Valley)	--	Datalogger in 1 unused well near Montara Creek. Data from 2 MWSD production wells. Data from LUST site shallow monitoring wells since WY1999.	Static 2009 levels in MWSD production wells were lower when compared to pre-drought levels going since 2003 (Appendix B). Shallow groundwater in LUST monitoring wells were slightly lower than pre-drought years but recharging from winter rains (Appendix D).	Drought years recharge appeared normal in stream valley aquifer but limited in underlying bedrock aquifer.
22	Montara Terrace	yes	Datalogger in 1 unused well. Data from LUST site shallow monitoring wells since WY2004.	Groundwater levels and recharge appear normal but slightly lower than pre-drought years (Figure 12, Appendix D). Groundwater recharge apparent.	Groundwater storage appeared not to show meaningful depletion by drought but with variable local groundwater conditions. Local recharge generally limited to storms, and enhancing recharge from rainfall would benefit groundwater supplies.
23	Martini Uplands (Daffodil Cyn. and Ocean View Farms)	--	Baseflow Martini Creek above Old San Pedro Trail and in Daffodil Canyon at canyon mouth and at Hwy 1. Datalogger in 2 unused wells.	Baseflows 2009 were higher than 2007 and similar to water year 2004 (Figure 18). Wetter-than-normal rainfall years 2005 and 2006 showed higher baseflows.	Daffodil Canyon provided some recharge to the terrace at its mouth but channel incision limits recharge across the terrace reach. Channel incision also curtails recharge from Martini Creek. The subarea is relatively unimpaired by urbanization and an analog to other subareas.
24	Seal Cove	yes	Datalogger in well just north of subarea.	Depth to water was acceptable and showed storm recharge just to the north (Figure 13).	Should have variable local groundwater conditions. Local recharge limited to storms, and enhancing recharge from rainfall would benefit groundwater supplies.
25	Mavericks	--	Not monitored	--	--

Notes:
1. Subareas as defined in the phase II study with the exception to Seal Cove and Mavericks, which was added for this phase III study.

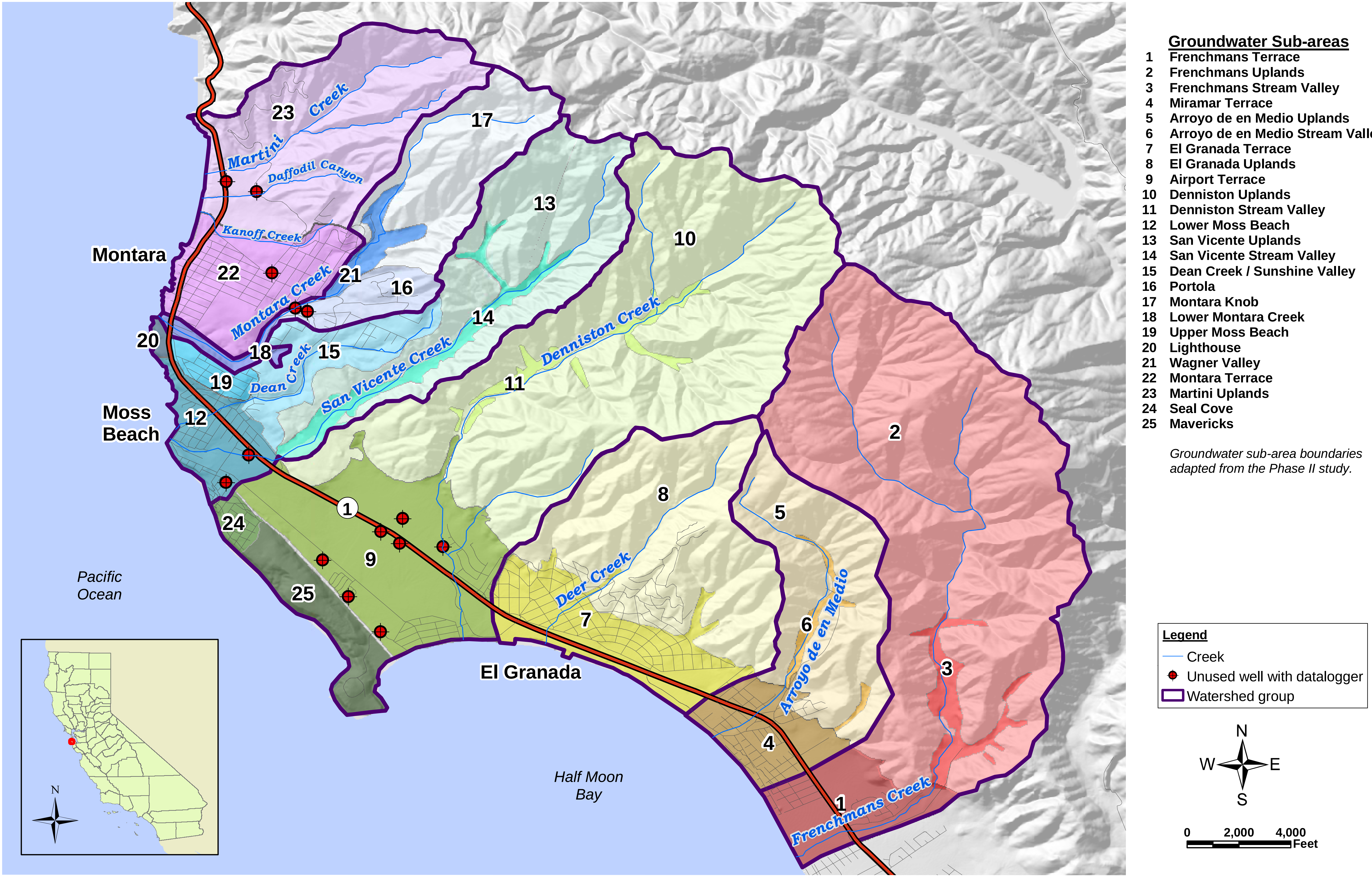
FIGURES



Balance Hydrologics, Inc.

Figure 1. Monitoring network, Midcoast Groundwater Study Phase III, San Mateo County, California.

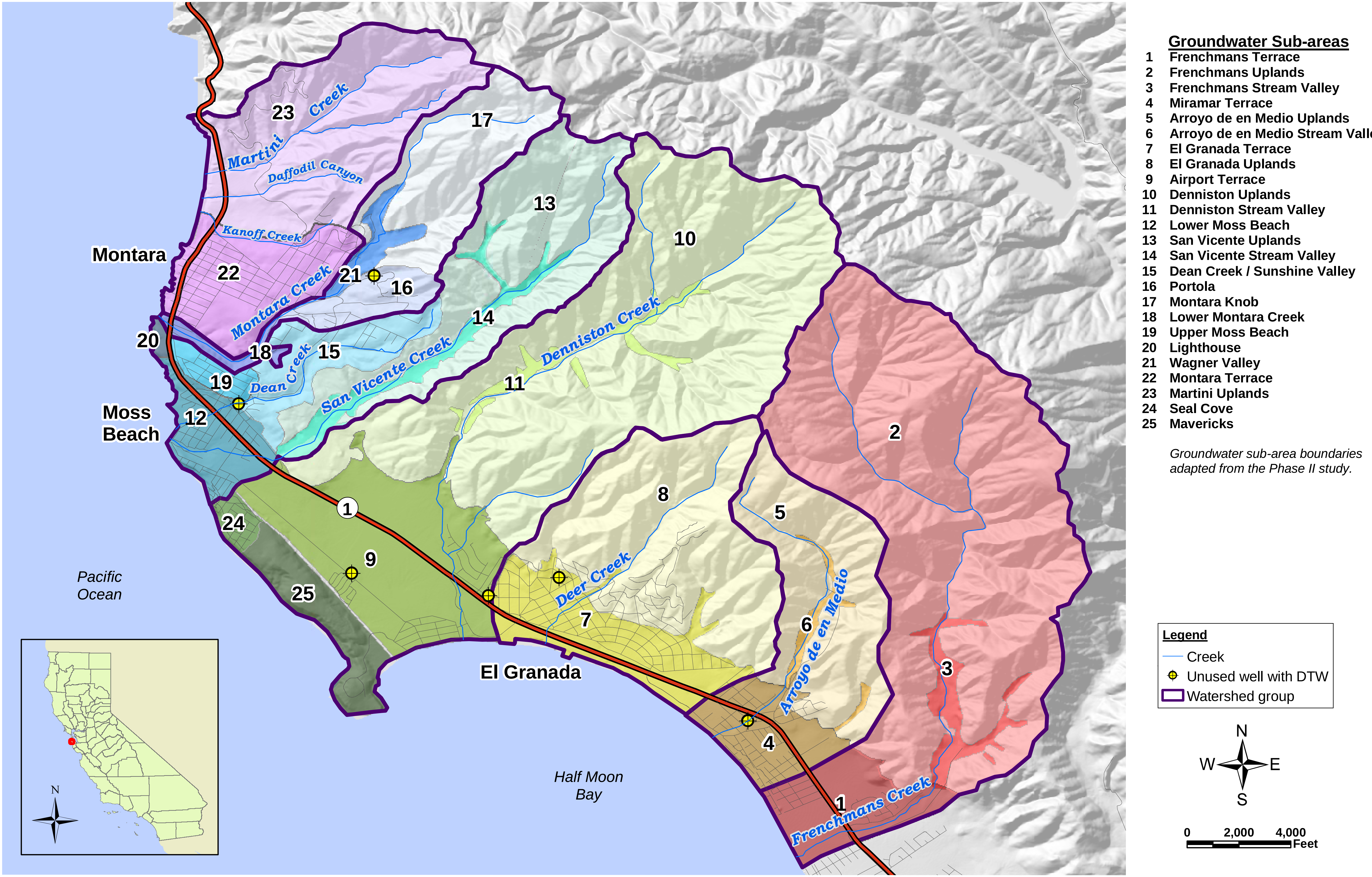
209093 figures.mxd



Balance Hydrologics, Inc.

Figure 2. Unused wells monitored with dataloggers, Midcoast Groundwater Study Phase III, San Mateo County, California.

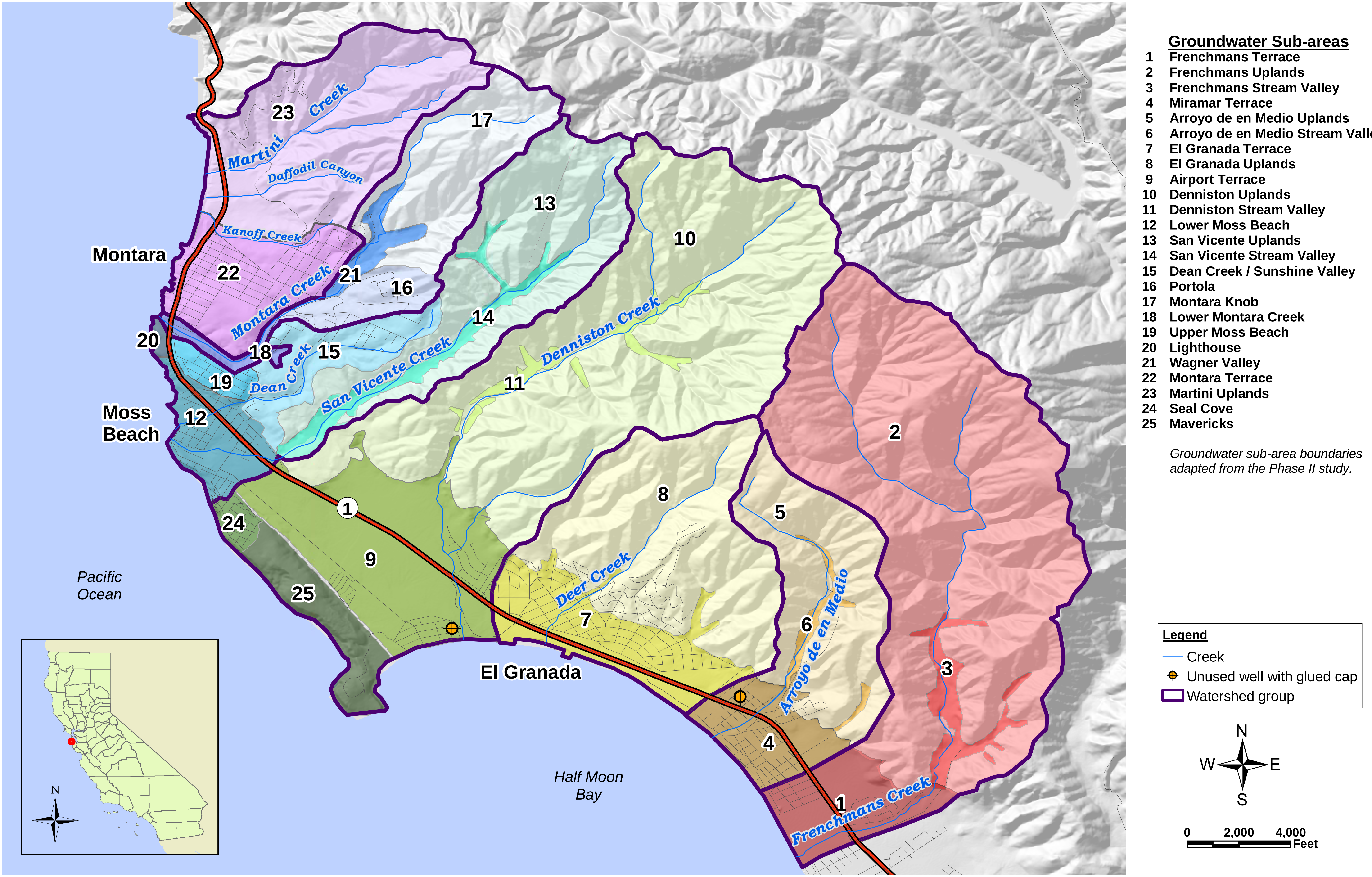
209093 figures.mxd



Balance Hydrologics, Inc.

Figure 3. Unused wells monitored by depth-to-water measurements only, Midcoast Groundwater Study Phase III, San Mateo County, California.

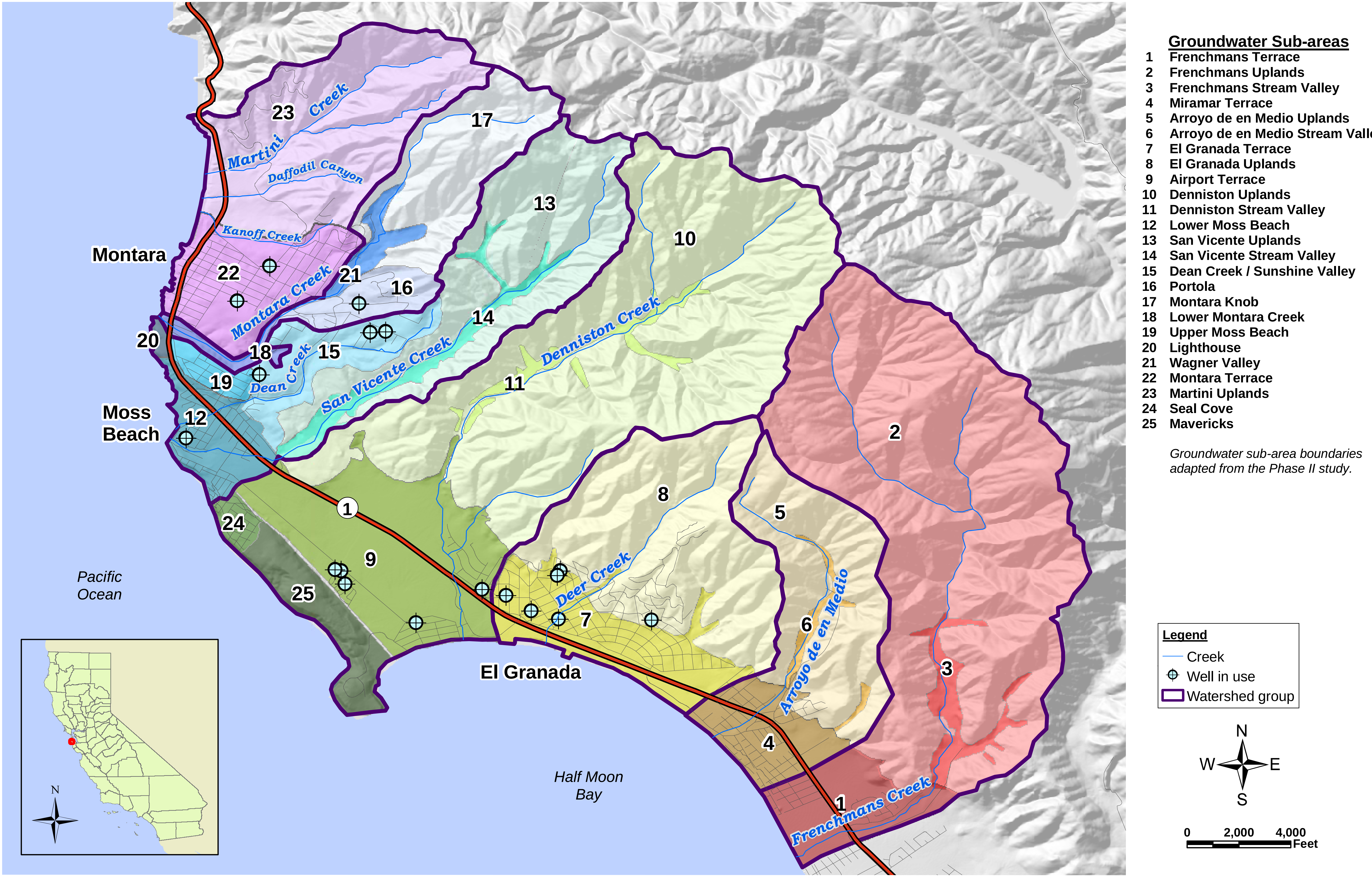
209093 figures.mxd



Balance Hydrologics, Inc.

Figure 4. Unused wells with cap glued on and not monitored, Midcoast Groundwater Study Phase III, San Mateo County, California.

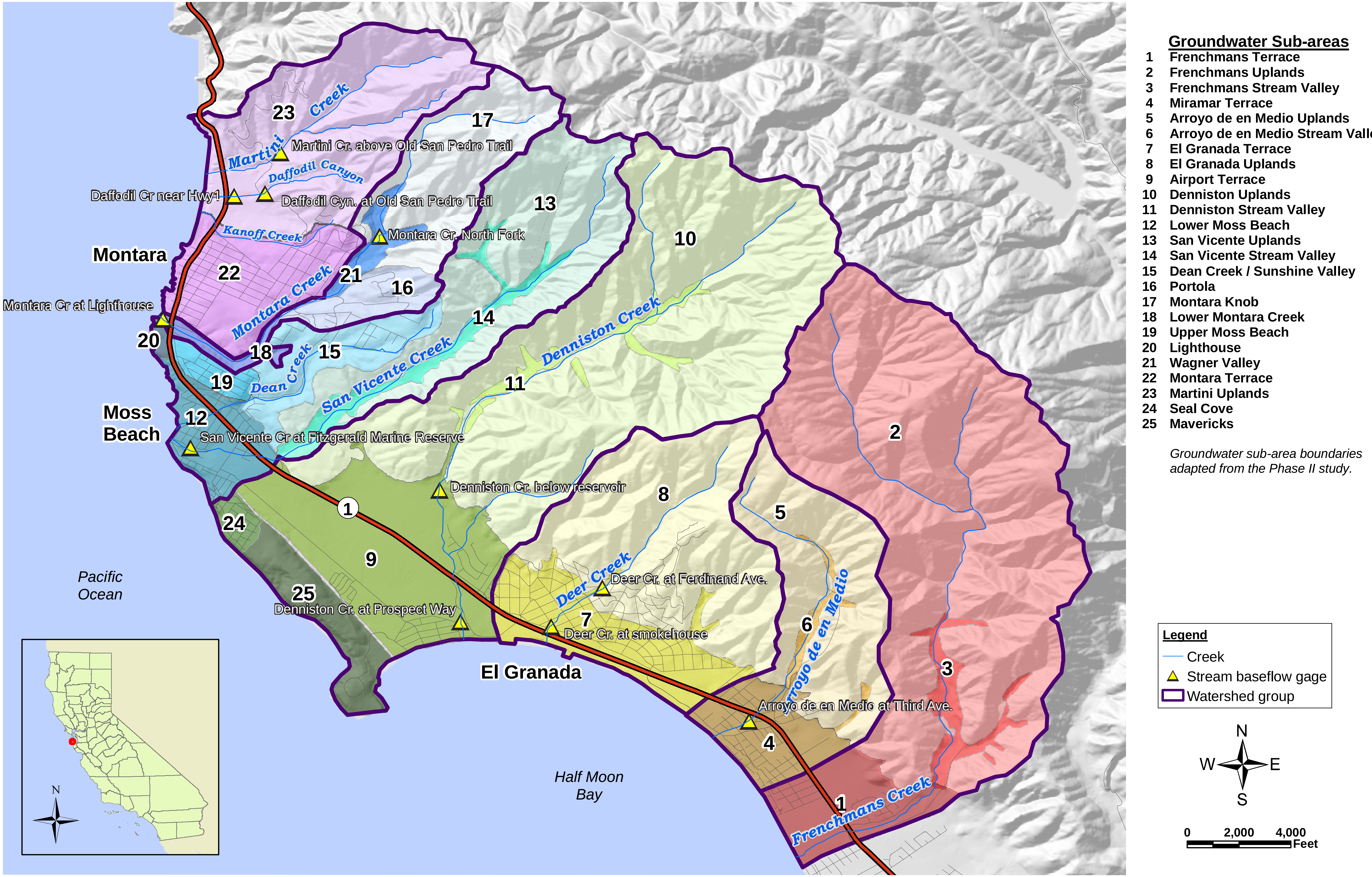
209093 figures.mxd



Balance Hydrologics, Inc.

Figure 5. Wells in use and not monitored, Midcoast Groundwater Study Phase III, San Mateo County, California.

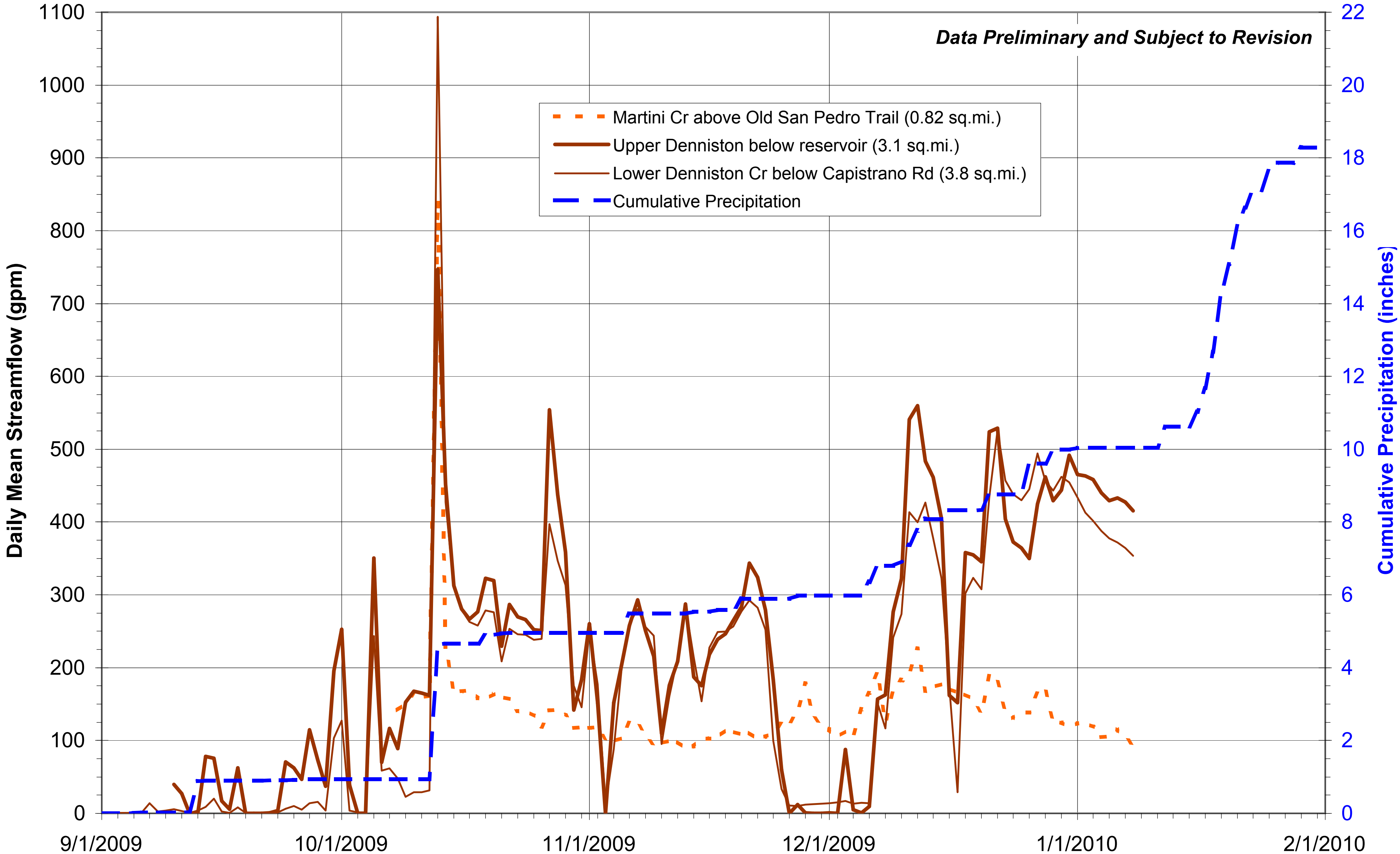
209093 figures.mxd



Balance Hydrologics, Inc.

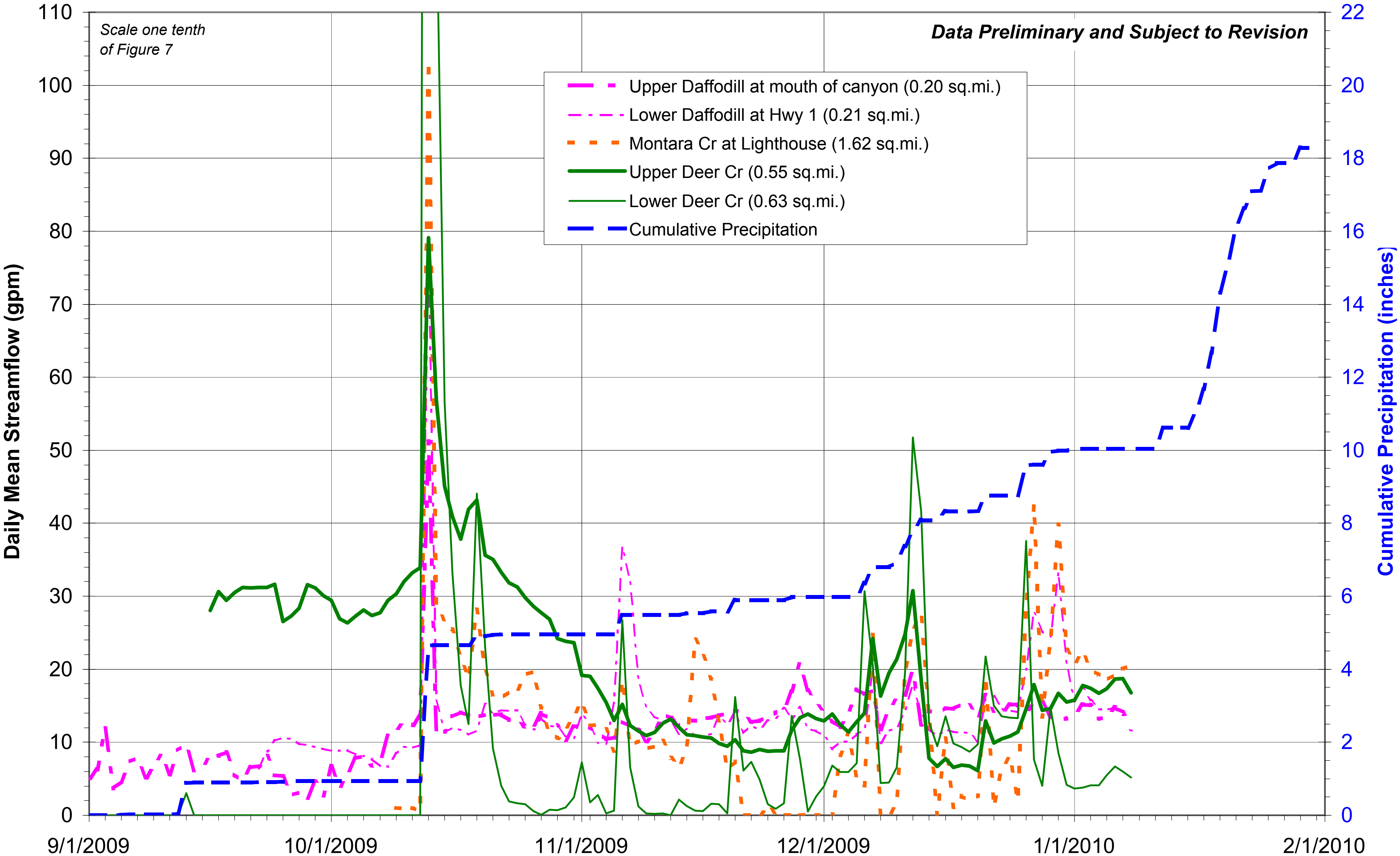
Figure 6. Stream gaging stations, Midcoast Groundwater Study Phase III, San Mateo County, California.

209093 figures.mxd



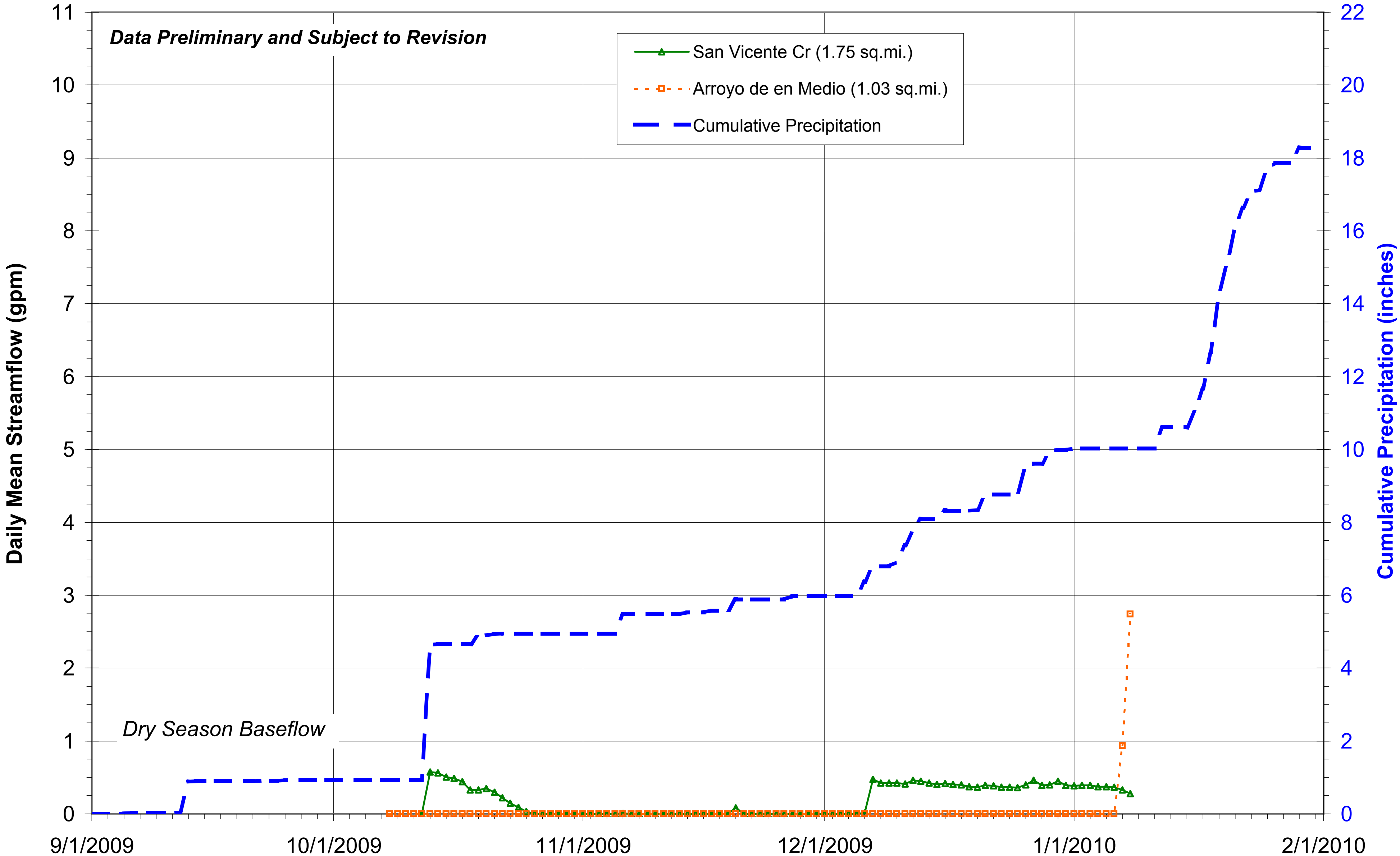
Balance Hydrologics, Inc.®

Figure 7. Gaging stations with relatively high dry-season baseflow from late water year 2009 through early water year 2010, Midcoast San Mateo County, California.



Balance Hydrologics, Inc.®

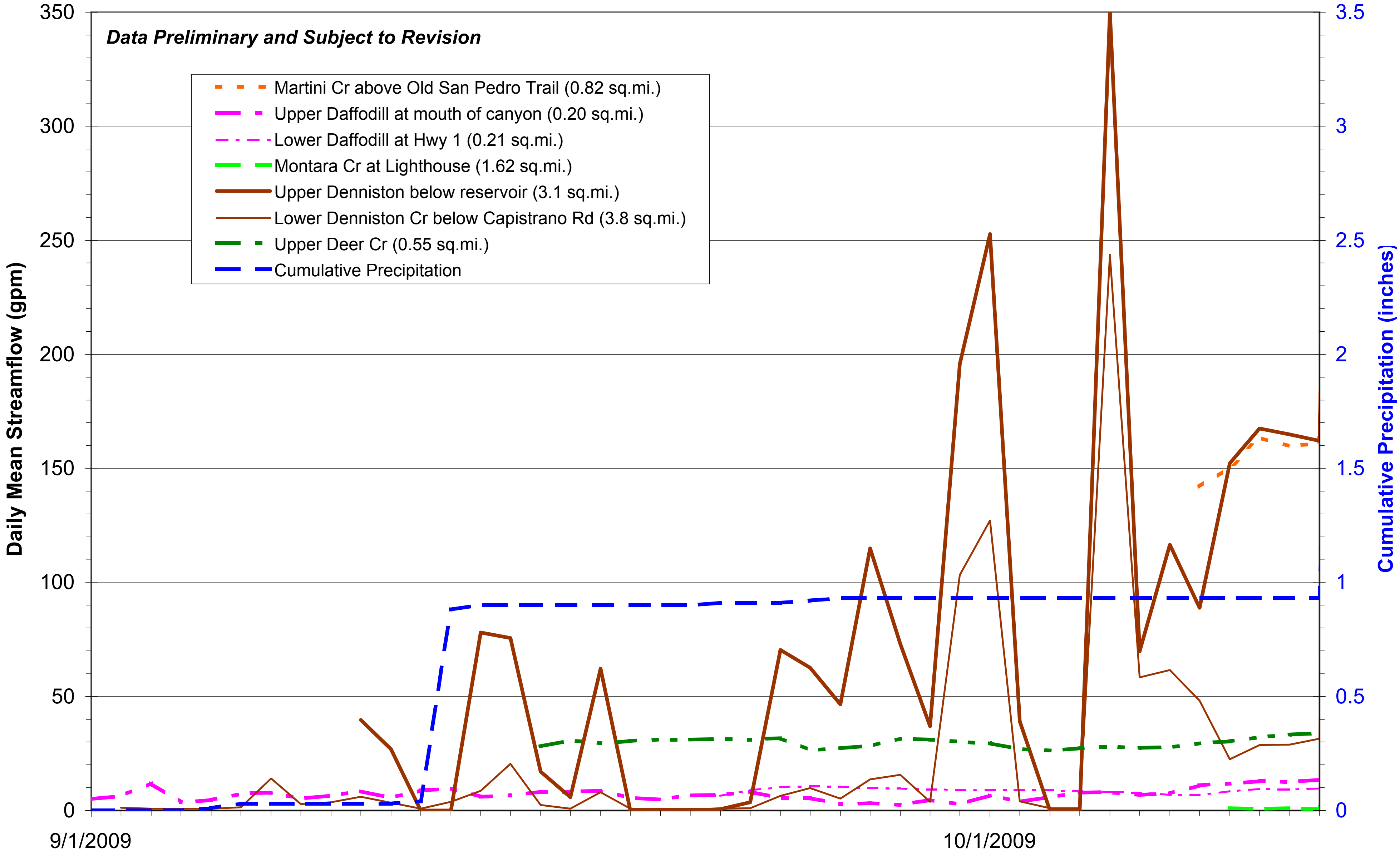
Figure 8. Gaging stations with relatively low dry-season baseflow from late water year 2009 through early water year 2010, Midcoast San Mateo County, California.



Balance Hydrologics, Inc.®

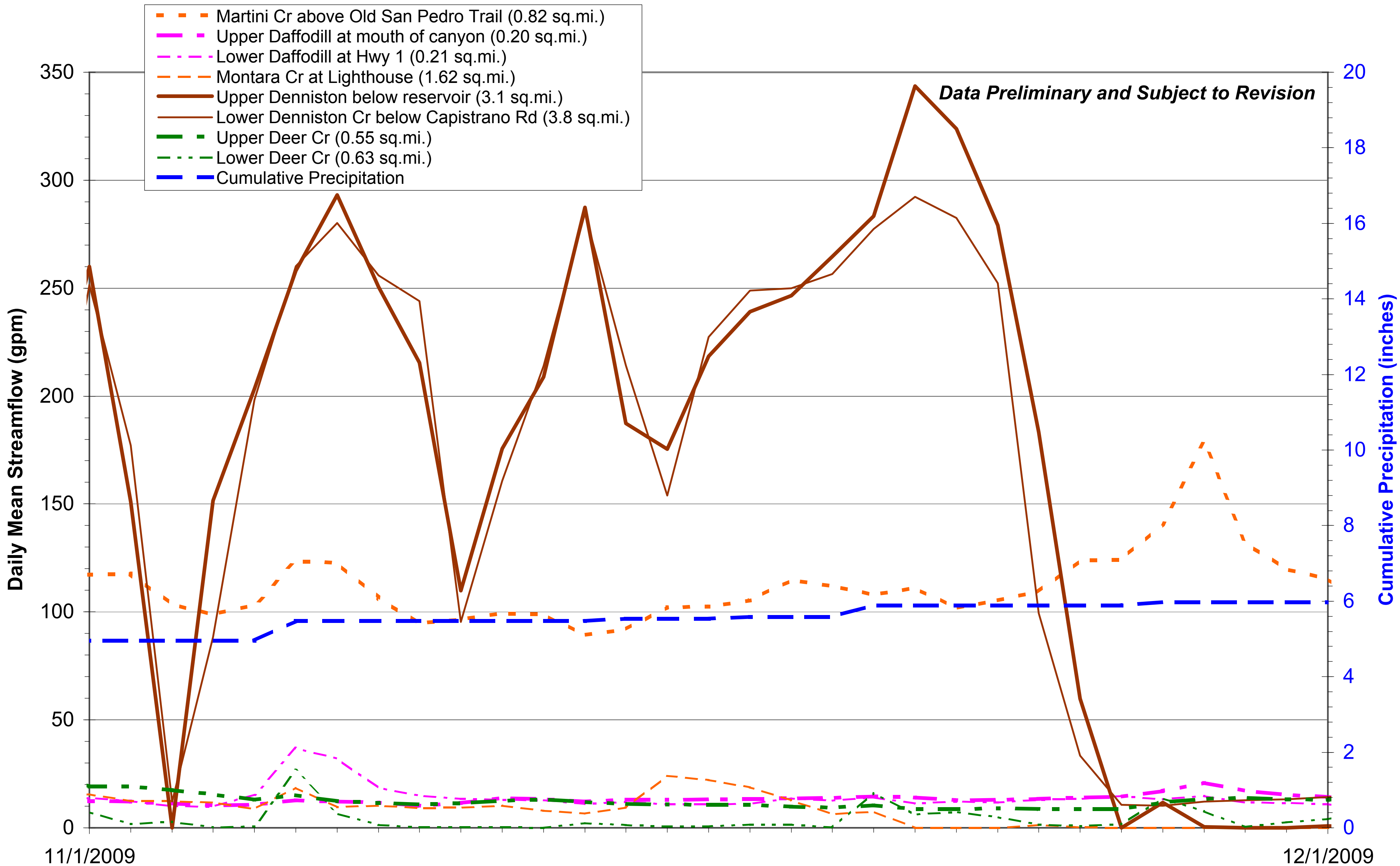
Figure 9. Streams with little to no baseflow from late water year 2009 through early water year 2010, Midcoast San Mateo County, California.

209093 Obs Log MDQ & DTW WY10 3-26-10.xls, Chart1 (no flow), 3/29/2010



Balance Hydrologics, Inc.®

Figure 10. Streams with dry-season baseflow prior to the October 13, 2009 storm, Midcoast San Mateo County, California. Streams with a dry bed through on marine terrace reach include Dean Cr. (Sunshine Valley), San Vicente Cr., and Arroyo de en Medio. Lower Deer Cr. was wet with negligible flow. The October 13th storm measure 3.73 inches at the MWSD Alta Vista water treatment and storage facility in Montara.



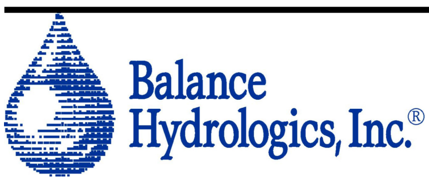
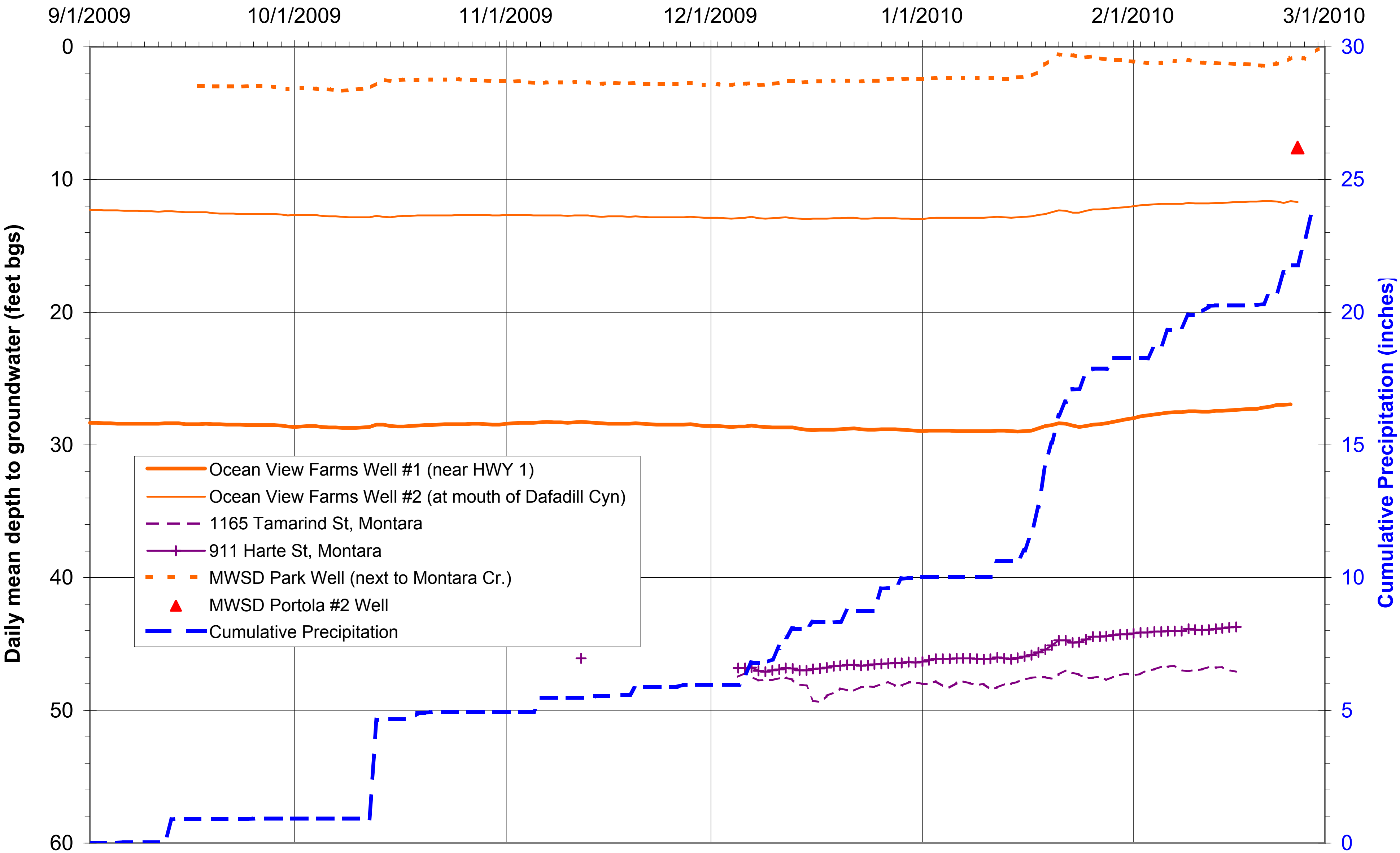
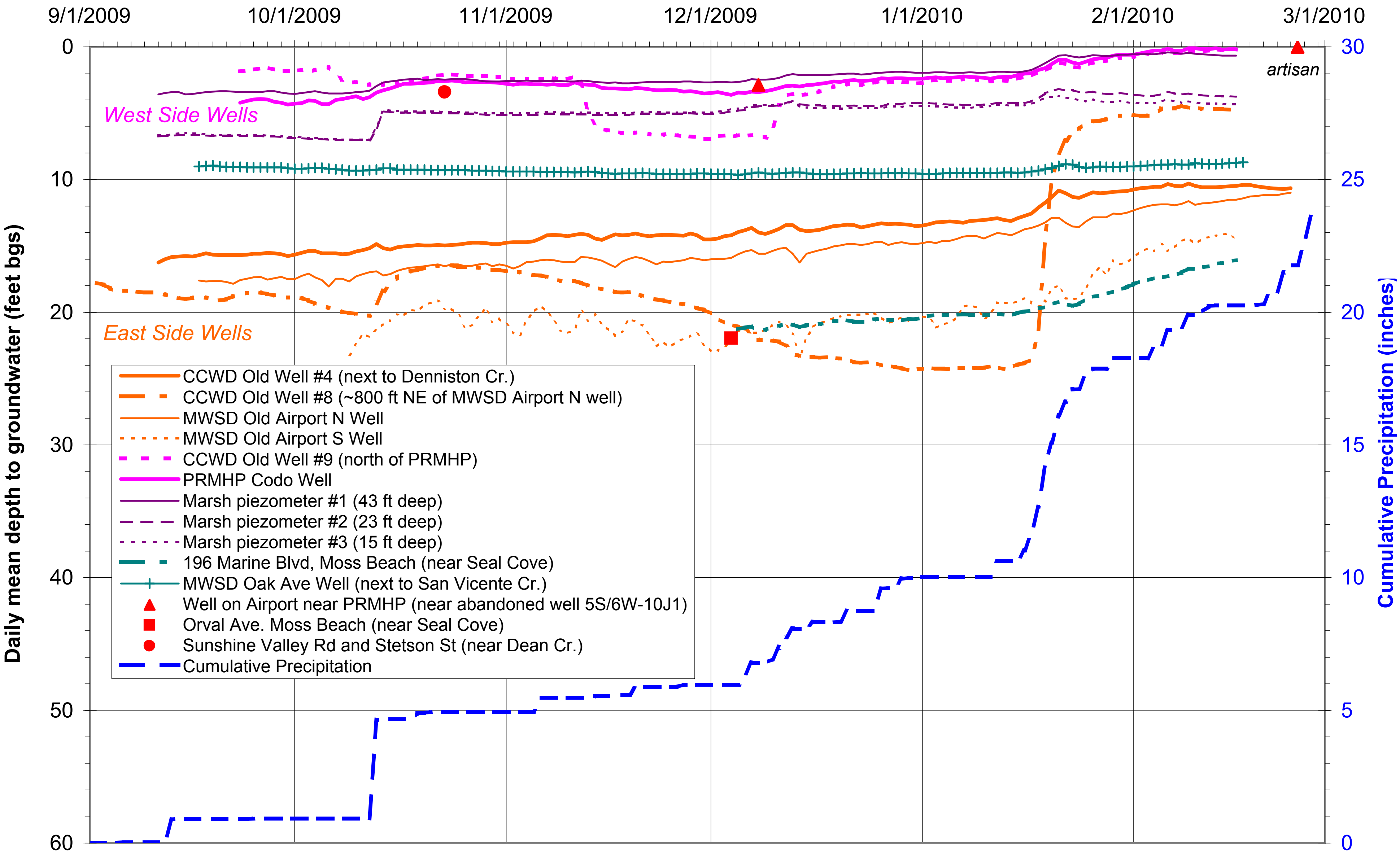


Figure 11. Streams with dry-season baseflow in November following the October 13, 2009 storm, Midcoast San Mateo County, California. Streams with no flow in their marine terrace reach include San Vicente Cr. and Arroyo de en Medio. The October 13th storm measure 3.73 inches at the MWSD Alta Vista water treatment and storage facility in Montara.



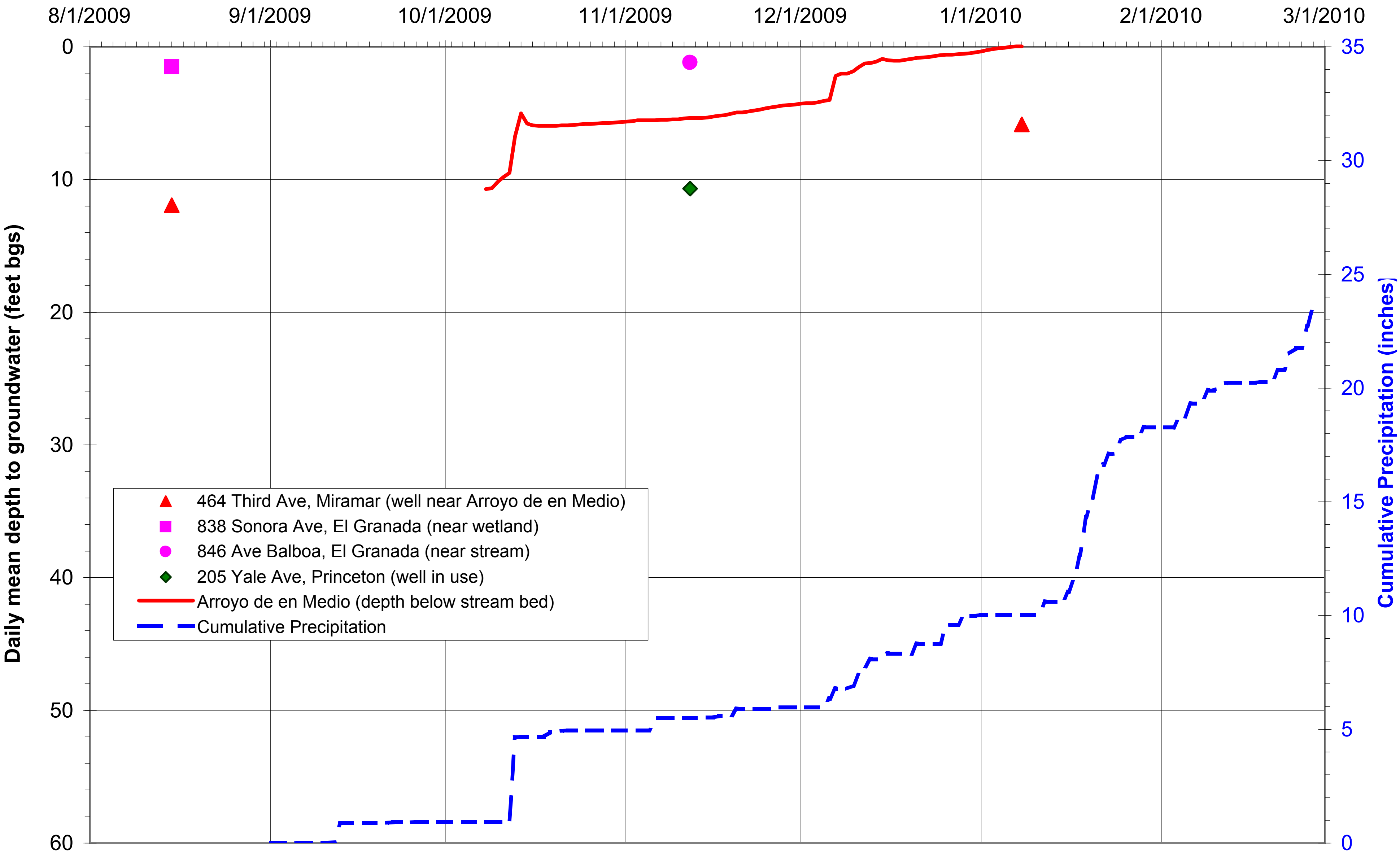
Balance Hydrologics, Inc.®

Figure 12. Groundwater monitoring from dry-season baseflow into winter of water year 2010, Ocean View Farms, Montara and Portola areas, Midcoast San Mateo County, California.



Balance Hydrologics, Inc.®

Figure 13. Groundwater monitoring from dry-season baseflow into winter of water year 2010, Half Moon Bay Airport Aquifer, Moss Beach and Seal Cove areas, Midcoast San Mateo County, California.



Balance Hydrologics, Inc.®

Figure 14. Groundwater monitoring from dry-season baseflow into winter of water year 2010, El Granada, Princeton, and Miramar, Midcoast San Mateo County, California.

209093 Obs Log MDQ & DTW WY10 3-26-10.xls, Chart3 (El Granada), 3/26/2010

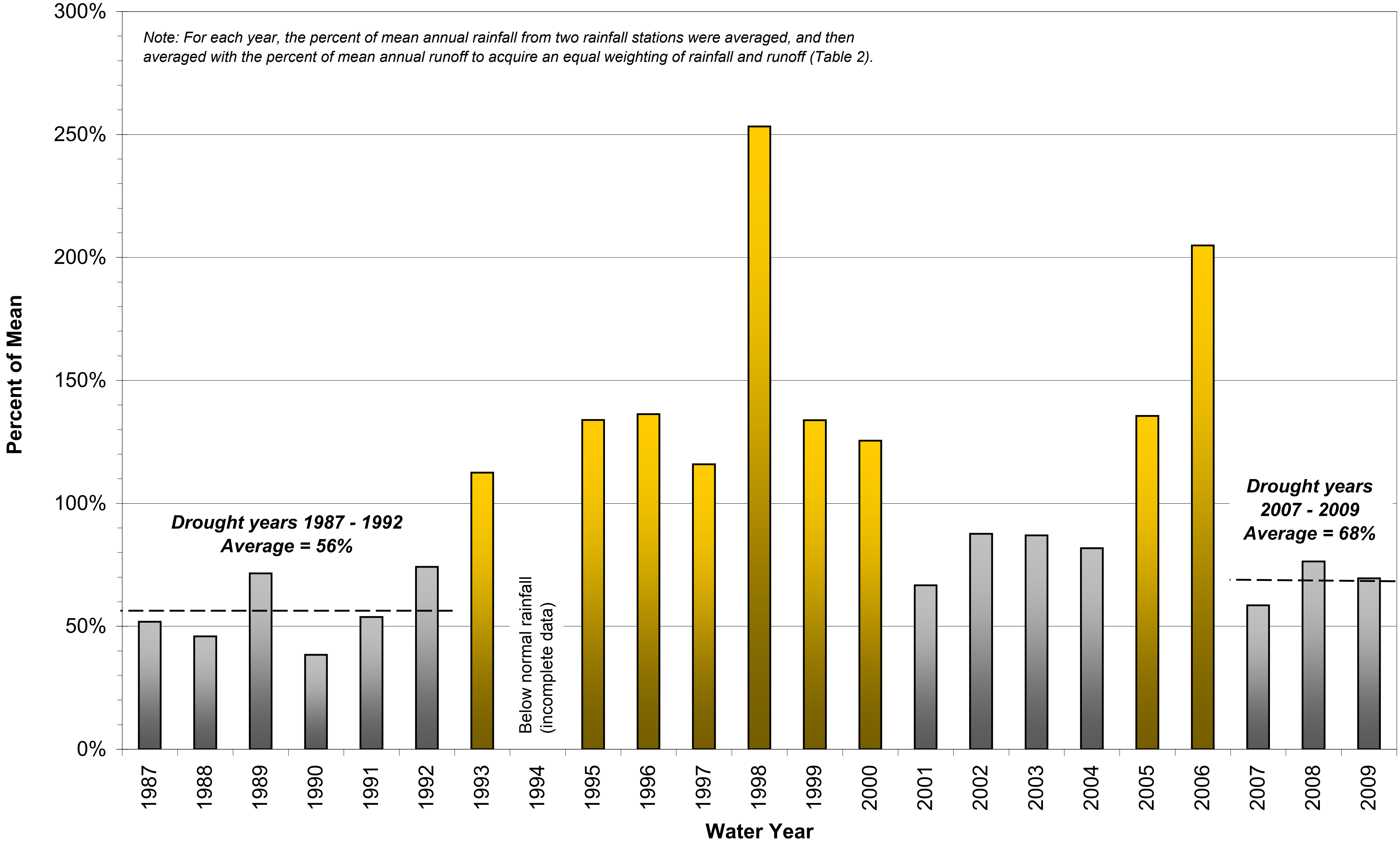
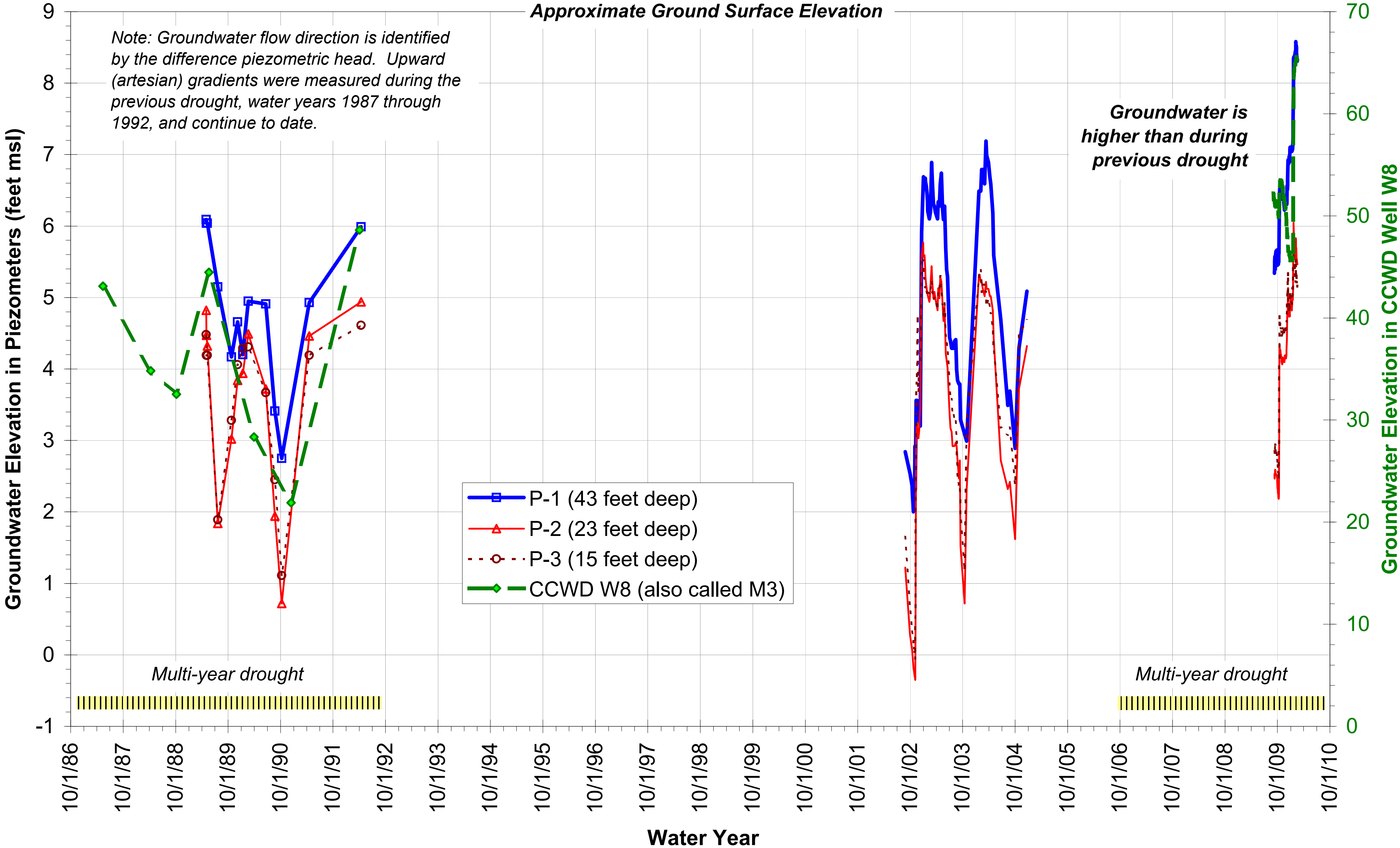


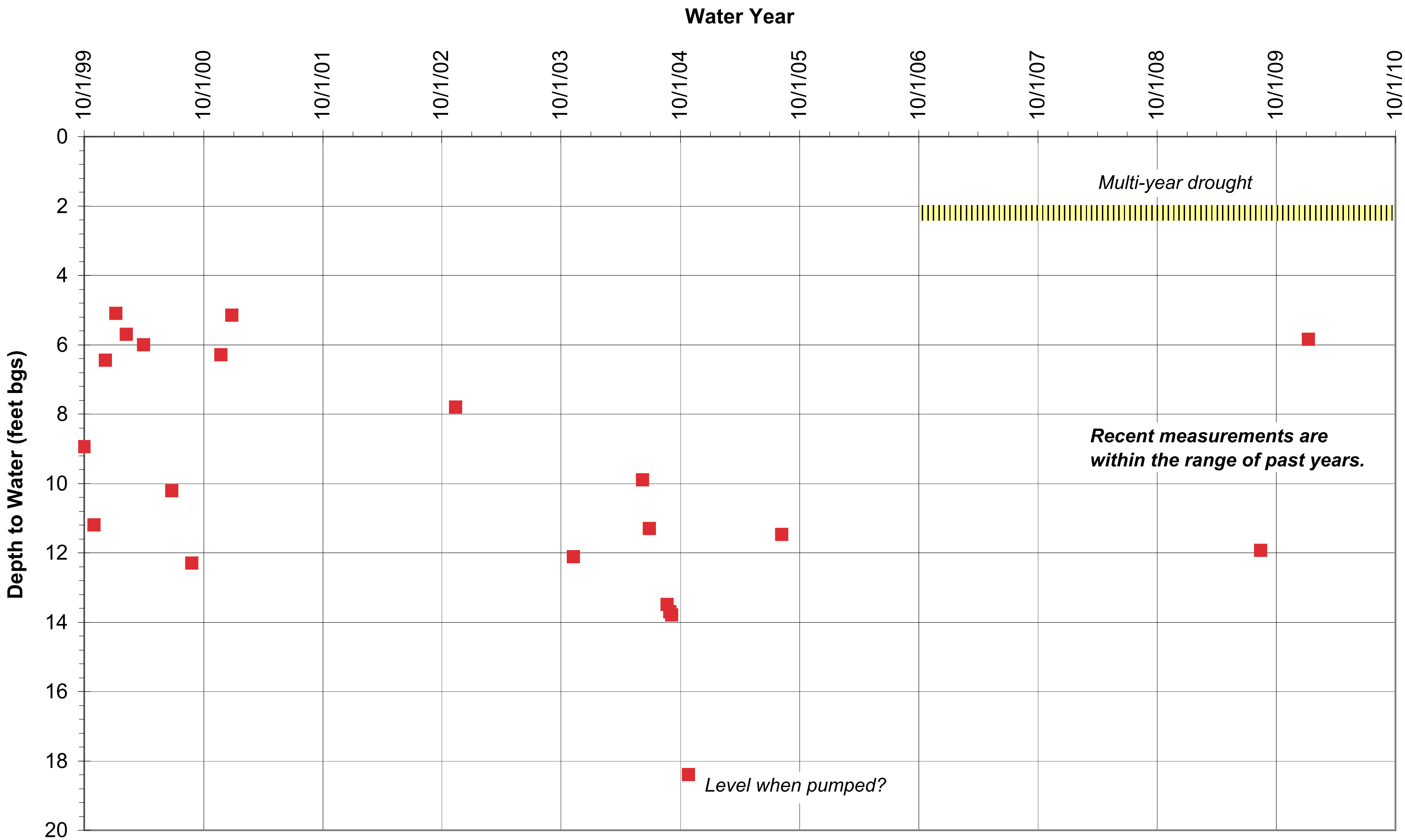
Figure 15. Average percent of mean rainfall and runoff, water years 1997 to 2009, Midcoast Groundwater Study Phase III, San Mateo County, California. Data source: NOAA NCDC Station 43714 at Half Moon Bay, 1948 to present; Montara Water and Sanitary District Alta Vista water treatment and storage facility, Montara, CA, 2001 to present; USGS Station 11162630 Pilarcitos Creek at Half Moon Bay, 1967 to present. Below normal years shaded in grey.

PillarPoint_SWL(6-9-10).xls, Chart2 (2), 6/9/2010



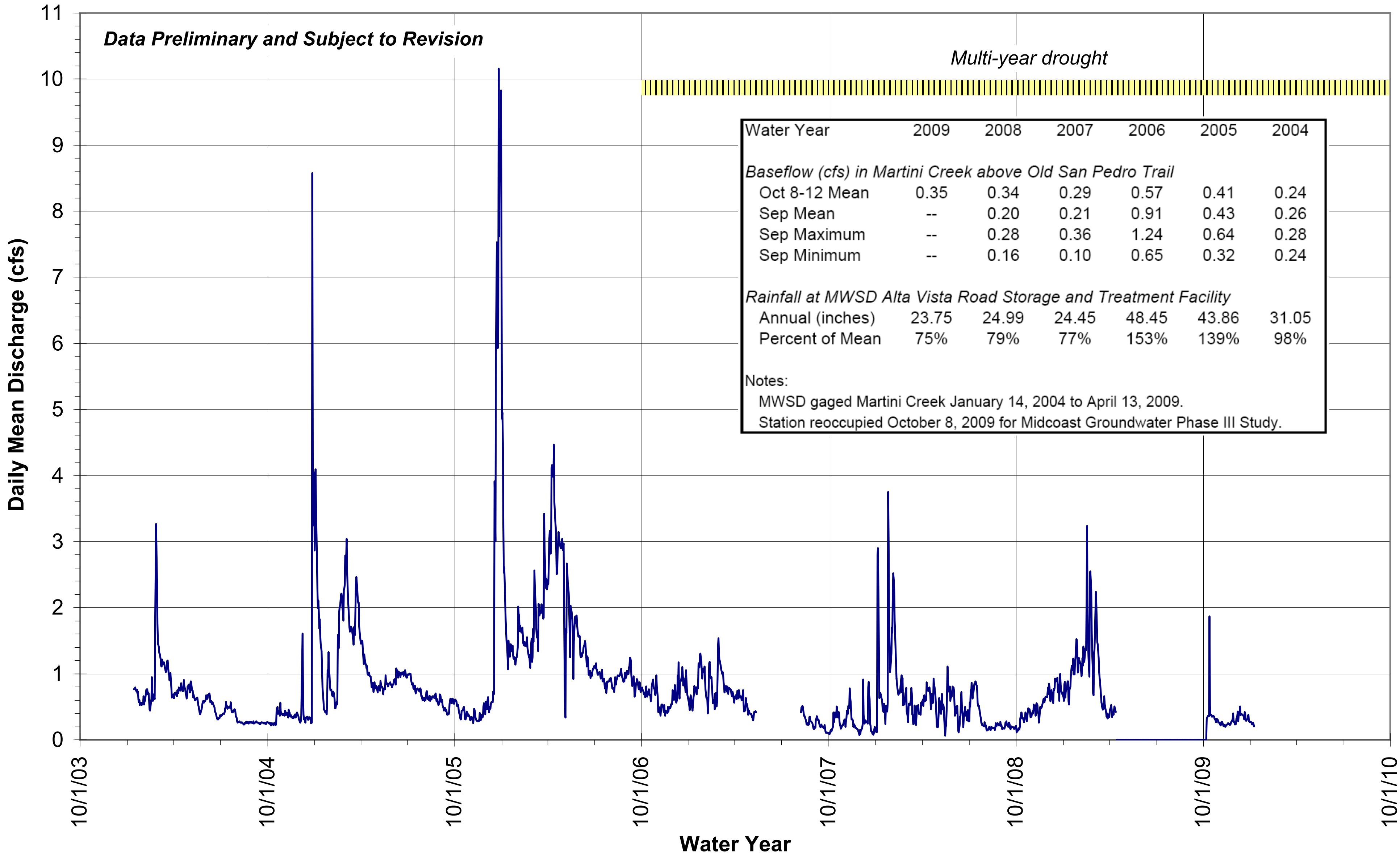
Balance Hydrologics, Inc.®

Figure 16. Comparison of water levels measured in the Airport Aquifer, water years 1997 to 2010, San Mateo County, California. The piezometer nest is located at the north end of Pillar Point Marsh along W Point Avenue, and W8 is centrally located, approximately 600 feet northeast of Highway 1. Source of historic data: LSCE & ESA, 1992; Montara Water and Sanitary District (data collected by Cal-Am during water years 2003 to 2005).



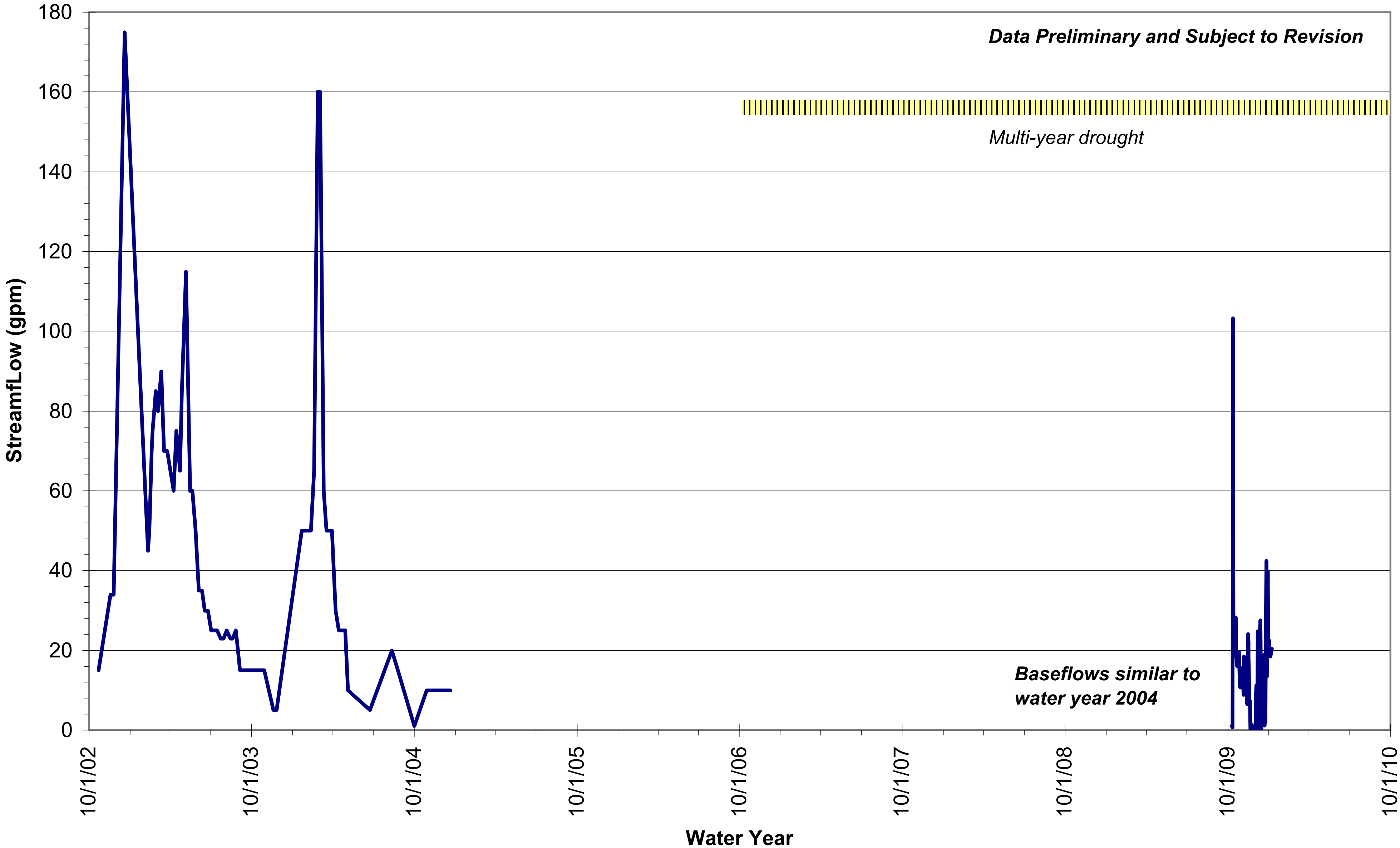
Balance Hydrologics, Inc.®

Figure 17. Water levels measured in inactive well located near Arroyo de en Medio at 464 Third Avenue, Miramar, San Mateo County, California. Source of historic data: Home owner (1999-2005). The well is occasionally used for yard irrigation but not pumped during Phase III study.



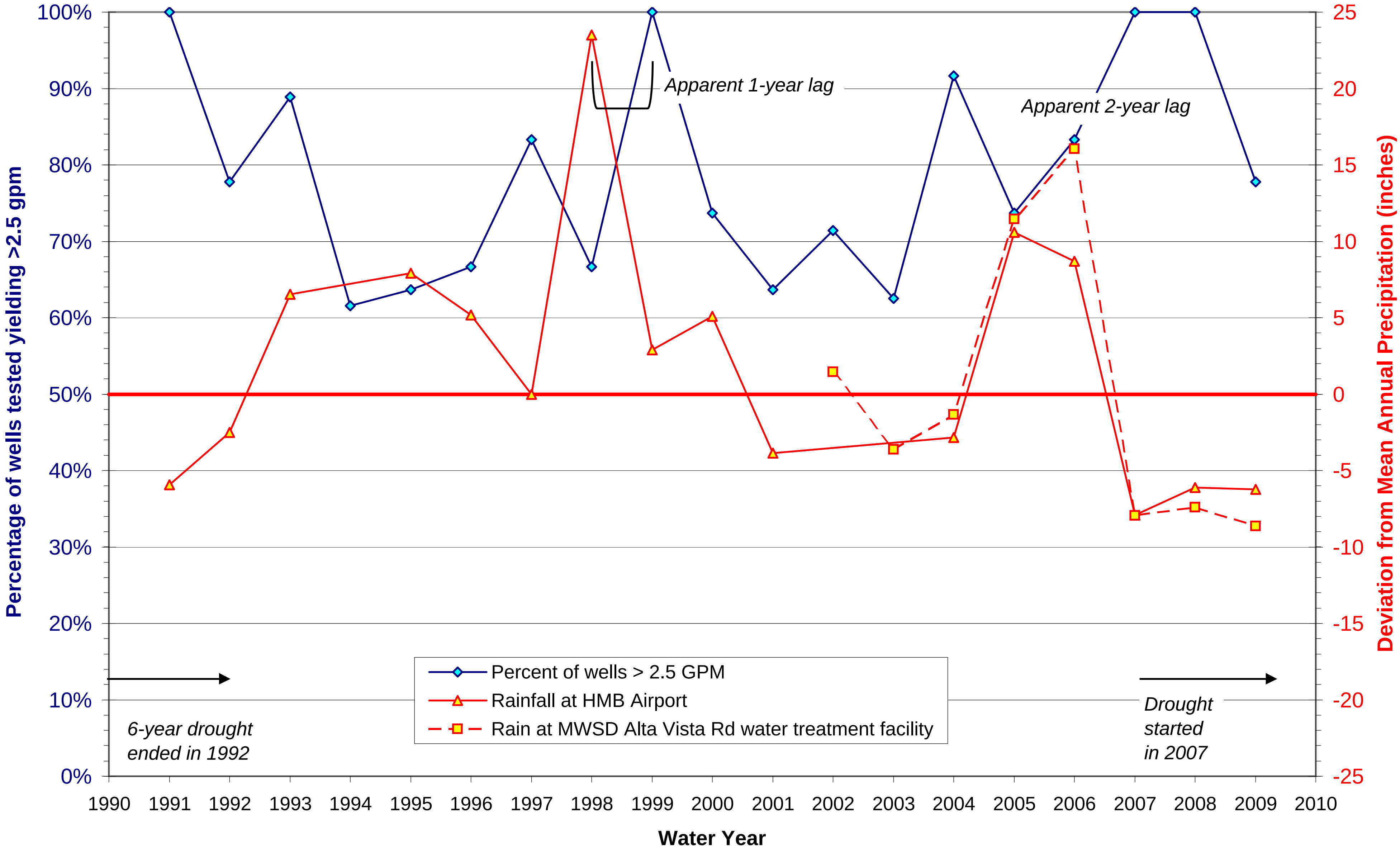
Balance Hydrologics, Inc.®

Figure 18. Martini Creek flow above Old San Pedro Trail, water years 2004 to 2010, San Mateo County, California. Source of historic data: January 14, 2004 to April 13, 2009, Montara Water and Sanitary District.



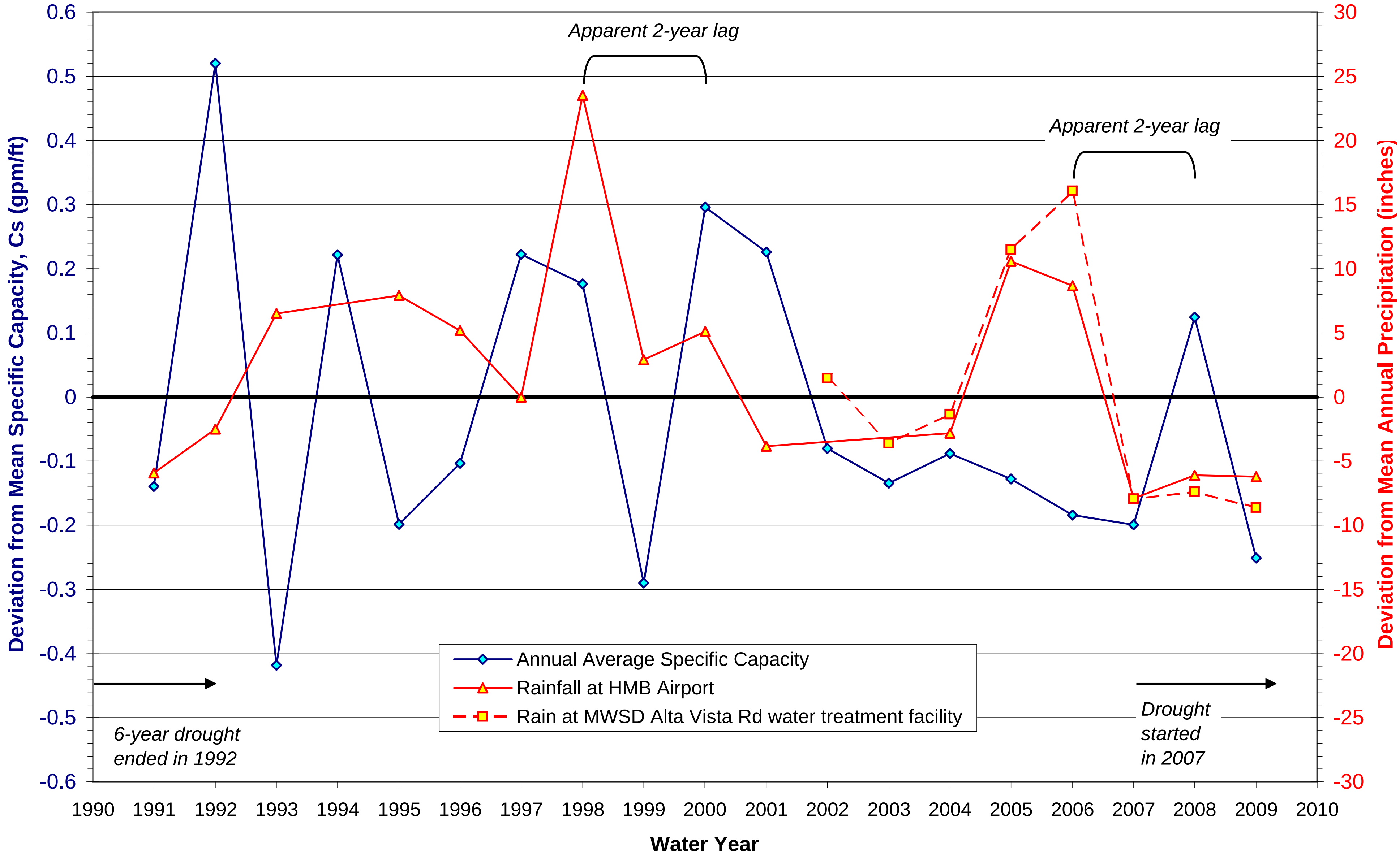
Balance Hydrologics, Inc.®

Figure 19. Montara Creek flow at Point Montara lighthouse old diversion dam, San Mateo County, California. Baseflows were similar to those measured in water years 2002 and 2003, normal to slightly dryer than normal ranfall. Source of historic data: Montara Water and Sanitary District (data collected by CalAm).



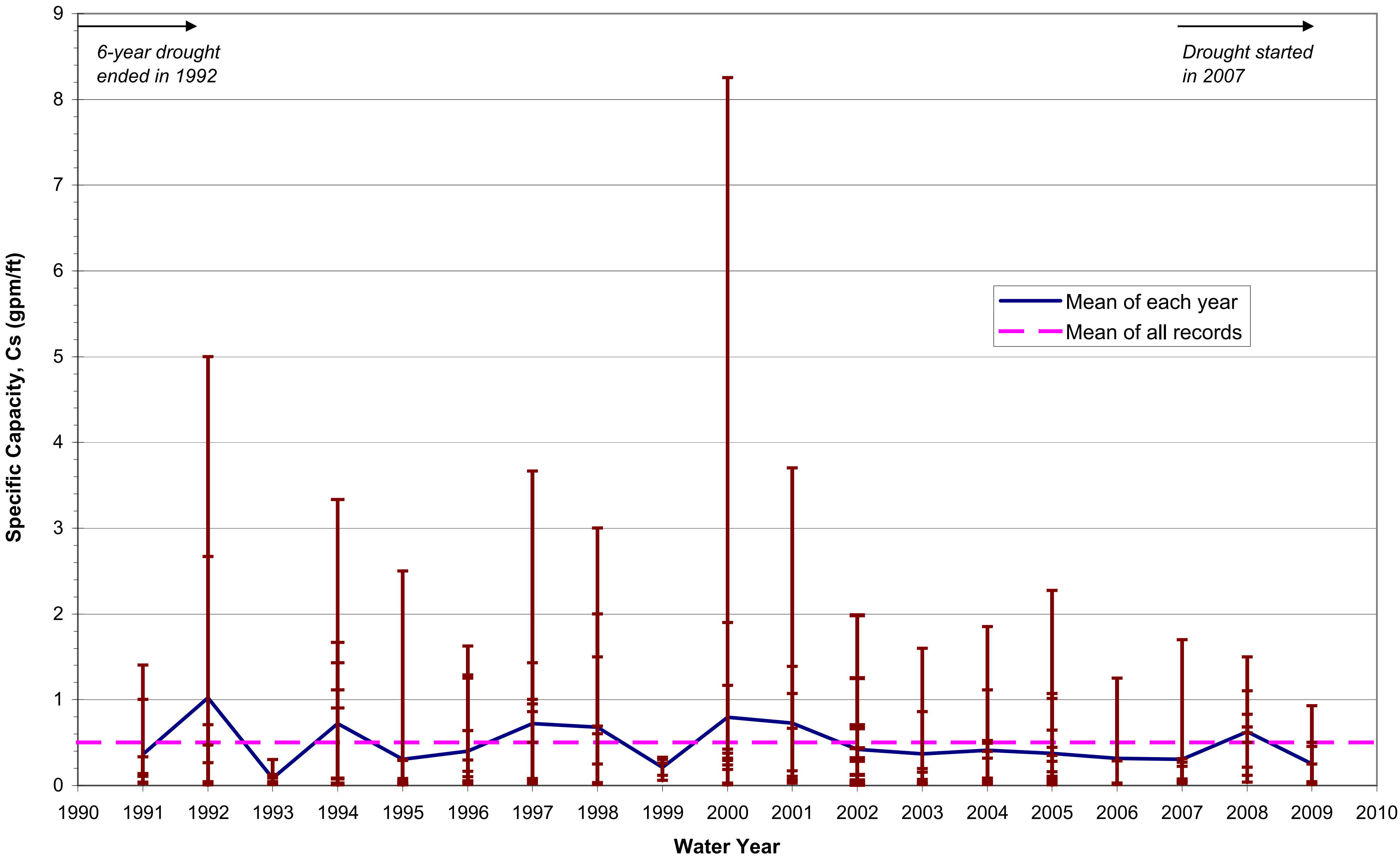
Balance Hydrologics, Inc.®

Figure 20. Comparison of annual precipitation with the percentage of domestic wells tested that yielded greater than 2.5 gallons per minute, Midcoast Groundwater Study Phase III, San Mateo County, California. Data Sources: Simms Plumbing and Water Equipment 205 pump-test records for home resale 1991-2009; NOAA NCDC Station 43714 at Half Moon Bay; Montara Water and Sanitary District.



Balance Hydrologics, Inc.®

Figure 21. Comparison of annual precipitation with specific capacity of domestic wells, Midcoast Groundwater Study Phase III, San Mateo County, California. Data Sources: Simms Plumbing and Water Equipment 205 pump-test records for home resale 1991-2009; NOAA NCDC Station 43714 at Half Moon Bay; Montara Water and Sanitary District.



Balance Hydrologics, Inc.®

Figure 22. Specific capacity of domestic wells tested by year, Midcoast Groundwater Study Phase III, San Mateo County, California. Data Source: Simms Plumbing and Water Equipment 205 pump-test records for home resale 1991-2009.

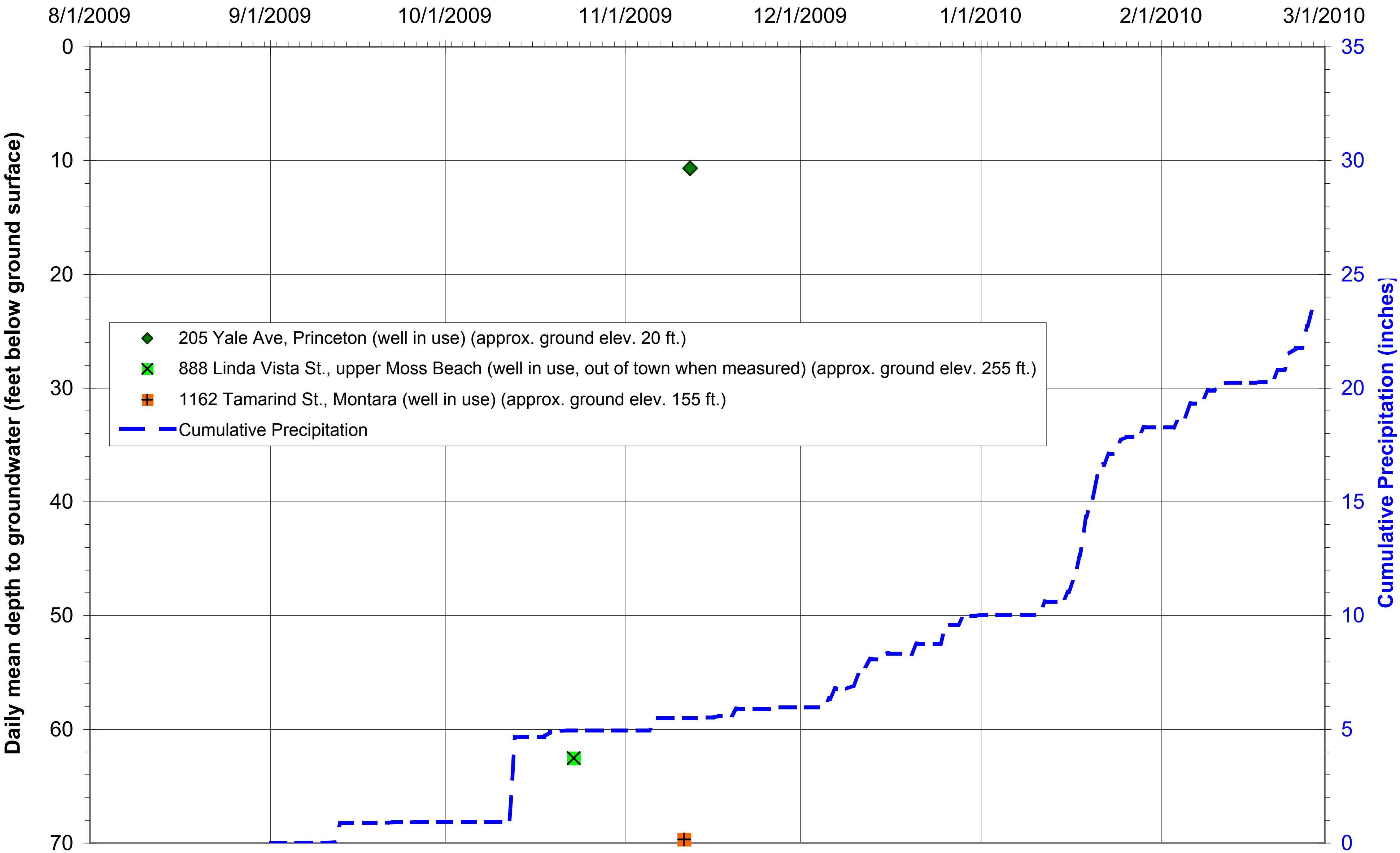
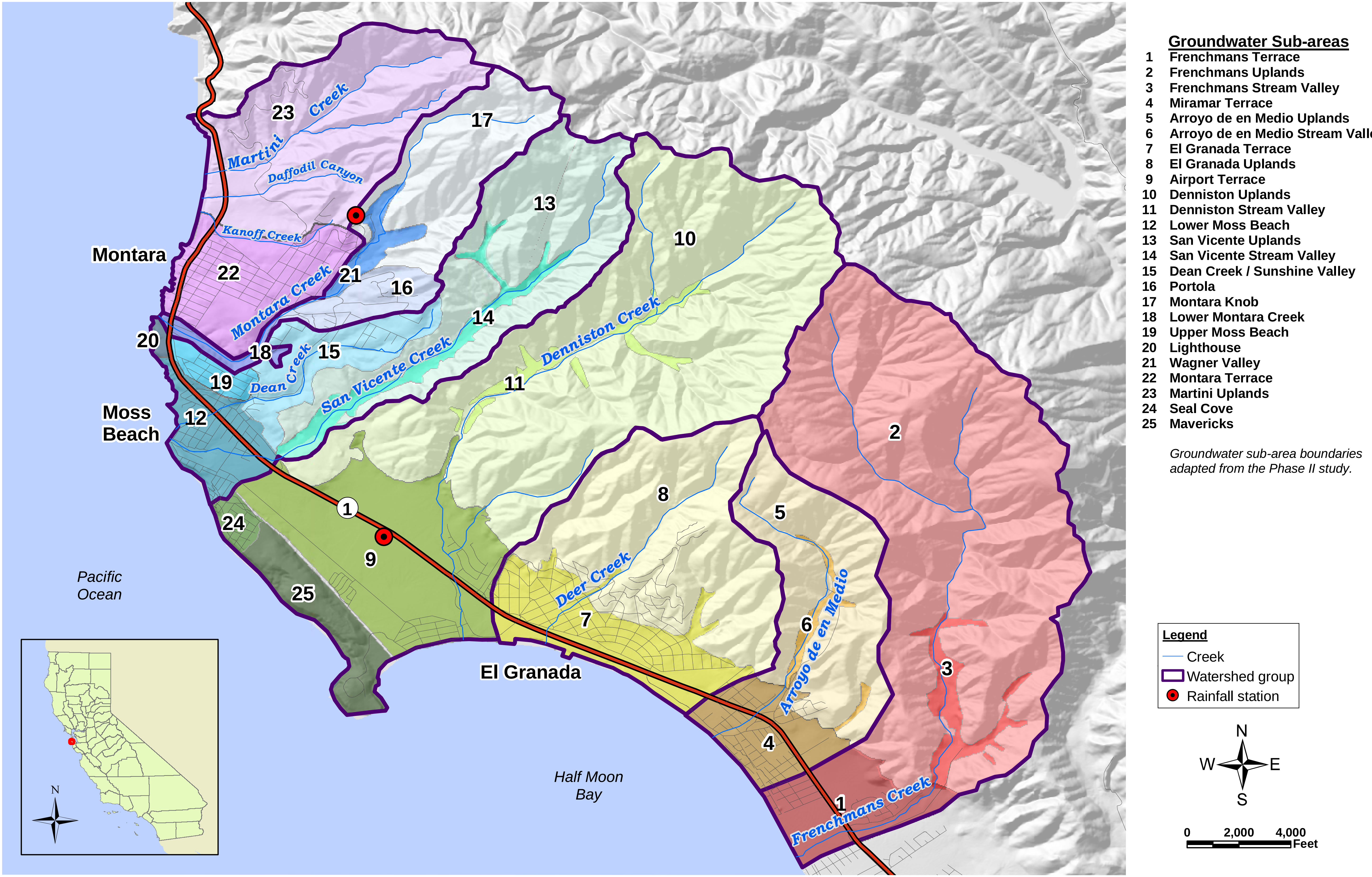


Figure 23. Depth to water in domestic wells in used by resident, Midcoast Groundwater Study Phase III, San Mateo County, California. While looking for unused wells to monitor, a few depth-to-water measurements were taken in wells that were being pumped.

APPENDICES

APPENDIX A

Long-term Monthly Rainfall Records, Midcoast San Mateo County, California



Balance Hydrologics, Inc.

Figure A1: Rainfall stations, Midcoast Groundwater Study Phase III, San Mateo County, California.

209093 figures.mxd

Table A2. Monthly rainfall totals at Half Moon Bay, San Mateo County, California

Latitude N37.4725, Longitude W122.4433, Elevation 27 ft.

NOAA NCDC Station 43714

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL	% of MEAN
1948				0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00	0.00	0.04	incomplete	--
1949	0.55	0.66	4.99	1.73	3.91	4.96	0.00	0.41	0.00	0.00	0.17	0.00 n	17.38	65%
1950	0.00 c	0.00 z	0.00 z	0.00 z	2.24 d	1.34	2.12	0.37	0.14	0.00	0.00	0.08	incomplete	--
1951	1.95	5.46	6.01	5.11	2.98	2.84	0.91	0.98	0.17	0.12	0.00	0.28	26.81	101%
1952	1.16	4.15	11.30	9.31	2.20	6.21	0.62	0.45	1.14	0.03	0.00	0.15	36.72	138%
1953	0.27	2.66	11.36	4.55	0.09 o	0.00 z	3.17 f	0.60	0.56	0.00	0.53	0.12	incomplete	--
1954	0.67	3.33	1.04	4.18	2.58	5.03	1.49	0.06	0.64	0.10	0.55	0.08	19.75	74%
1955	0.23	1.96	4.53	5.06	1.37	0.28	2.50	0.36	0.07	0.17	0.12	0.28	16.93	64%
1956	0.21	2.32	13.81	11.38	2.81	0.00	1.88	1.37	0.07	0.25	0.45	0.45	35	132%
1957	1.75	0.00	0.57	3.31	4.42	5.98	1.65	4.10	0.08	0.00	0.08	1.08	23.02	87%
1958	3.17	1.78	3.88	6.23	10.79	9.38	5.83	0.68	0.71	0.38	0.00	0.18	43.01	162%
1959	0.27	0.50	1.89	5.07	5.64	0.64	0.42	0.36	0.00	0.00	0.21	3.66	18.66	70%
1960	0.40	0.00	1.97	5.29	4.66	1.90	1.27	0.71	0.00	0.00	0.00	0.00	16.2	61%
1961	0.88	5.12	1.70	2.98 a	1.89	3.25	1.06	1.73	0.22	0.00	0.10	0.57	19.5	73%
1962	0.12	3.66	3.18	2.09	8.64	3.52	0.82	0.24	0.00	0.00	0.29	0.51	23.07	87%
1963	10.97	0.60	3.57	3.44	3.65	4.33	5.08	0.64	0.00	0.00	0.03	0.09	32.4	122%
1964	2.48	4.00	1.04	5.32	0.52	2.46	0.23	0.47	0.58	0.00	0.00	0.00	17.1	64%
1965	1.89	3.11	7.50	4.41	1.40	1.58	5.22	0.00	0.06	0.00	0.23	0.00	25.4	96%
1966	0.00	5.58	4.96	3.77	3.51	0.68	0.71	0.20	0.00	0.12	0.27	0.25	20.05	75%
1967	0.00	5.18	3.62	10.44	0.25	6.18	7.43	0.25	1.44	0.00	0.00	0.00	34.79	131%
1968	0.76	2.13	2.89	6.19	2.62	5.78	0.61	0.24	0.00	0.00	0.28	0.00	21.5	81%
1969	0.65	2.69	5.90	8.06	8.68	2.07	2.76	0.06	0.40	0.00	0.00	0.21	31.48	118%
1970	1.73	0.76	4.55	8.49	2.31	2.04	0.32	0.27	0.21	0.00	0.00	0.00	20.68	78%
1971	0.90	8.41	7.67	1.61	0.76	3.49	1.51	0.53	0.08	0.28	0.36	0.40	26	98%
1972	0.23	2.29	5.10	1.27	1.33	0.19	1.25	0.11	0.28	0.00	0.00	0.98	13.03	49%
1973	6.90	6.49	3.17	8.78	7.33	0.00 z	0.23	0.21	0.05	0.00	0.09	0.62	incomplete	--
1974	3.04	9.50	6.32	4.87	2.16	7.20	3.22	0.01	0.50	1.01	0.13	0.00	37.96	143%
1975	1.36	0.64	3.64	2.95	4.88	7.11	2.14	0.10	0.28	0.52	0.59	0.02	24.23	91%
1976	4.49	0.85	0.69	0.52	2.54	1.13	2.04	0.13	0.04	0.14	1.56	0.59	14.72	55%
1977	0.30	1.73	2.41	2.26	1.31	3.15	0.20	1.23	0.00	0.16	0.27	1.59	14.61	55%
1978	0.47	3.37	5.60	9.01	5.62	5.58	4.50	0.00	0.00	0.00	0.00	0.00	34.15	128%
1979	0.05	3.04	0.83	8.11	6.27	4.83	0.89	0.85	0.00	0.29	0.13	0.00	25.29	95%
1980	3.23	3.97	5.76	5.40	7.49	1.90	1.88	0.32	0.03	0.07	0.05	0.18	30.28	114%
1981	0.18	0.65	2.44	7.48	2.42	4.71	0.24	0.33	0.00	0.00	0.42	0.37	19.24	72%
1982	3.98	7.08	6.00	12.01	5.11	7.91	5.02	0.00	0.42	0.00	0.15	1.73	49.41	186%
1983	3.82	7.03	5.41	8.98	9.14 b	13.05 a	3.33	0.89	0.03	0.00	0.14	0.80	52.62	198%
1984	1.12	8.07 b	9.46 a	0.26	2.15	2.12 a	1.09	0.20	0.46	0.06	0.33	0.18	25.50	96%
1985	3.81	9.86	3.20	1.02	2.90	5.07	0.13	0.32	0.47	0.31	0.05	0.40	27.54	104%
1986	1.51	0.00 z	3.18	4.98	11.48	7.12	0.50	0.84	0.09	0.08	0.25	2.20	incomplete	--
1987	0.42	0.32	3.10	5.10	3.87	4.16	0.95	0.06	0.08	0.00	0.10	0.00	18.16	68%
1988	2.13 b	2.63	6.03	4.48	0.58	0.12	3.04	0.69	0.29	0.15 j	0.01	0.02	20.17	76%
1989	0.94	3.55	5.17	2.01	1.30	7.95	1.83	0.31	0.10	0.13 b	0.27 a	0.95 a	24.51	92%
1990	2.05	1.95	0.03	4.29 a	2.52 a	1.33	0.29	2.82	0.46	0.24	0.14	0.33	16.45	62%
1991	0.55	0.74	2.58	0.56	4.19	8.81	0.90	0.67	0.32	0.27	0.92	0.25	20.76	78%
1992	2.63 a	1.01 a	3.60	3.18	8.70	3.45	0.40	0.06	0.84	0.02	0.18	0.12	24.19	91%
1993	2.88	0.67	8.10	9.21 a	5.59	2.79	1.68	1.38	0.48 c	0.06	0.17 f	0.21 c	33.22	125%
1994	0.62 b	1.55 g	2.77 b	2.63 b	5.61 a	0.77 b	1.85 f	1.64 d	0.11	0.13	0.17	0.09	incomplete	--
1995	0.08	5.34 a	3.93	11.38	0.26	8.71	2.35	1.54	0.78	0.05	0.05	0.15	34.62	130%
1996	0.07	0.30	8.25	8.27	7.05	3.34	1.98	2.16	0.13	0.06	0.07	0.20	31.88	120%
1997	1.47	2.71	8.83	9.86	0.29	0.59	0.96	0.44	0.57	0.13	0.77	0.08	26.7	100%
1998	0.77	7.84	3.65	12.13	15.70	2.58	2.73	4.01	0.30	0.18	0.06	0.25	50.2	189%
1999	0.99	3.75	2.12	6.40	7.60	4.82	2.73	0.12	0.46	0.05	0.34	0.21	29.59	111%
2000	0.82	2.94	0.93	7.53	11.27	2.45	3.10	1.72	0.18	0.26	0.19	0.41	31.8	120%
2001	3.74	1.30	0.69	5.75	6.44	1.67	2.19	0.02 n	0.12 b	0.28	0.39	0.26	22.85	86%
2002	0.47	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.18 a	0.21 c	0.17 b	incomplete	--
2003	0.17 f	2.70 d	9.00 m	1.34 e	3.46 j	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.00 z	0.25 d	incomplete	--
2004	0.22	2.27 a	8.81	3.33	6.37	1.39	0.31	0.15	0.05	0.34	0.33 a	0.29	23.86	90%
2005	4.60	1.38	8.66 a	6.11	5.28	5.52	1.69	2.32	1.31	0.23	0.04	0.15	37.29	140%
2006	0.57	1.89	9.94	4.68	2.64	9.50	5.37	0.50	0.07	0.15	0.00	0.07	35.38	133%
2007	0.54	2.38	4.26	1.43	6.03	0.91	1.96	0.46	0.1	0.38	0.06	0.27	18.78	71%
2008	2.17	1.08	3.72	8.64	3.62	0.35	0.17	0.11	0.08	0.17	0.23	0.07	20.41	77%
2009	0.42	2.66	2.65	1.17	8.76	2.66	0.41	1.39	0.15	0.21			20.48	77%
2010														
Mean	1.58	3.12	4.64	5.35	4.55	3.84	1.86	0.74	0.27	0.13	0.21	0.38	26.58	100%
Cumulative	1.58	4.70	9.34	14.68	19.23	23.07	24.93	25.68	25.95	26.08	26.29	26.67	--	--
Maximum	10.97	9.86	13.81	12.13	15.70	13.05	7.43	4.10	1.44	1.01	1.56	3.66	52.62	--
Minimum	0.00	0.00	0.03	0.26	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.03	--
Sta. Dev.	1.909	2.494	3.043	3.199	3.295	2.907	1.667	0.895	0.329	0.171	0.267	0.611	9.218	--
Skew	2.604	1.071	0.878	0.379	1.037	0.866	1.366	2.189	1.767	2.680	2.804	3.482	0.994	--
Kurtosis	9.493	0.447	0.495	-0.736	1.111	0.462	1.628	5.237	3.230	11.054	10.972	14.724	0.729	--
Sample Size	60	57	58	59	58	57	57	58	59	60	59	60	54	53

Notes: a = 1 day missing, b = 2 days missing, c = 3 days, ..etc.., z = 26 or more days missing

Individual months not used for annual or monthly statistics if more than 5 days are missing.

Multi-year droughts highlighted in yellow

Monthly Total Rainfall at Alta Vista Water Treatment and Storage Facility, Montara, CA.

Montara Water and Sanitary District, San Mateo County

Latitude N37°32'54.02", Longitude W122°29'53.33", NAD27, Elevation 475 fee

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL	% of MEAN
2001	--	--	--	4.75	6.65	1.65	2.10	0.00	0.25	0.10	0.15	0.35	incomplete	--
2002	0.60	7.00	14.20	2.70	3.10	3.30	0.80	1.10	0.45	0.30	0.30	0.00	33.85	105%
2003	0.10	0.99	10.70	3.45	2.80	2.25	6.05	1.70	0.25	0.00	0.30	0.20	28.79	89%
2004	0.10	3.65	13.85	4.50	4.20	1.50	0.75	0.80	0.10	0.65	0.90	0.05	31.05	96%
2005	3.86	2.15	10.80	5.40	6.35	6.15	2.85	3.10	2.40	0.30	0.20	0.30	43.86	136%
2006	1.15	3.20	14.20	5.55	4.50	10.70	8.35	0.50	0.00	0.20	0.00	0.10	48.45	151%
2007	0.65	4.50	4.70	1.70	7.50	1.25	2.05	0.80	0.10	0.80	0.05	0.35	24.45	76%
2008	3.25	1.30	4.50	10.97	3.15	0.50	0.30	0.30	0.00	0.20	0.50	0.02	24.99	78%
2009	0.69	2.56	2.44	1.26	9.19	3.22	0.37	2.24	0.19	0.48	0.18	0.93	23.75	74%
2010	4.02	1.02	4.02	8.29	5.32	4.00	3.73	1.68					32.08	100%
Mean	1.60	2.93	8.82	4.86	5.28	3.45	2.74	1.22	0.42	0.34	0.29	0.26	32.36	
Cumulative	1.60	4.53	13.36	18.21	23.49	26.94	29.68	30.90	31.31	31.65	31.94	**32.19**	--	
Maximum	4.02	7.00	14.20	10.97	9.19	10.70	8.35	3.10	2.40	0.80	0.90	0.93	48.45	
Minimum	0.10	0.99	2.44	1.26	2.80	0.50	0.30	0.00	0.00	0.00	0.00	0.00	23.75	
Sta. Dev.	1.625	1.951	4.874	2.974	2.120	3.023	2.658	0.957	0.757	0.260	0.273	0.288	8.653	
Skew	0.772	1.137	-0.097	0.943	0.554	1.755	1.265	0.753	2.807	0.696	1.567	1.785	1.018	
Kurtosis	-1.486	1.268	-2.118	0.760	-0.600	3.341	0.958	0.063	8.118	-0.334	2.816	3.832	0.064	
Sample Size	9	9	9	10	10	10	10	10	9	9	9	9	9	

Notes: WY2001 through WY2008 daily rainfall manually measured each morning at 8:00 by Montara Water and Sanitary District staff.
WY2009 through WY2010 measurements automated with a tipping-bucket rain gage.
Real-time data posted to www.balancehydro.com/mwsd

APPENDIX B

Baseflow Gaging Records, Midcoast San Mateo County, California

Form 1a. Annual Hydrologic Record: Upper Denniston Creek

Water Year:	2009
Stream:	Denniston Creek
Station:	below reservoir
County, State:	San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Approximately 0.64 mile upstream from Highway 1 adjacent Cabrillo Farm buildings
Latitude: 37°31'8.40"N, Longitude: 122°29'22.00"W (WGS84)
Drainage area is 1974 acres or 3.08 square miles.
Regulation: Denniston Reservoir

Period of Record

Gage was installed on 9/10/09 by Balance Hydrologics.
Gaging sponsored by San Mateo County Department of Planning and Building.

Mean Flows

Insufficient record available to complete the calculation of mean daily flow.
Monthly mean flows are presented below.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1												
2												
3												
4												
5												
6												
7												
8												
9												
10											gage installed 9-10-09 →	0.09
11												0.06
12												0.00
13												0.00
14												0.17
15												0.17
16												0.04
17												0.01
18												0.14
19												0.00
20												0.00
21												0.00
22												0.00
23												0.01
24												0.16
25												0.14
26												0.10
27												0.26
28												0.16
29					...							0.08
30					...							0.44
31		...			...		...		...			...
MEAN												0.10
MAX. DAY												0.44
MIN. DAY												0.00
cfs days												2.03
ac-ft												4.02

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

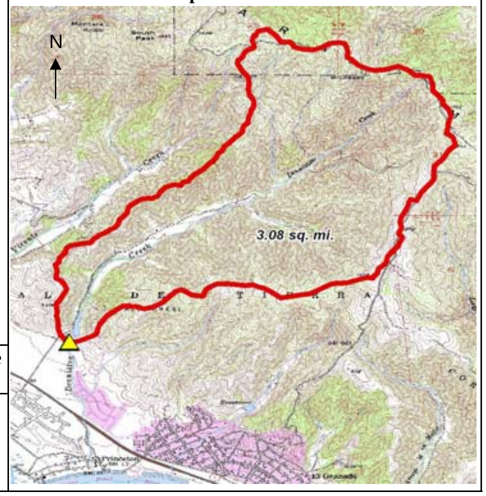
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.44	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 1b. Annual Hydrologic Record: Upper Denniston Creek

Water Year: 2010
Stream: Denniston Creek
Station: below reservoir
County, State: San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Approximately 0.64 mile upstream from Highway 1 adjacent Cabrillo Farm buildings
Latitude: 37°31'8.40"N, Longitude: 122°29'22.00"W (WGS84)
Drainage area is 1974 acres or 3.08 square miles.
Regulation: Denniston Reservoir

Period of Record

Gage was installed on 9/10/09 by Balance Hydrologics.
Preliminary record presenting data available through 1/8/10.
Gaging sponsored by San Mateo County Department of Planning and Building.

Mean Flows

Insufficient record available to complete the calculation of mean daily flow.
Monthly mean flows are presented below.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
10/13/09	13:45	5.36	3.99	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.56	0.58	0.00	0.97								
2	0.09	0.34	0.00	0.92								
3	0.00	0.00	0.20	0.90								
4	0.00	0.34	0.01	0.86								
5	0.78	0.45	0.00	0.84								
6	0.16	0.58	0.02	0.83								
7	0.26	0.65	0.35	0.81								
8	0.20	0.56	0.36	0.79								
9	0.34	0.48	0.62									
10	0.37	0.24	0.72									
11	0.37	0.39	1.21									
12	0.36	0.47	1.25									
13	1.67	0.64	1.08									
14	1.01	0.42	1.03									
15	0.70	0.39	0.90									
16	0.62	0.49	0.36									
17	0.59	0.53	0.34									
18	0.62	0.55	0.80									
19	0.72	0.59	0.79									
20	0.71	0.63	0.77									
21	0.51	0.77	1.17									
22	0.64	0.72	1.18									
23	0.60	0.62	0.90									
24	0.59	0.41	0.83									
25	0.56	0.13	0.81									
26	0.56	0.00	0.78									
27	1.23	0.03	0.95									
28	0.97	0.00	1.03									
29	0.80	0.00	0.96		...							
30	0.32	0.00	0.99		...							
31	0.41	...	1.09		...		...		...			...
MEAN	0.56	0.40	0.69									
MAX. DAY	1.67	0.77	1.25									
MIN. DAY	0.00	0.00	0.00									
cfs days	17.32	11.99	21.48									
ac-ft	34.35	23.79	42.60									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

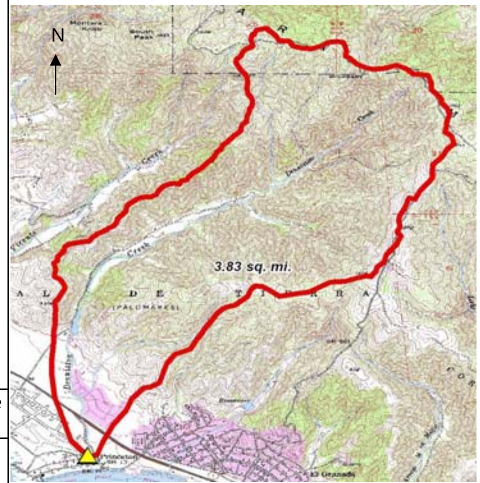
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	1.67	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 2a. Annual Hydrologic Record: Lower Denniston Creek

Water Year:	**2008**
Stream:	Denniston Creek
Station:	at Prospect Way
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Approximately 0.26 mile downstream from Highway 1 behind the Mezza Luna Restaurant located at 459 Prospect Way, Half Moon Bay
Latitude: 37°30'18.50"N, Longitude: 122°29'14.09"W (WGS84)
Drainage area is 2449 acres or 3.83 square miles.
Regulation: Denniston Reservoir, numerous wells between reservoir and gage of unknown construction or duration of operation

Period of Record

Gage was installed on 2/20/08 by Balance Hydrologics.

Mean Flows

Insufficient record available to complete the calculation of mean daily flow.
Monthly mean flows are presented below.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
2/23/08	18:00	1.26	3.87	-	-	-	-
				-	-	-	-
				-	-	-	-
				-	-	-	-

At near by gages peak flows for WY2008 occurred on January 4, or January 25 2008

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1						1.89	0.82	0.51	0.51	0.07	0.02	0.24
2						1.84	0.88	0.52	0.58	0.03	0.02	0.08
3						1.77	0.93	0.63	0.57	0.04	0.29	0.21
4						1.73	0.87	0.62	0.64	0.03	0.14	0.07
5						1.65	0.85	0.59	0.77	0.03	0.07	0.09
6						1.60	0.76	0.49	0.62	0.33	0.02	0.29
7						1.54	0.71	0.51	0.44	0.14	0.41	0.39
8						1.49	0.52	0.57	0.31	0.21	0.46	0.24
9						1.45	0.38	0.55	0.28	0.21	0.56	0.10
10						1.35	0.70	0.52	0.16	0.03	0.62	0.13
11						1.35	0.68	0.53	0.11	0.03	0.63	0.12
12						1.35	0.67	0.57	0.06	0.03	0.62	0.15
13						1.39	0.64	0.41	0.31	0.18	0.60	0.39
14						1.31	0.60	0.15	0.30	0.08	0.56	0.45
15						1.33	0.63	0.37	0.50	0.03	0.50	0.53
16						1.26	0.65	0.46	0.42	0.32	0.34	0.49
17						1.19	0.55	0.29	0.34	0.28	0.55	0.49
18						1.21	0.55	0.37	0.26	0.05	0.58	0.25
19						1.36	0.61	0.47	0.04	0.03	0.30	0.09
20				gage installed 2/20/08 →	1.98	1.30	0.60	0.52	0.03	0.23	0.40	0.10
21					1.93	1.10	0.56	0.57	0.23	0.19	0.35	0.20
22					1.91	1.03	0.66	0.58	0.08	0.09	0.41	0.34
23					2.26	0.94	0.68	0.51	0.13	0.24	0.44	0.21
24					2.46	0.92	0.61	0.39	0.12	0.22	0.60	0.15
25					2.29	0.89	0.54	0.39	0.03	0.10	0.55	0.19
26					2.22	0.82	0.60	0.51	0.31	0.03	0.29	0.16
27					2.14	0.82	0.65	0.42	0.03	0.16	0.29	0.12
28					2.11	0.84	0.59	0.20	0.03	0.21	0.09	0.10
29					2.00	0.90	0.58	0.21	0.21	0.29	0.13	0.13
30					...	0.87	0.58	0.30	0.26	0.03	0.09	0.10
31		...			...	0.81	...	0.49	...	0.22	0.19	...
MEAN						1.27	0.66	0.46	0.29	0.13	0.36	0.22
MAX. DAY						1.89	0.93	0.63	0.77	0.33	0.63	0.53
MIN. DAY						0.81	0.38	0.15	0.03	0.03	0.02	0.07
cfs days						39.32	19.66	14.18	8.69	4.15	11.12	6.60
ac-ft						77.98	39.00	28.12	17.23	8.23	22.06	13.08

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

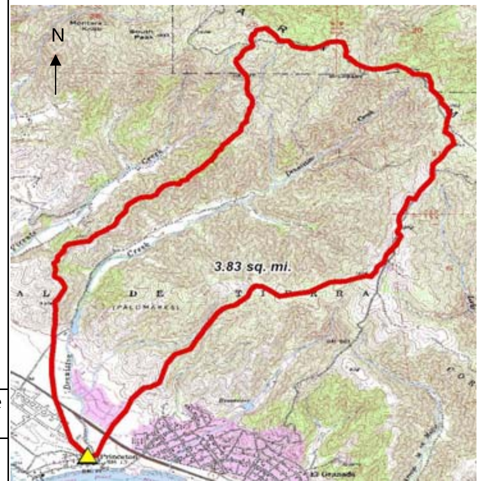
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	1.89	(cfs)
Min. daily discharge	0.02	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 2b. Annual Hydrologic Record: Lower Denniston Creek

Water Year: 2009

Stream: Denniston Creek
Station: at Prospect Way
County, State: San Mateo County, CA
Station Location Map



Station Location / Watershed Descriptors

Approximately 0.26 mile downstream from Highway 1 behind the
Mezza Luna Restaurant located at 459 Prospect Way, Half Moon Bay
Latitude: 37°30'18.50"N, Longitude: 122°29'14.09"W (WGS84)
Drainage area is 2449 acres or 3.83 square miles.
Regulation: Denniston Reservoir, numerous wells between reservoir
and gage of unknown construction or duration of operation

Period of Record

Gage was installed on 2/20/08 by Balance Hydrologics.
Period of record stops on 12-17-09 and starts again on 9-2-09 for reporting purposes.
High flow portion of the record has not been included this preliminary data set.
Gaging sponsored by San Mateo County Resource Conservation District.

Mean Flows

Insufficient record available to complete the calculation of mean daily flow.
Monthly mean flows are presented below.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
2/23/08	18:00	1.26	3.87	-	-	-	-
11/20/08	19:15	1.06	2.51	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.09	1.28	1.67									...
2	0.21	1.20	1.53									0.00
3	0.46	1.02	1.49									0.00
4	0.69	1.09	1.48									0.00
5	0.61	0.93	1.30									0.00
6	0.50	0.79	0.90									0.00
7	0.29	0.76	1.09									0.03
8	0.24	0.76	1.17									0.01
9	0.17	0.82	1.14									0.01
10	0.14	0.76	1.10									0.02
11	0.25	0.74	1.04									0.01
12	0.26	0.72	1.03									0.00
13	0.31	0.71	1.09									0.01
14	0.22	0.72	1.23									0.02
15	0.16	0.96	1.68									0.04
16	0.09	1.09	1.44									0.01
17	0.04	1.12	0.86									0.00
18	0.05	1.22										0.02
19	0.12	1.12										0.00
20	0.24	1.69										0.00
21	0.20	1.54										0.00
22	0.18	1.18										0.00
23	0.11	1.44										0.00
24	0.06	1.55										0.01
25	0.09	1.59										0.02
26	0.15	1.54										0.01
27	0.36	1.63										0.03
28	0.31	1.55										0.03
29	0.45	1.48										0.01
30	0.62	1.48			...							0.23
31	0.73	...			...		...		...			...
MEAN	0.27	1.15										0.02
MAX. DAY	0.73	1.69										0.23
MIN. DAY	0.04	0.71										0.00
cfs days	8.41	34.46										0.54
ac-ft	16.68	68.35										1.07

High flow portion of the record has not been included in this preliminary data set.

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

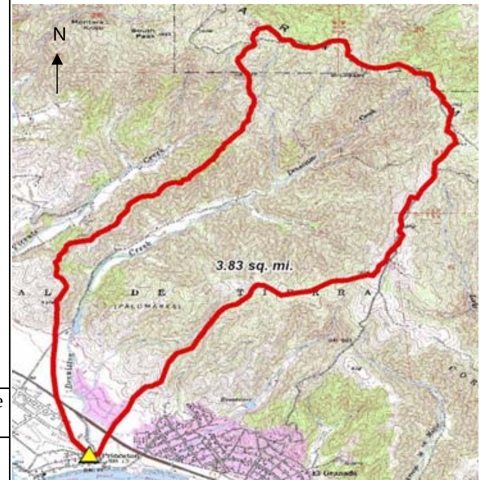
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	1.69	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 2c. Annual Hydrologic Record: Lower Denniston Creek

Water Year:	**2010**
Stream:	Denniston Creek
Station:	at Prospect Way
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Approximately 0.26 mile downstream from Highway 1 behind the Mezza Luna Restaurant located at 459 Prospect Way, Half Moon Bay
Latitude: 37°30'18.50"N, Longitude: 122°29'14.09"W (WGS84)
Drainage area is 2449 acres or 3.83 square miles.
Regulation: Denniston Reservoir, numerous wells between reservoir and gage of unknown construction or duration of operation

Period of Record

Gage was installed on 2/20/08 by Balance Hydrologics.
Preliminary record presenting data available through 1/8/10.
Gaging sponsored by San Mateo County Resource Conservation District.

Mean Flows

Insufficient record available to complete the calculation of mean daily flow.
Monthly mean flows are presented below.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
2/23/08	18:00	1.26	3.87	-	-	-	-
11/20/08	19:15	1.06	2.51	-	-	-	-
10/13/09	14:45	1.54	6.74	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.28	0.56	0.03	0.97								
2	0.01	0.39	0.03	0.92								
3	0.00	0.03	0.04	0.90								
4	0.00	0.20	0.03	0.86								
5	0.54	0.44	0.03	0.84								
6	0.13	0.58	0.03	0.83								
7	0.14	0.62	0.34	0.81								
8	0.11	0.57	0.26	0.79								
9	0.05	0.54	0.54									
10	0.06	0.21	0.61									
11	0.06	0.36	0.92									
12	0.07	0.48	0.89									
13	2.44	0.63	0.95									
14	0.95	0.48	0.84									
15	0.69	0.34	0.72									
16	0.62	0.51	0.39									
17	0.59	0.55	0.06									
18	0.57	0.56	0.67									
19	0.62	0.57	0.72									
20	0.62	0.62	0.68									
21	0.47	0.65	0.97									
22	0.56	0.63	1.17									
23	0.55	0.56	1.02									
24	0.55	0.22	0.98									
25	0.53	0.07	0.96									
26	0.53	0.02	0.99									
27	0.88	0.02	1.10									
28	0.77	0.03	1.02									
29	0.70	0.03	0.99		...							
30	0.39	0.03	1.03		...							
31	0.32	...	1.01		...		...		...			...
MEAN	0.48	0.38	0.65									
MAX. DAY	2.44	0.65	1.17									
MIN. DAY	0.00	0.02	0.03									
cfs days	14.82	11.52	20.02									
ac-ft	29.39	22.85	39.71									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

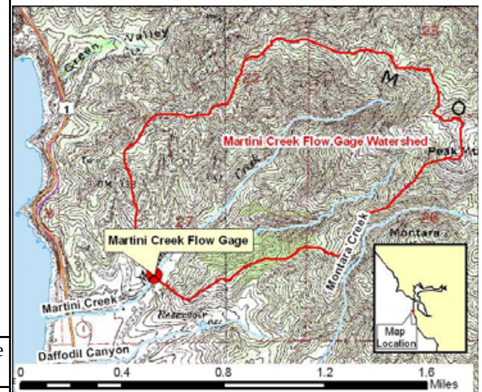
Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	2.44	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 3. Annual Hydrologic Record: Martini Creek

Water Year: 2010
Stream: Martini Creek
Station: above Old San Pedro Road Bridge
County, State: San Mateo County, CA
Station Location Map



Station Location / Watershed Descriptors

Located on right bank 500 feet upstream of Old San Pedro Trail Bridge.
Coordinates: N37.55454 W122.50625, NAD27
Elevation: 110 feet, NGVD 1929
Watershed area above gage: 0.82 square mile

Period of Record

Previous gaging by Montara Water & Sanitary District from 11/18/03 to 4/14/09
Reinstalled on 10/8/09 sponsored by San Mateo County Department of Planning and Building.
Preliminary record presenting data available through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
12/29/03	---- no record ----			12/31/05	5:30	1.53	18.7
2/25/04	22:30	1.26	9.6	2/26/07	16:30	0.66	2.2
12/27/04	6:30	1.66	26.9	10/13/09	16:00	0.89	4.4
12/22/05	14:15	1.50	17.3	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1		0.26	0.26	0.27								
2		0.26	0.23	0.28								
3		0.23	0.25	0.26								
4	gage reinstalled 10/08/09	0.22	0.24	0.23								
5		0.23	0.32	0.24								
6		0.28	0.37	0.26								
7		0.27	0.43	0.24								
8	0.32	0.24	0.28	0.20								
9	0.34	0.21	0.37									
10	0.36	0.21	0.41									
11	0.36	0.22	0.43									
12	0.36	0.22	0.50									
13	1.87	0.20	0.37									
14	0.51	0.20	0.39									
15	0.37	0.23	0.39									
16	0.37	0.23	0.38									
17	0.38	0.23	0.37									
18	0.35	0.26	0.36									
19	0.35	0.25	0.35									
20	0.37	0.24	0.31									
21	0.36	0.25	0.42									
22	0.35	0.23	0.40									
23	0.31	0.23	0.31									
24	0.31	0.24	0.29									
25	0.30	0.28	0.31									
26	0.26	0.28	0.31									
27	0.31	0.31	0.37									
28	0.32	0.40	0.38									
29	0.30	0.29	0.28									
30	0.26	0.27	0.28									
31	0.26	...	0.27		...		...		...			...
MEAN	0.40	0.25	0.34									
MAX. DAY	1.87	0.40	0.50									
MIN. DAY	0.26	0.20	0.23									
cfs days	9.66	7.48	10.63									
ac-ft	19.15	14.83	21.09									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	1.87	(cfs)
Min. daily discharge	0.20	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 4a. Annual Hydrologic Record: Daffodil Canyon

Water Year:	**2009**
Stream:	Daffodill Canyon
Station:	Upper Daffodill Canyon
County, State:	San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Located:	120 feet upstream of Old San Pedro Trail
Coordinates:	N37.55033 W122.5072, NAD27
Elevation:	110 feet, NGVD 1929
Watershed area above gage: 0.20 square mile	

Period of Record

Gaging sponsored by Montara Water & Sanitary District
Gage installed on 11/13/07.
Preliminary record presenting data available 9/1/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1												0.01
2												0.01
3												0.03
4												0.01
5												0.01
6												0.02
7												0.02
8												0.01
9												0.01
10												0.02
11												0.01
12												0.02
13												0.02
14												0.01
15												0.01
16												0.02
17												0.02
18												0.02
19												0.01
20												0.01
21												0.01
22												0.01
23												0.02
24												0.01
25												0.01
26												0.01
27												0.01
28												0.01
29					--							0.01
30					--							0.01
31		--			--		--		--			--
MEAN												0.01
MAX. DAY												0.03
MIN. DAY												0.01
cfs days												0.42
ac-ft												0.83

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

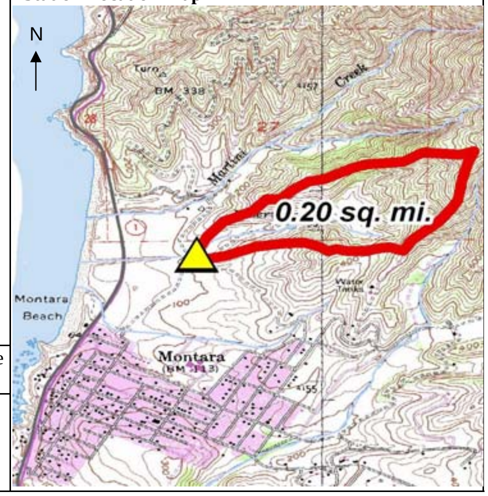
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.03	(cfs)
Min. daily discharge	0.01	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 4b. Annual Hydrologic Record: Daffodil Canyon

Water Year:	**2010**
Stream:	Daffodill Canyon
Station:	Upper Daffodill Canyon
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Located:	120 feet upstream of Old San Pedro Trail
Coordinates:	N37.55033 W122.5072, NAD27
Elevation:	110 feet, NGVD 1929
Watershed area above gage: 0.20 square mile	

Period of Record

Gaging sponsored by Montara Water & Sanitary District
Gage installed on 11/13/07.
Preliminary record presenting data available 9/1/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
10/13/09	13:00	0.58	0.5	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year 2010 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.01	0.03	0.03	0.03								
2	0.01	0.03	0.03	0.03								
3	0.01	0.03	0.03	0.03								
4	0.02	0.02	0.03	0.03								
5	0.02	0.02	0.04	0.03								
6	0.02	0.03	0.04	0.03								
7	0.02	0.03	0.04	0.03								
8	0.02	0.03	0.03	0.03								
9	0.03	0.02	0.03									
10	0.03	0.03	0.04									
11	0.03	0.03	0.04									
12	0.03	0.03	0.04									
13	0.11	0.03	0.03									
14	0.02	0.03	0.03									
15	0.03	0.03	0.03									
16	0.03	0.03	0.03									
17	0.03	0.03	0.03									
18	0.03	0.03	0.03									
19	0.03	0.03	0.03									
20	0.03	0.03	0.03									
21	0.03	0.03	0.04									
22	0.03	0.03	0.03									
23	0.03	0.03	0.03									
24	0.03	0.03	0.03									
25	0.03	0.03	0.03									
26	0.03	0.03	0.03									
27	0.03	0.04	0.03									
28	0.03	0.05	0.03									
29	0.03	0.04	0.03									
30	0.02	0.03	0.03		--							
31	0.03	--	0.03		--		--		--			--
MEAN	0.03	0.03	0.03									
MAX. DAY	0.11	0.05	0.04									
MIN. DAY	0.01	0.02	0.03									
cfs days	0.87	0.89	1.02									
ac-ft	1.72	1.77	2.01									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

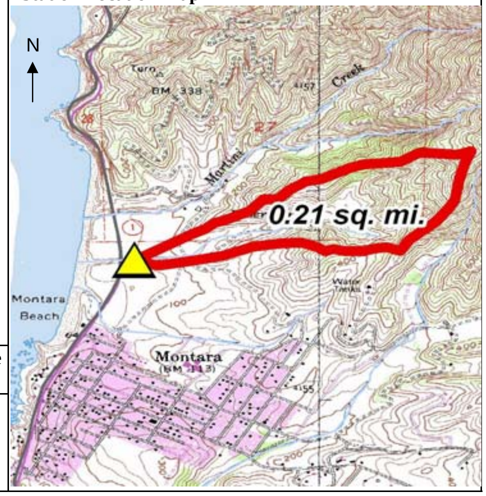
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.11	(cfs)
Min. daily discharge	0.01	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 5a. Annual Hydrologic Record: Daffodil Canyon

Water Year:	**2009**
Stream:	Daffodill Canyon
Station:	Lower Daffodill Canyon
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Located: 200 feet upstream of Highway 1
Coordinates: N37.549948° W122.511180°, WGS84
Elevation: 54 feet NGVD29
Watershed area above gage: 0.21 square mile

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Gage was installed on 9/20/08 by Balance Hydrologics
Preliminary record presenting data available through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												gage installed 9/22/09
19												
20												
21												
22												0.01
23												0.02
24												0.02
25												0.02
26												0.02
27												0.02
28												0.02
29												0.02
30					--							0.02
31		--			--		--		--			--
MEAN												0.02
MAX. DAY												0.02
MIN. DAY												0.01
cfs days												0.19
ac-ft												0.37

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

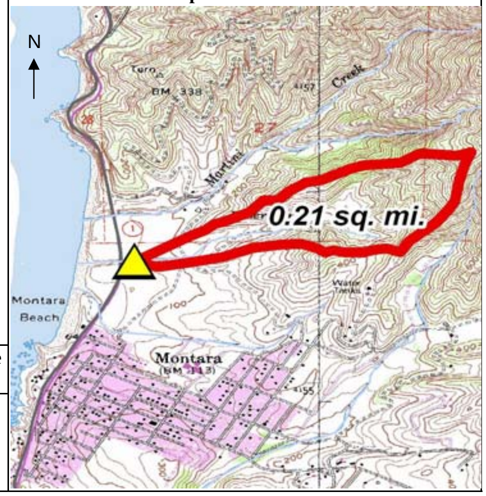
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.02	(cfs)
Min. daily discharge	0.01	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 5b. Annual Hydrologic Record: Daffodil Canyon

Water Year:	**2010**
Stream:	Daffodill Canyon
Station:	Lower Daffodill Canyon
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Located: 200 feet upstream of Highway 1
Coordinates: N37.549948° W122.511180°, WGS84
Elevation: 54 feet NGVD29
Watershed area above gage: 0.21 square mile

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Gage was installed on 9/20/08 by Balance Hydrologics
Preliminary record presenting data available through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.
Preliminary record presenting data available through 1/8/10.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
10/13/2009	12:00	0.90	0.1	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.02	0.03	0.02	0.03								
2	0.02	0.03	0.02	0.04								
3	0.02	0.02	0.02	0.04								
4	0.02	0.02	0.02	0.03								
5	0.02	0.03	0.02	0.03								
6	0.02	0.08	0.03	0.03								
7	0.02	0.07	0.04	0.03								
8	0.01	0.04	0.02	0.03								
9	0.02	0.03	0.03									
10	0.02	0.03	0.03									
11	0.02	0.03	0.03									
12	0.02	0.03	0.04									
13	0.17	0.02	0.03									
14	0.04	0.03	0.03									
15	0.03	0.02	0.02									
16	0.03	0.02	0.03									
17	0.03	0.02	0.03									
18	0.02	0.03	0.03									
19	0.03	0.03	0.03									
20	0.03	0.03	0.02									
21	0.03	0.03	0.04									
22	0.03	0.03	0.04									
23	0.03	0.03	0.03									
24	0.03	0.03	0.03									
25	0.03	0.03	0.03									
26	0.03	0.03	0.04									
27	0.03	0.03	0.06									
28	0.03	0.03	0.06									
29	0.03	0.03	0.05		--							
30	0.02	0.03	0.07		--							
31	0.02	--	0.05		--		--		--			--
MEAN	0.03	0.03	0.03	0.03								
MAX. DAY	0.17	0.08	0.07	0.04								
MIN. DAY	0.01	0.02	0.02	0.03								
cfs days	0.91	0.95	1.04	0.27								
ac-ft	1.80	1.88	2.07	0.53								

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

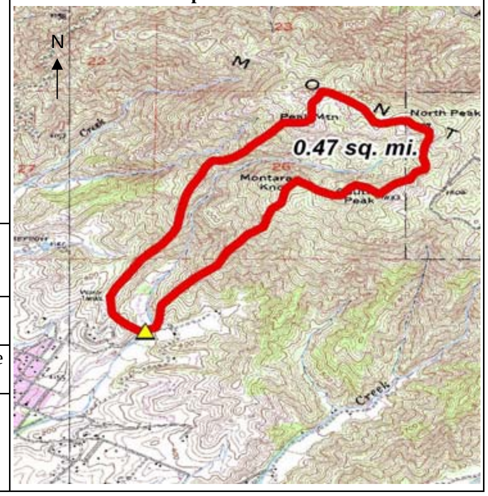
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.17	(cfs)
Min. daily discharge	0.01	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 6a. Annual Hydrologic Record: Montara Creek

Water Year: 2009
Stream: Montara Creek
Station: At Riviera Road
County, State: San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Located:	Downstream side of the Riviera Road crossing of Montra Creek
Coordinates:	N37.5456 W122.495, NAD27
Elevation:	296 feet, NGVD 1929
Watershed area above gage: 0.47 square miles	

Period of Record

Gaging sponsored by Montara Water & Sanitary District
Gage installed on 9/27/07.
Preliminary record presenting data available 9/1/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1												0.00
2												0.00
3												0.00
4												0.00
5												0.00
6												0.00
7												0.00
8												0.00
9												0.00
10												0.00
11												0.00
12												0.00
13												0.00
14												0.00
15												0.00
16												0.00
17												0.00
18												0.00
19												0.00
20												0.00
21												0.00
22												0.00
23												0.00
24												0.00
25												0.00
26												0.00
27												0.00
28												0.00
29					--							0.00
30					--							0.00
31		--			--		--		--			--
MEAN												0.00
MAX. DAY												0.00
MIN. DAY												0.00
cfs days												0.00
ac-ft												0.00

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.00	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 6b. Annual Hydrologic Record: Montara Creek

Water Year:	**2010**
Stream:	Montara Creek
Station:	At Riviera Road
County, State:	San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Located:	Downstream side of the Riviera Road crossing of Montra Creek
Coordinates:	N37.5456 W122.495, NAD27
Elevation:	296 feet, NGVD 1929
Watershed area above gage: 0.47 square miles	

Period of Record

Gaging sponsored by Montara Water & Sanitary District
Gage installed on 9/27/07.
Preliminary record presenting data available 9/1/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.00	0.00	0.00	0.00								
2	0.00	0.00	0.00	0.00								
3	0.00	0.00	0.00	0.00								
4	0.00	0.00	0.00	0.00								
5	0.00	0.00	0.00	0.00								
6	0.00	0.00	0.00	0.00								
7	0.00	0.00	0.00	0.00								
8	0.00	0.00	0.00	0.00								
9	0.00	0.00	0.00									
10	0.00	0.00	0.00									
11	0.00	0.00	0.00									
12	0.00	0.00	0.00									
13	0.00	0.00	0.00									
14	0.00	0.00	0.00									
15	0.00	0.00	0.00									
16	0.00	0.00	0.00									
17	0.00	0.00	0.00									
18	0.00	0.00	0.00									
19	0.00	0.00	0.00									
20	0.00	0.00	0.00									
21	0.00	0.00	0.00									
22	0.00	0.00	0.00									
23	0.00	0.00	0.00									
24	0.00	0.00	0.00									
25	0.00	0.00	0.00									
26	0.00	0.00	0.00									
27	0.00	0.00	0.00									
28	0.00	0.00	0.00									
29	0.00	0.00	0.00		--							
30	0.00	0.00	0.00		--							
31	0.00	--	0.00		--		--		--			--
MEAN	0.00	0.00	0.00									
MAX. DAY	0.00	0.00	0.00									
MIN. DAY	0.00	0.00	0.00									
cfs days	0.00	0.00	0.00									
ac-ft	0.00	0.00	0.00									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	0.00	(cfs)
Max. daily discharge	0.00	(cfs)
Min. daily discharge	0.00	(cfs)
Total	0.0	(cfs-days)
Total Volume	0.0	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 7. Annual Hydrologic Record: Montara Creek

Water Year:	**2010**
Stream:	Montara Creek
Station:	at Point Montara Lighthouse
County, State:	San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Located:	upstream of unused diversion dam accessed by trail from lighthouse
Coordinates:	N37.537022° W122.518696°, WGS84
Elevation:	24 feet NGVD29
Watershed area above gage: 1.62 square miles	

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Installed on 10/09/09 by Balance Hydrologics
Preliminary record presenting data available through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
10/13/2010	10:15	0.85	0.73	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1		0.03	0.00	0.05								
2		0.03	0.00	0.05								
3		0.03	0.02	0.04								
4		0.03	0.02	0.04								
5	gage installed 10/09/09	0.02	0.01	0.04								
6		0.04	0.01	0.04								
7		0.02	0.06	0.04								
8		0.02	0.00	0.05								
9	0.00	0.02	0.00									
10	0.00	0.02	0.00									
11	0.00	0.02	0.04									
12	0.00	0.02	0.06									
13	0.23	0.01	0.06									
14	0.06	0.02	0.03									
15	0.06	0.05	0.00									
16	0.06	0.05	0.02									
17	0.05	0.04	0.00									
18	0.04	0.03	0.01									
19	0.06	0.01	0.00									
20	0.04	0.02	0.01									
21	0.04	0.00	0.04									
22	0.04	0.00	0.00									
23	0.04	0.00	0.01									
24	0.04	0.00	0.02									
25	0.04	0.00	0.00									
26	0.04	0.00	0.06									
27	0.03	0.00	0.09									
28	0.02	0.00	0.03									
29	0.02	0.00	0.05		--							
30	0.03	0.00	0.09		--							
31	0.03	--	0.05		--		--		--			--
MEAN	0.04	0.02	0.03									
MAX. DAY	0.23	0.05	0.09									
MIN. DAY	0.00	0.00	0.00									
cfs days	0.99	0.54	0.82									
ac-ft	1.96	1.08	1.63									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

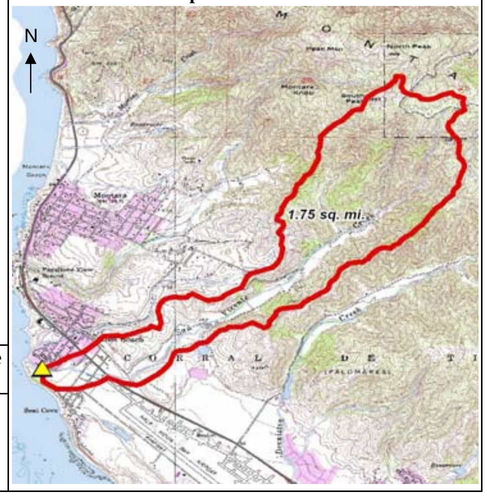
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.23	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 8. Annual Hydrologic Record: Montara Creek

Water Year:	**2010**
Stream:	San Vicente Creek
Station:	Fitzgerald Marine Reserve
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Located: at pedestrian bridge at end of California Avenue, Moss Beach
Coordinates: N37.523444°, W122.515764°, WGS84
Elevation: 28 feet NGVD29
Watershed area above gage: 1.75 square miles

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Installed on 10/12/09 by Balance Hydrologics
Preliminary record presenting data available through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year 2010 Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1		0.00	0.00	0.00								
2		0.00	0.00	0.00								
3		0.00	0.00	0.00								
4		0.00	0.00	0.00								
5		0.00	0.00	0.00								
6		0.00	0.00	0.00								
7		0.00	0.00	0.00								
8	gage installed 10/12/09	0.00	0.00	0.00								
9		0.00	0.00									
10		0.00	0.00									
11		0.00	0.00									
12	0.00	0.00	0.00									
13	0.00	0.00	0.00									
14	0.00	0.00	0.00									
15	0.00	0.00	0.00									
16	0.00	0.00	0.00									
17	0.00	0.00	0.00									
18	0.00	0.00	0.00									
19	0.00	0.00	0.00									
20	0.00	0.00	0.00									
21	0.00	0.00	0.00									
22	0.00	0.00	0.00									
23	0.00	0.00	0.00									
24	0.00	0.00	0.00									
25	0.00	0.00	0.00									
26	0.00	0.00	0.00									
27	0.00	0.00	0.00									
28	0.00	0.00	0.00									
29	0.00	0.00	0.00		--							
30	0.00	0.00	0.00		--							
31	0.00	--	0.00		--		--		--			--
MEAN	0.00	0.00	0.00									
MAX. DAY	0.00	0.00	0.00									
MIN. DAY	0.00	0.00	0.00									
cfs days	0.01	0.00	0.02									
ac-ft	0.02	0.00	0.05									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.00	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 9. Annual Hydrologic Record: Montara Creek

Water Year: **2010**
Stream: Arroyo de en Medio
Station: at Third Avenue, Miramar
County, State: San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Located: 60 feet downstream from end of Third St.
Coordinates: N37.494664° W122.456812°, WGS84
Elevation: 57 feet NGVD29
Watershed area above gage: 1.03 square miles

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Installed on 10/08/09 by Balance Hydrologics
Preliminary record presenting data available through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1		0.00	0.00	0.00								
2		0.00	0.00	0.00								
3		0.00	0.00	0.00								
4	gage installed 10/08/09	0.00	0.00	0.00								
5		0.00	0.00	0.00								
6		0.00	0.00	0.00								
7		0.00	0.00	0.00								
8	0.00	0.00	0.00	0.00								
9	0.00	0.00	0.00									
10	0.00	0.00	0.00									
11	0.00	0.00	0.00									
12	0.00	0.00	0.00									
13	0.00	0.00	0.00									
14	0.00	0.00	0.00									
15	0.00	0.00	0.00									
16	0.00	0.00	0.00									
17	0.00	0.00	0.00									
18	0.00	0.00	0.00									
19	0.00	0.00	0.00									
20	0.00	0.00	0.00									
21	0.00	0.00	0.00									
22	0.00	0.00	0.00									
23	0.00	0.00	0.00									
24	0.00	0.00	0.00									
25	0.00	0.00	0.00									
26	0.00	0.00	0.00									
27	0.00	0.00	0.00									
28	0.00	0.00	0.00									
29	0.00	0.00	0.00		--							
30	0.00	0.00	0.00		--							
31	0.00	--	0.00		--		--		--			--
MEAN	0.00	0.00	0.00									
MAX. DAY	0.00	0.00	0.00									
MIN. DAY	0.00	0.00	0.00									
cfs days	0.00	0.00	0.02									
ac-ft	0.00	0.00	0.05									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.00	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 10a. Annual Hydrologic Record: Montara Creek

Water Year:	**2009**
Stream:	Deer Creek
Station:	at Ferdinand Avenue, El Granada
County, State:	San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Located:	900 feet upstream of Ave. Balboa at end of Ferdinand Ave. & Vallejo St.
Coordinates:	N 37.508705° W122.472293°, WGS84
Elevation:	127 feet NGVD29
Watershed area above gage: 0.55 square miles	

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Installed on 9/16/09 by Balance Hydrologics
Preliminary record presenting data available 9/16/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												gage installed 9/16/09
13												
14												
15												
16												0.06
17												0.07
18												0.07
19												0.07
20												0.07
21												0.07
22												0.07
23												0.07
24												0.07
25												0.06
26												0.06
27												0.06
28												0.07
29					--							0.07
30					--							0.07
31		--			--		--		--			--
MEAN												0.07
MAX. DAY												0.07
MIN. DAY												0.06
cfs days												1.00
ac-ft												1.99

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.07	(cfs)
Min. daily discharge	0.06	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 10b. Annual Hydrologic Record: Montara Creek

Water Year:	**2010**
Stream:	Deer Creek
Station:	at Ferdinand Avenue, El Granada
County, State:	San Mateo County, CA

Station Location Map

Station Location / Watershed Descriptors

Located:	900 feet upstream of Ave. Balboa at end of Ferdinand Ave. & Vallejo St.
Coordinates:	N 37.508705° W122.472293°, WGS84
Elevation:	127 feet NGVD29
Watershed area above gage: 0.55 square miles	

Period of Record

Sponsored by San Mateo County Department of Planning and Building.
Installed on 9/16/09 by Balance Hydrologics
Preliminary record presenting data available 9/16/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
10/13/2009	10:45	0.88	0.29	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.07	0.04	0.03	0.04								
2	0.06	0.04	0.03	0.04								
3	0.06	0.04	0.03	0.04								
4	0.06	0.03	0.03	0.04								
5	0.06	0.03	0.03	0.04								
6	0.06	0.03	0.03	0.04								
7	0.06	0.03	0.05	0.04								
8	0.07	0.03	0.04	0.04								
9	0.07	0.02	0.04									
10	0.07	0.03	0.05									
11	0.07	0.03	0.06									
12	0.08	0.03	0.07									
13	0.18	0.03	0.04									
14	0.13	0.02	0.02									
15	0.10	0.02	0.01									
16	0.09	0.02	0.02									
17	0.08	0.02	0.01									
18	0.09	0.02	0.02									
19	0.10	0.02	0.02									
20	0.08	0.02	0.01									
21	0.08	0.02	0.03									
22	0.07	0.02	0.02									
23	0.07	0.02	0.02									
24	0.07	0.02	0.02									
25	0.07	0.02	0.03									
26	0.06	0.02	0.03									
27	0.06	0.03	0.04									
28	0.06	0.03	0.03									
29	0.05	0.03	0.03		--							
30	0.05	0.03	0.04		--							
31	0.05	--	0.03		--		--		--			--
MEAN	0.08	0.03	0.03									
MAX. DAY	0.18	0.04	0.07									
MIN. DAY	0.05	0.02	0.01									
cfs days	2.34	0.80	0.96									
ac-ft	4.64	1.59	1.90									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.18	(cfs)
Min. daily discharge	0.01	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

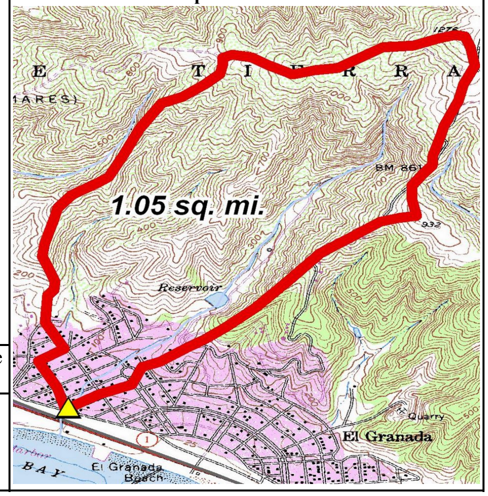
Form 11a. Annual Hydrologic Record: Montara Creek

Water Year:	**2009**
Stream:	Deer Creek
Station:	at Avenue Alhambra, El Granada
County, State:	San Mateo County, CA

Station Location / Watershed Descriptors

Located:	60 feet upstream of Avenue Albambra; behind The Smokehouse
Coordinates:	N 37.504625° W122.477700°, WGS84
Elevation:	52 feet, NGVD29
Watershed area above gage: 1.05 square miles	

Station Location Map



Period of Record

Sponsored by San Mateo County Resource Conservation District.

Preliminary record presenting data available 9/1/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1												0.00
2												0.00
3												0.00
4												0.00
5												0.00
6												0.00
7												0.00
8												0.00
9												0.00
10												0.00
11												0.00
12												0.00
13												0.01
14												0.00
15												0.00
16												0.00
17												0.00
18												0.00
19												0.00
20												0.00
21												0.00
22												0.00
23												0.00
24												0.00
25												0.00
26												0.00
27												0.00
28												0.00
29					--							0.00
30					--							0.00
31		--			--		--		--			--
MEAN												0.00
MAX. DAY												0.01
MIN. DAY												0.00
cfs days												0.01
ac-ft												0.01

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

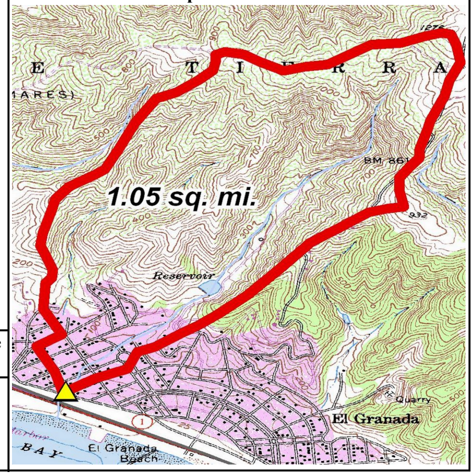
Mean daily discharge	incomplete	(cfs)
Max. daily discharge	0.01	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

Form 11b. Annual Hydrologic Record: Montara Creek

Water Year:	**2010**
Stream:	Deer Creek
Station:	at Avenue Alhambra, El Granada
County, State:	San Mateo County, CA

Station Location Map



Station Location / Watershed Descriptors

Located: 60 feet upstream of Avenue Albambra; behind The Smokehouse
Coordinates: N 37.504625° W122.477700°, WGS84
Elevation: 52 feet, NGVD29
Watershed area above gage: 1.05 square miles

Period of Record

Sponsored by San Mateo County Resource Conservation District.

Preliminary record presenting data available 9/1/09 through 1/8/10.

Mean Flows

Mean monthly flows are presented below.
Insufficient record available to complete the calculation of mean daily flow.

Seasonal Peak Flows (period of record)

Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)	Date	Time (24-hr)	Gage Ht. (feet)	Discharge (cfs)
10/13/2009	10:30	4.13	3.0	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Water Year Daily Mean Flow (cubic feet per second)

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT
1	0.00	0.02	0.01	0.01								
2	0.00	0.00	0.02	0.01								
3	0.00	0.01	0.01	0.01								
4	0.00	0.00	0.01	0.01								
5	0.00	0.00	0.02	0.01								
6	0.00	0.06	0.07	0.01								
7	0.00	0.01	0.05	0.01								
8	0.00	0.00	0.01	0.01								
9	0.00	0.00	0.01									
10	0.00	0.00	0.01									
11	0.00	0.00	0.04									
12	0.00	0.00	0.12									
13	1.13	0.00	0.09									
14	0.28	0.00	0.03									
15	0.13	0.00	0.02									
16	0.07	0.00	0.03									
17	0.04	0.00	0.02									
18	0.03	0.00	0.02									
19	0.10	0.00	0.02									
20	0.05	0.04	0.02									
21	0.02	0.01	0.05									
22	0.01	0.02	0.03									
23	0.00	0.01	0.03									
24	0.00	0.00	0.03									
25	0.00	0.00	0.03									
26	0.00	0.00	0.08									
27	0.00	0.03	0.02									
28	0.00	0.02	0.01									
29	0.00	0.00	0.03		--							
30	0.00	0.01	0.02		--							
31	0.01	--	0.01		--		--		--			--
MEAN	0.06	0.01	0.03									
MAX. DAY	1.13	0.06	0.12									
MIN. DAY	0.00	0.00	0.01									
cfs days	1.88	0.26	0.97									
ac-ft	3.73	0.52	1.93									

Monitor's Comments

1. Daily values with more than 2 to 3 significant figures result from electronic calculations no additional precision is implied.
2. Peak flows recorded for the record of flow are estimates based on a preliminary stage discharge rating curve
3. Annual mean, maximum and minimum flows are not presented as a result of an incomplete annual record.

Water Year Summary

Mean daily discharge	incomplete	(cfs)
Max. daily discharge	1.13	(cfs)
Min. daily discharge	0.00	(cfs)
Total	incomplete	(cfs-days)
Total Volume	incomplete	(ac-ft)

Balance Hydrologics, Inc. 224 Walnut Ave., Suite E, Santa Cruz, CA 95060 (831) 457-9900; fax: (831) 457-8800
Balance Hydrologics, Inc. 800 Bancroft Way, Suite 101, Berkeley, CA 94710 (510) 704-1000; fax: (510) 704-1001; www.balancehydro.com

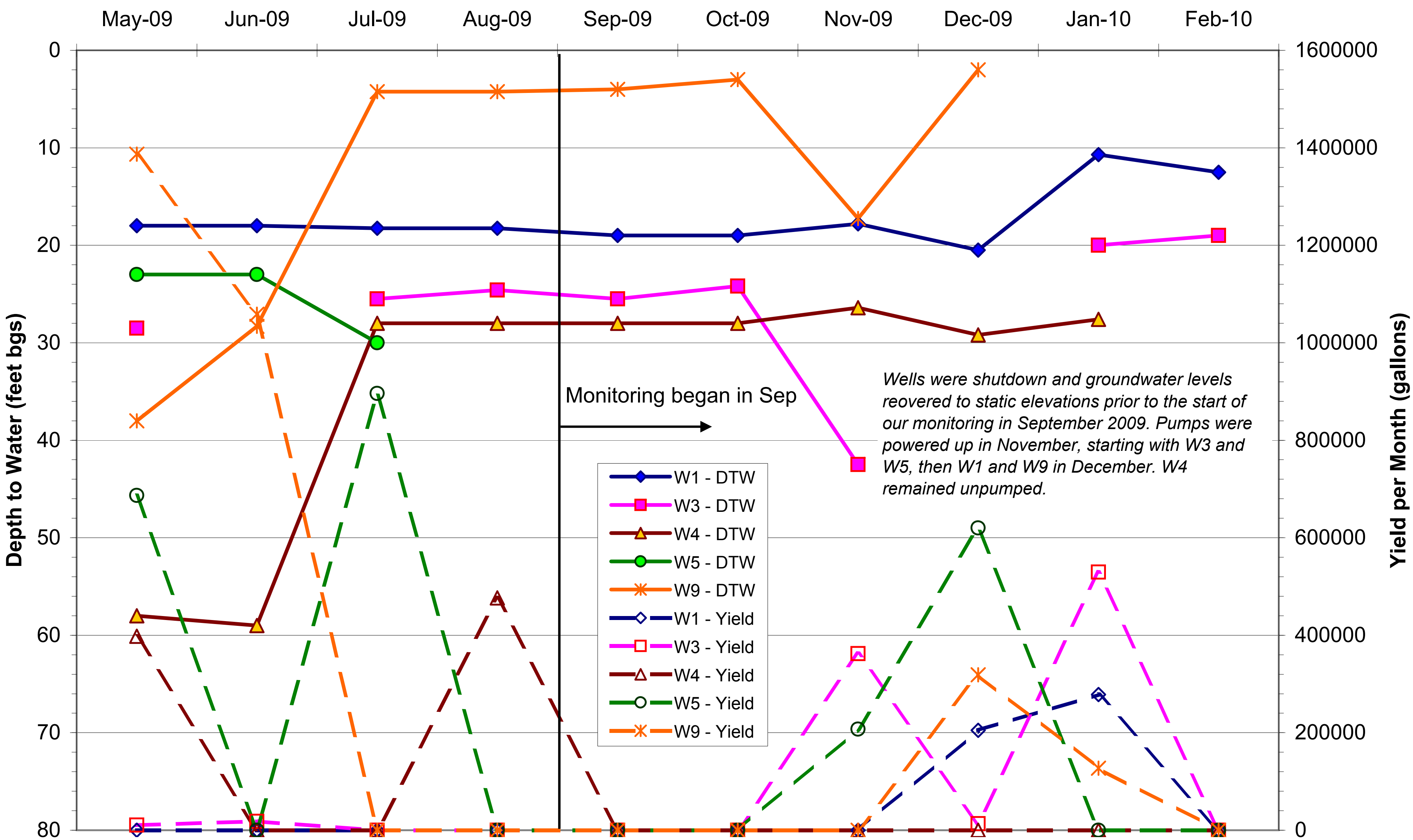
APPENDIX C

Groundwater Levels in MWSD and CCWD wells as far Back as Water Year 2003, Midcoast San Mateo County, California

Balance Hydrologics, Inc.

Figure C1: Active production wells for Montara Water and Sanitary District and Coastside County Water District, Midcoast Groundwater Study Phase III, San Mateo County, California.

209093 figures.mxd



Balance Hydrologics, Inc.®

Figure C2. Water level in CCWD wells and gallons pumped per month, Half Moon Bay Airport Aquifer, San Mateo County, California. Data source: Coastside County Water District.

Well Data from CCWD(3-29-10).xls, Chart1, 3/29/2010

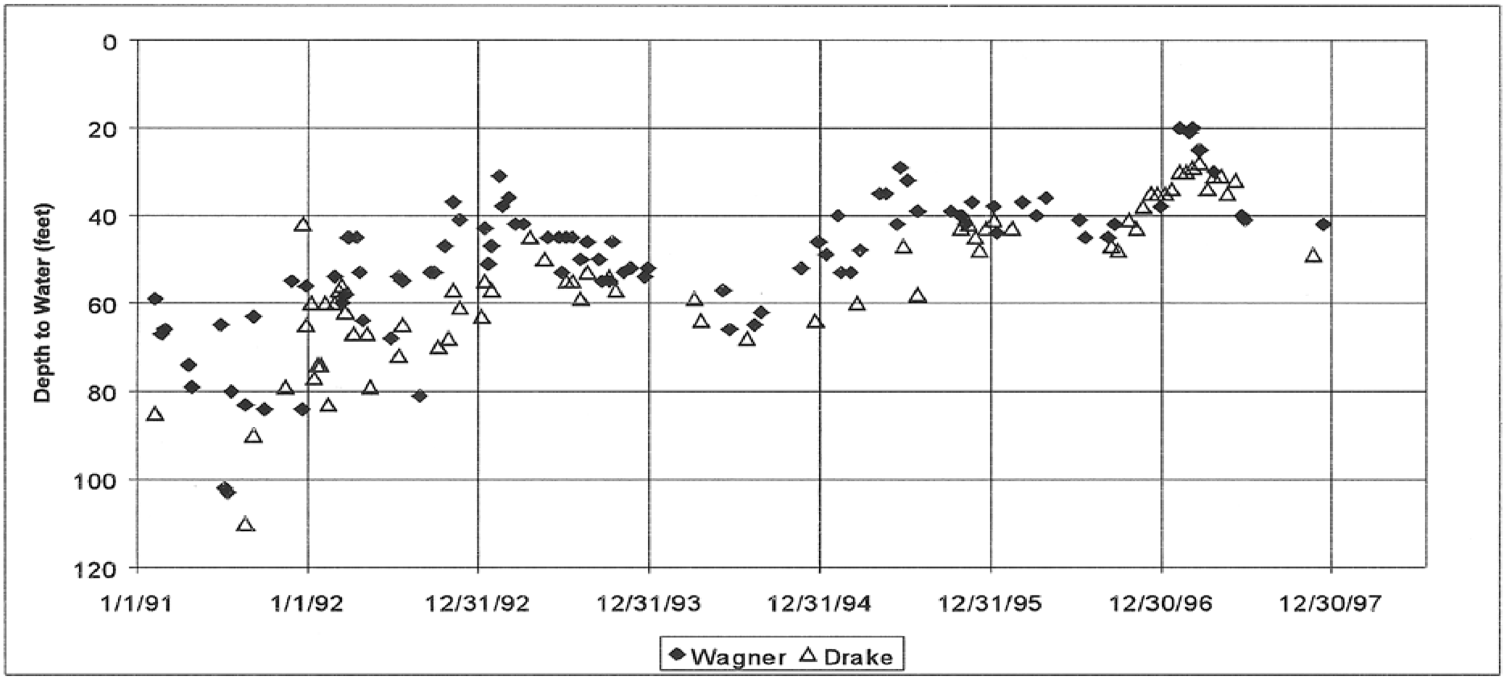


Figure 8
DEPTH TO GROUNDWATER IN CITIZENS UTILITIES WAGNER AND DRAKE PRODUCTION WELLS, MONTARA AREA

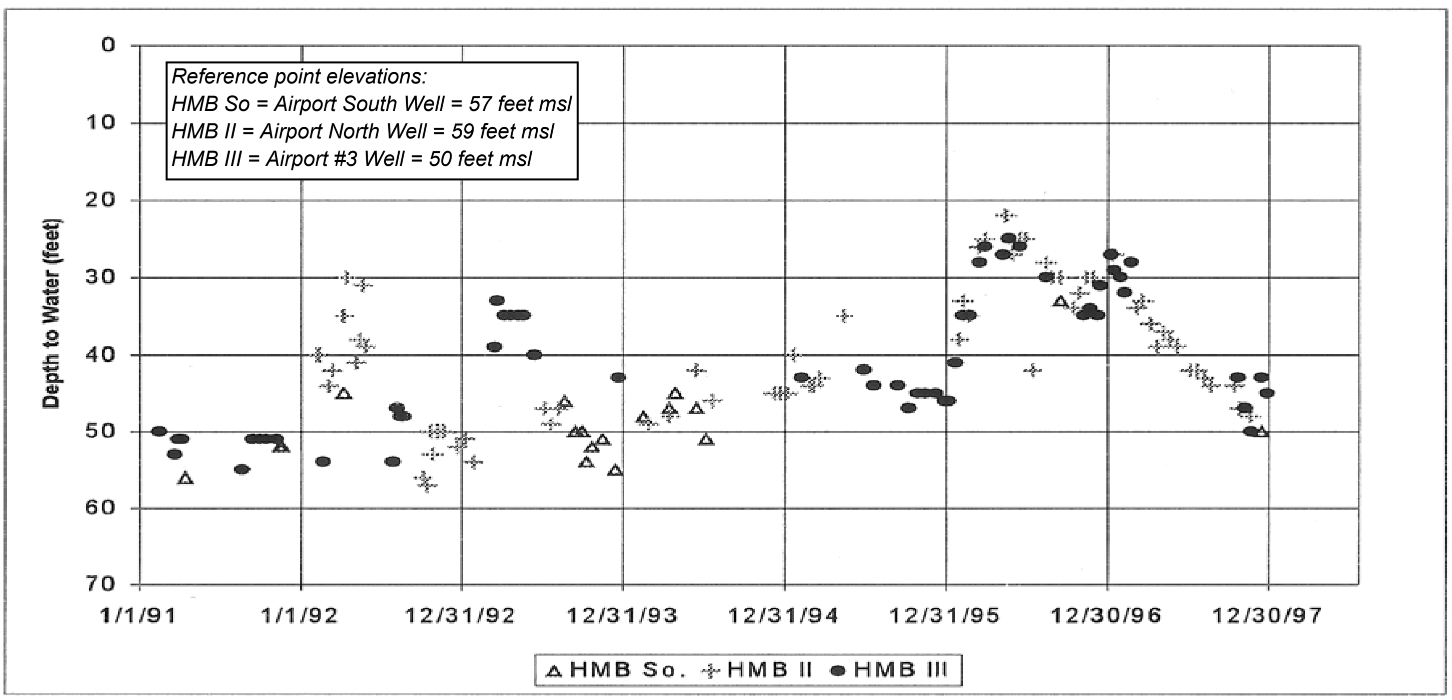
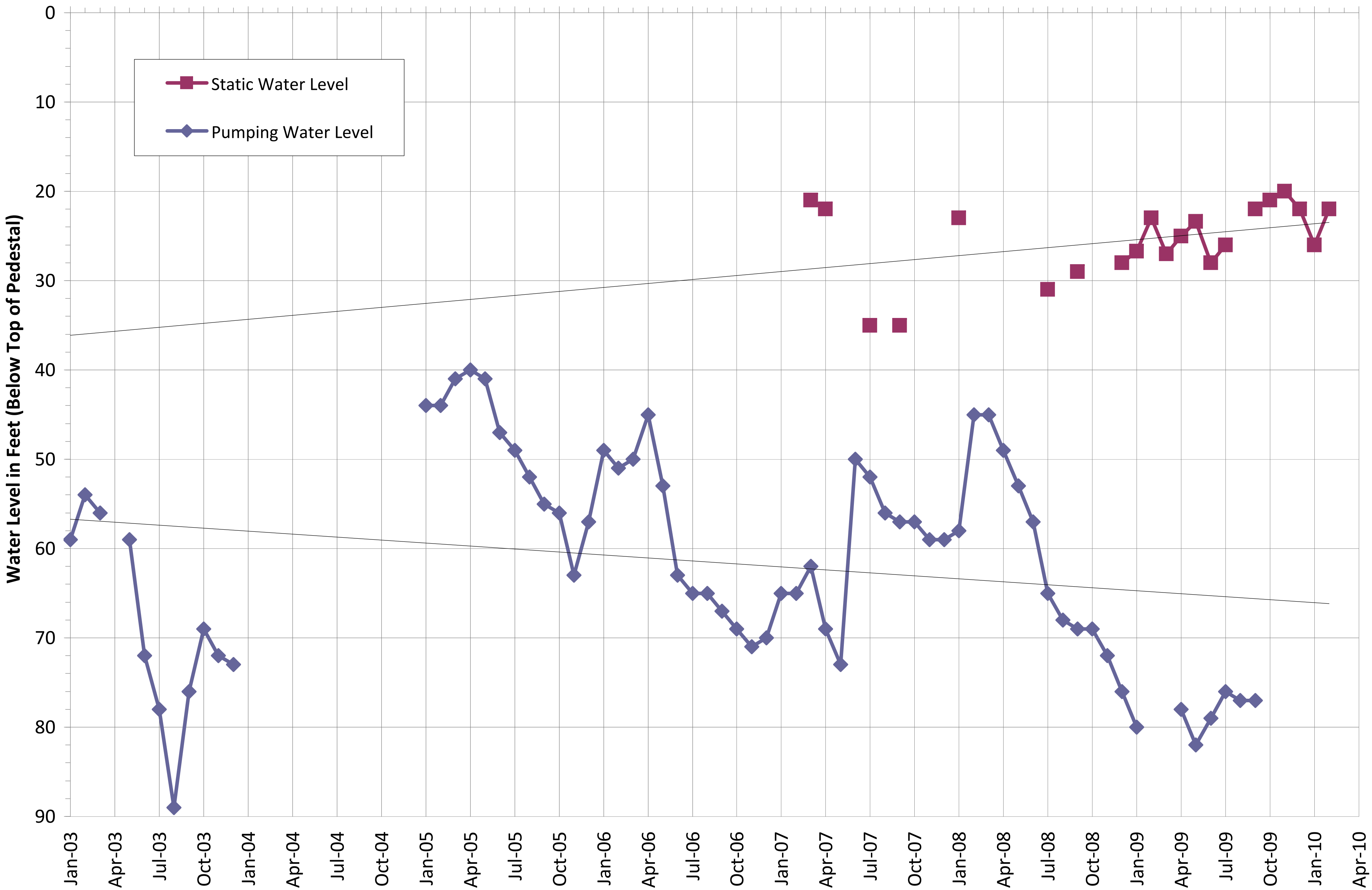


Figure 9
DEPTH TO GROUNDWATER IN CITIZENS UTILITIES AIRPORT PRODUCTION WELLS, DENNISTON SUB-BASIN

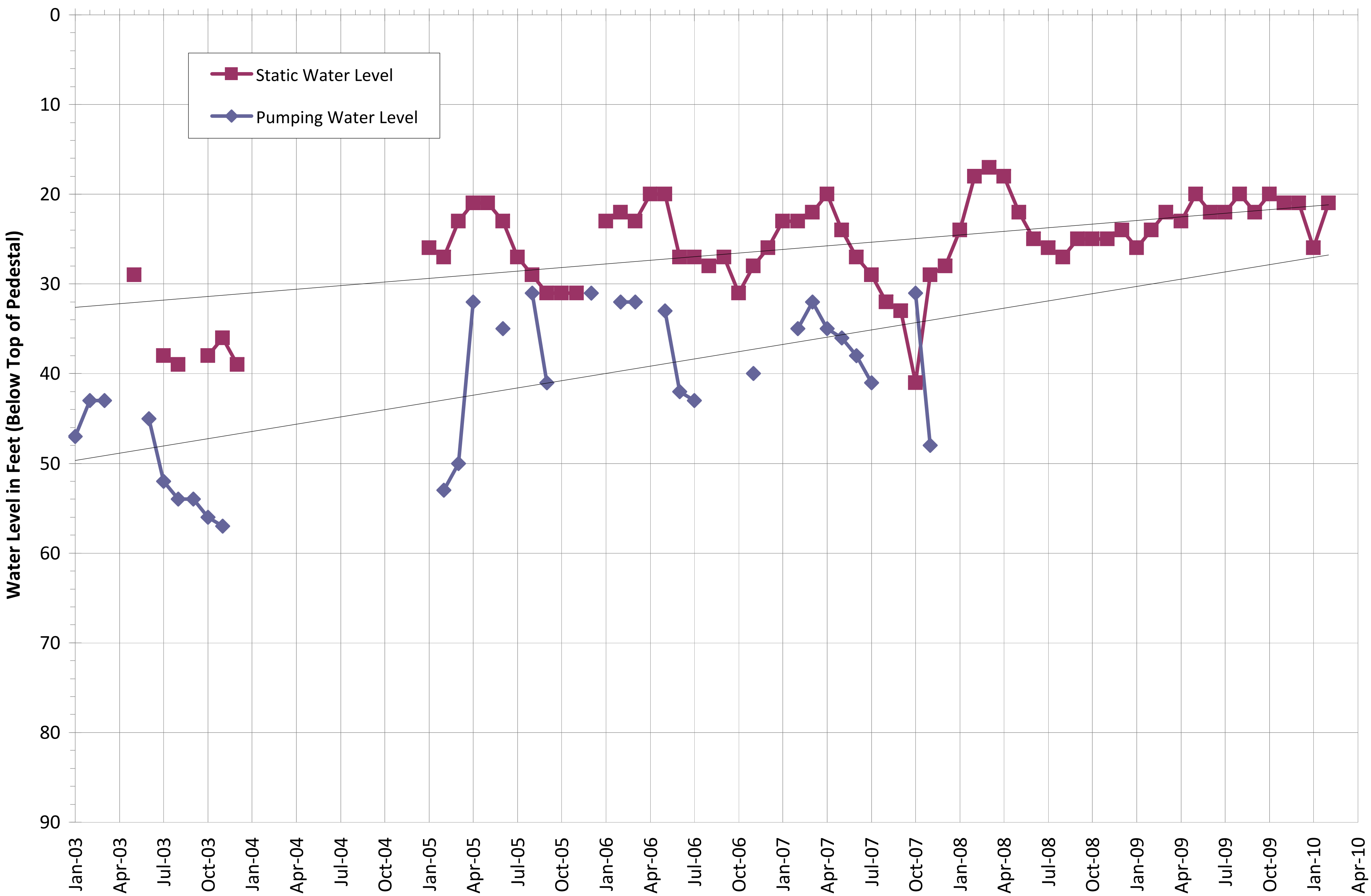
Balance Hydrologics, Inc.®

Figure C3. Recharge in the Airport Aquifer and Wagner Valley following the 1987 to 1992 drought, Midcoast Groundwater Study Phase III, San Mateo County, California. Source: Montara Water Supply Study (DWR, 1999).

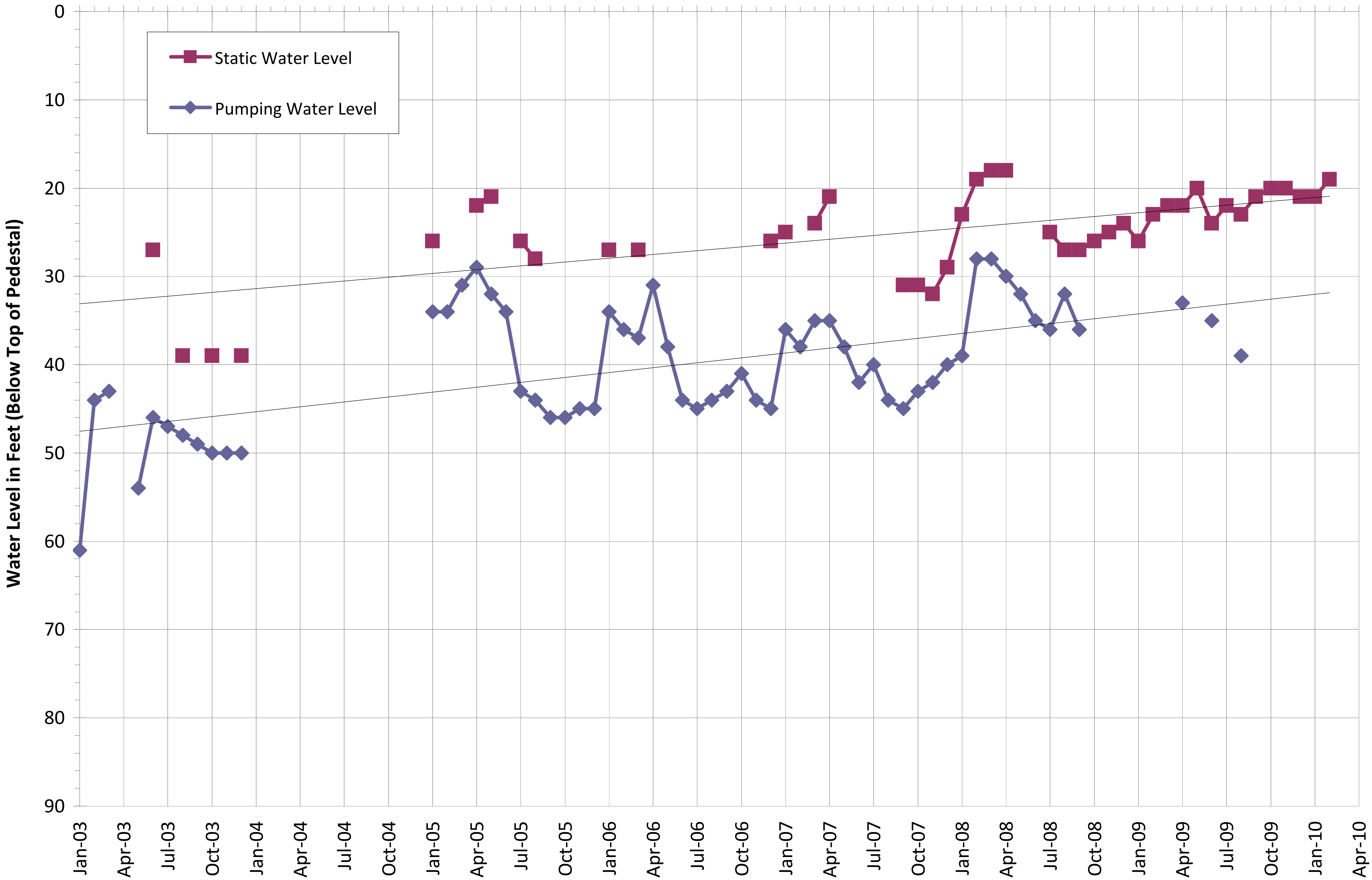
Airport South Well

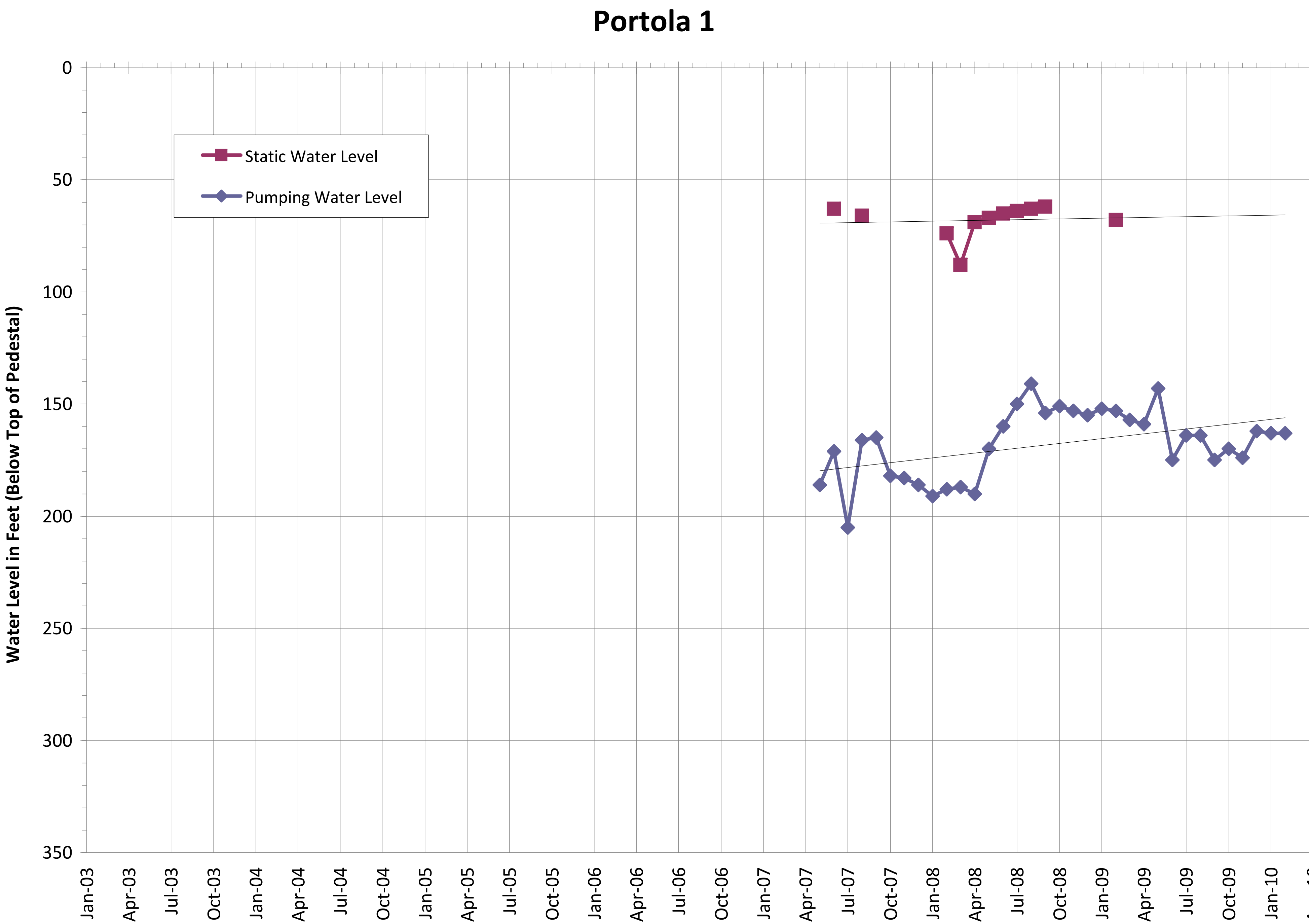


North Airport Well

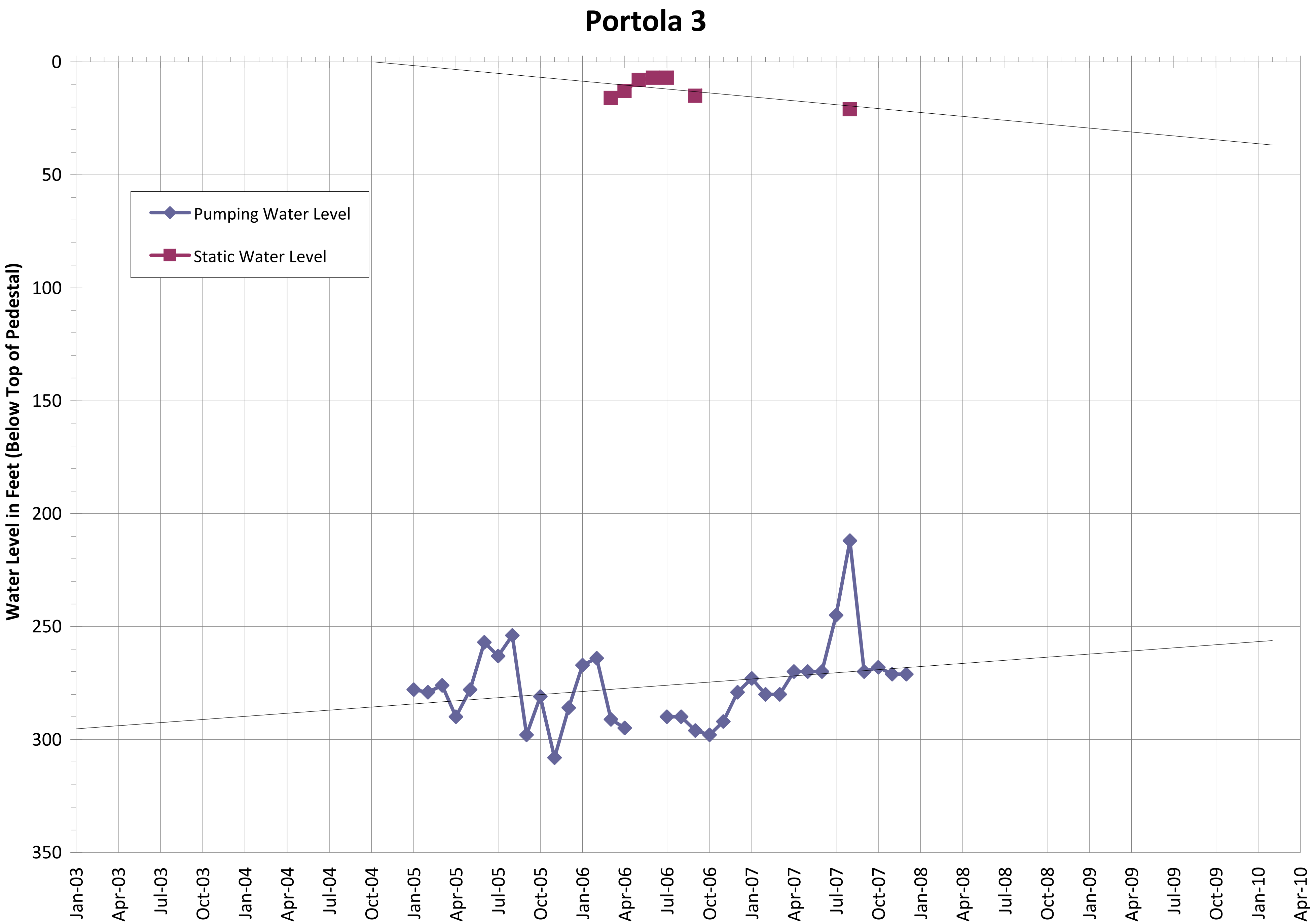


Airport Well 3

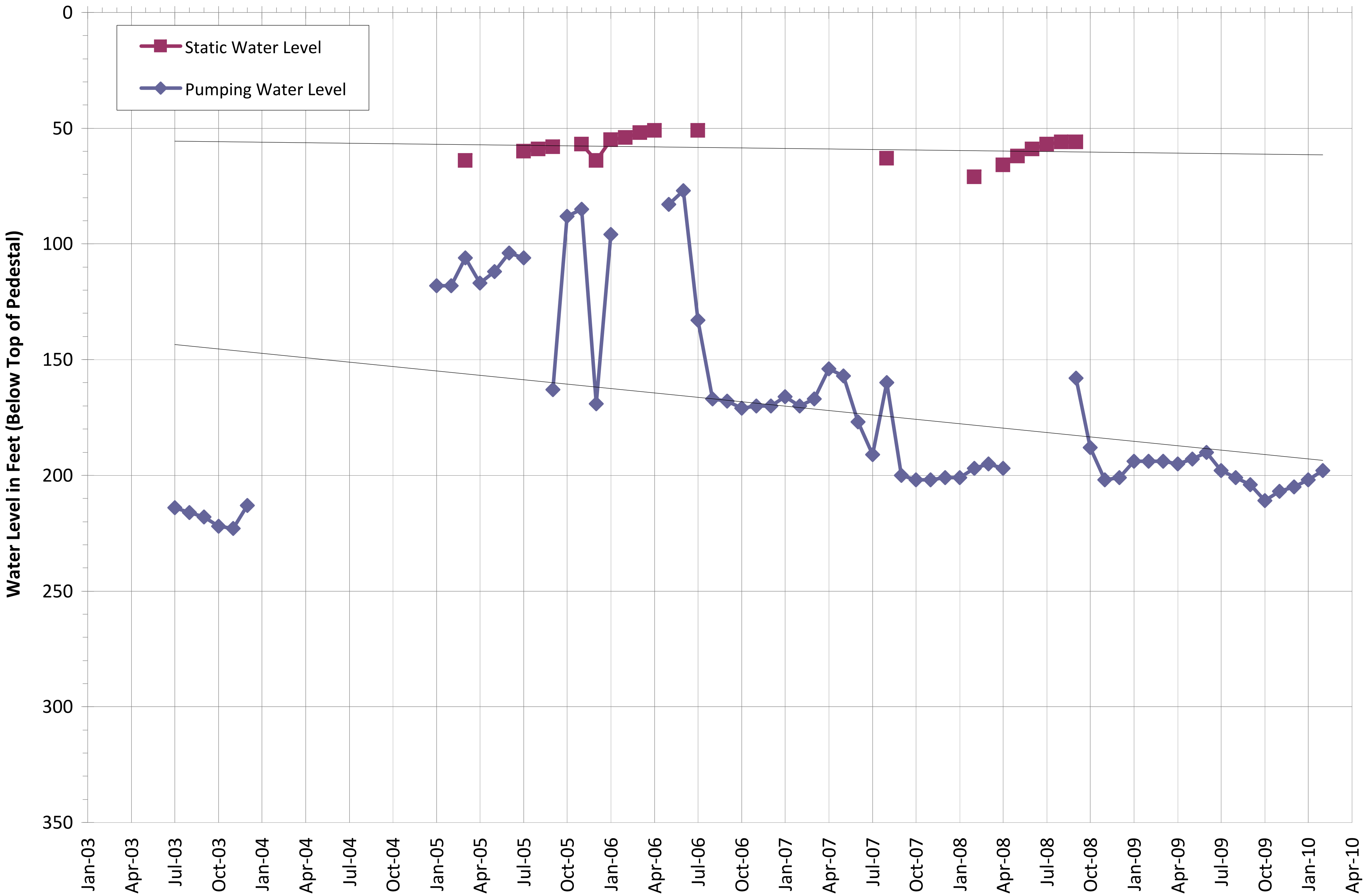




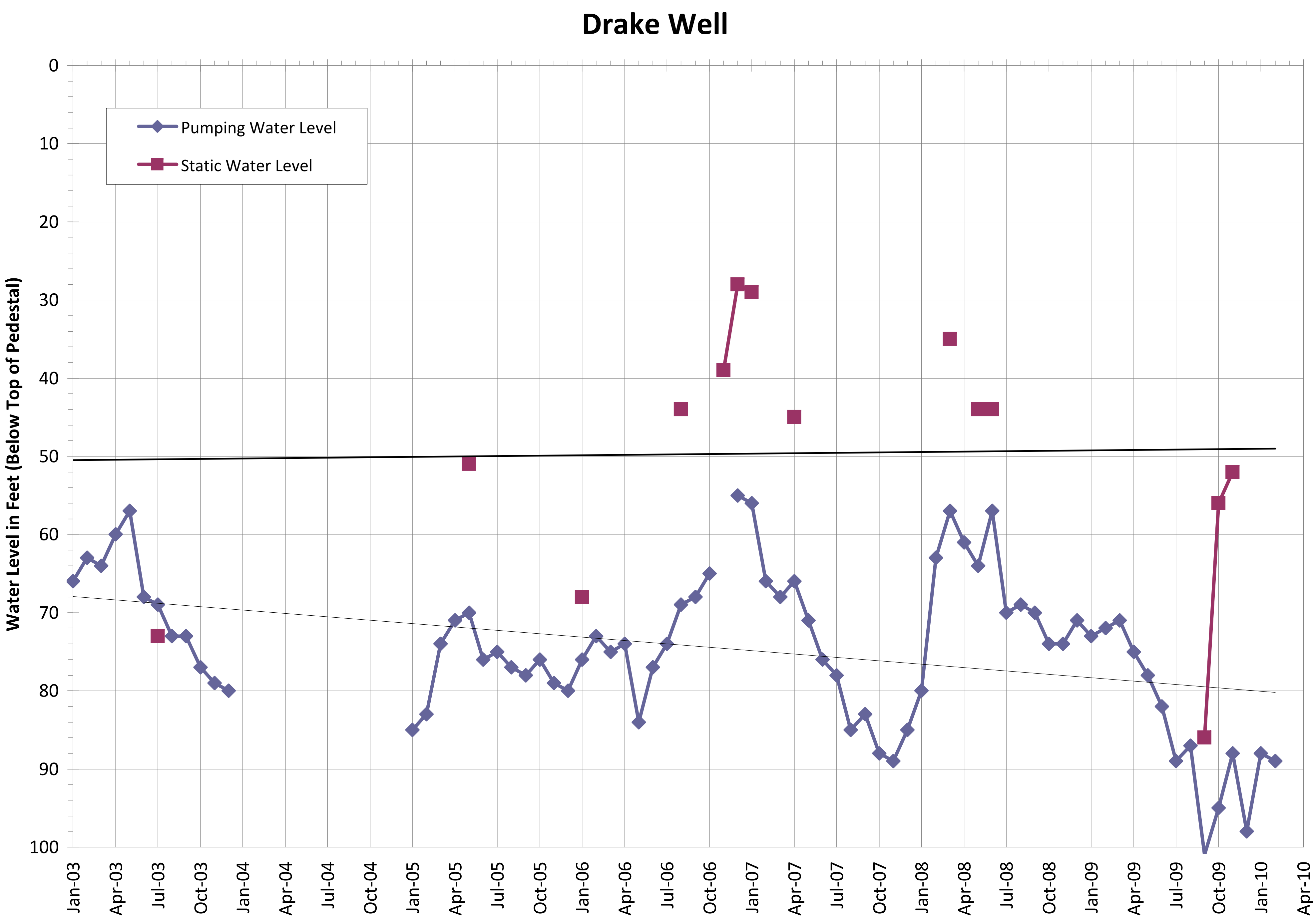
Portola 1
Static Water Level
Pumping Water Level
Water Level in Feet (Below Top of Pedestal)
0
50
100
150
200
250
300
350
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Jan-10
Apr-10


Portola 3
Pumping Water Level
Static Water Level
Water Level in Feet (Below Top of Pedestal)
0
50
100
150
200
250
300
350
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Jan-10
Apr-10

Portola 4

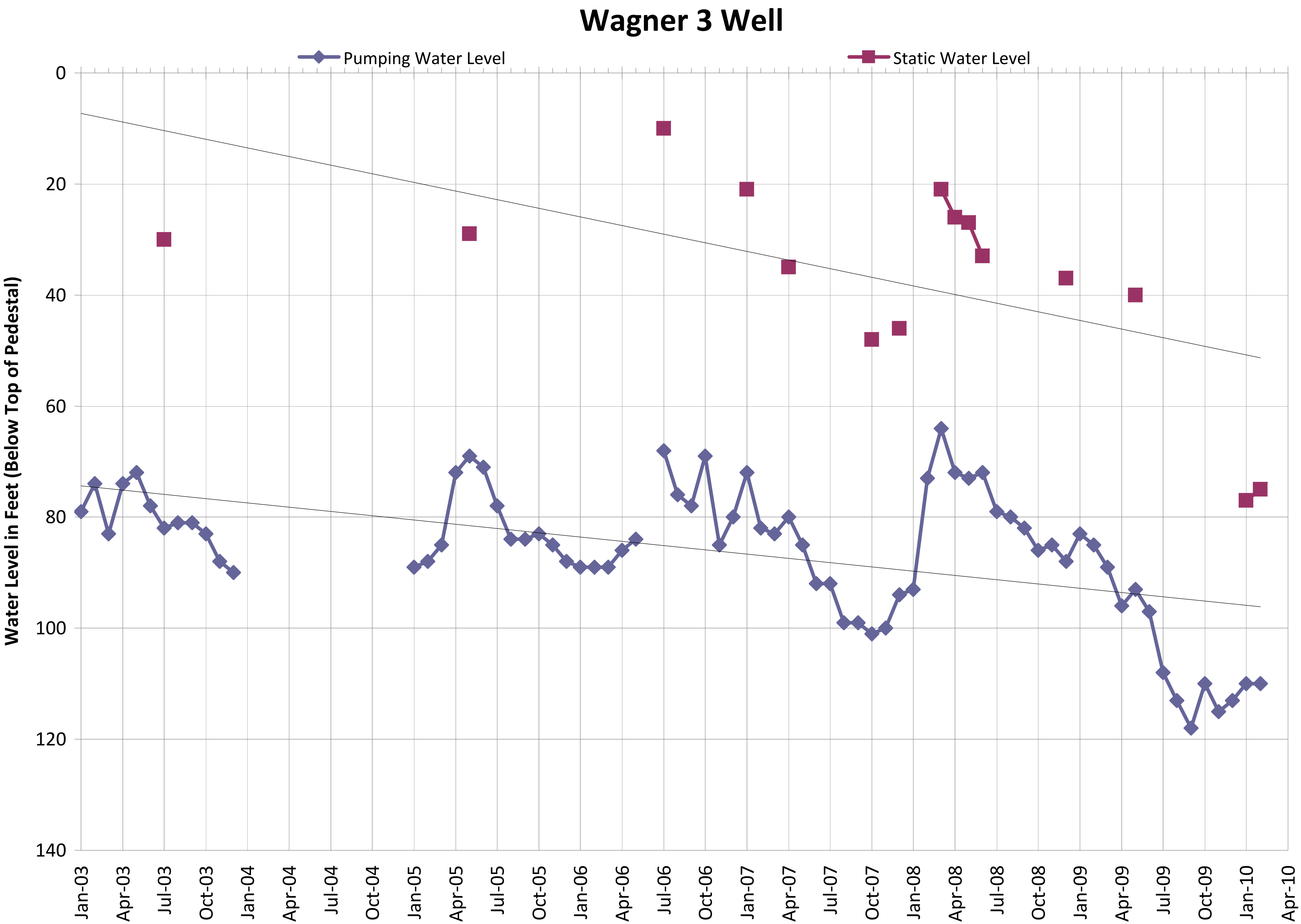


Static Water Level
Pumping Water Level
Water Level in Feet (Below Top of Pedestal)
0
50
100
150
200
250
300
350
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Jan-10
Apr-10



Groundwater Level Charts from MWSD -mw.xls, Drake, 3/13/10

Montara Water and Sanitary District



Wagner 3 Well
Pumping Water Level
Static Water Level
Water Level in Feet (Below Top of Pedestal)
0
20
40
60
80
100
120
140
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Jan-10
Apr-10

APPENDIX D

Groundwater Levels at LUST Sites as far Back as Water Year 1996, Midcoast San Mateo County, California

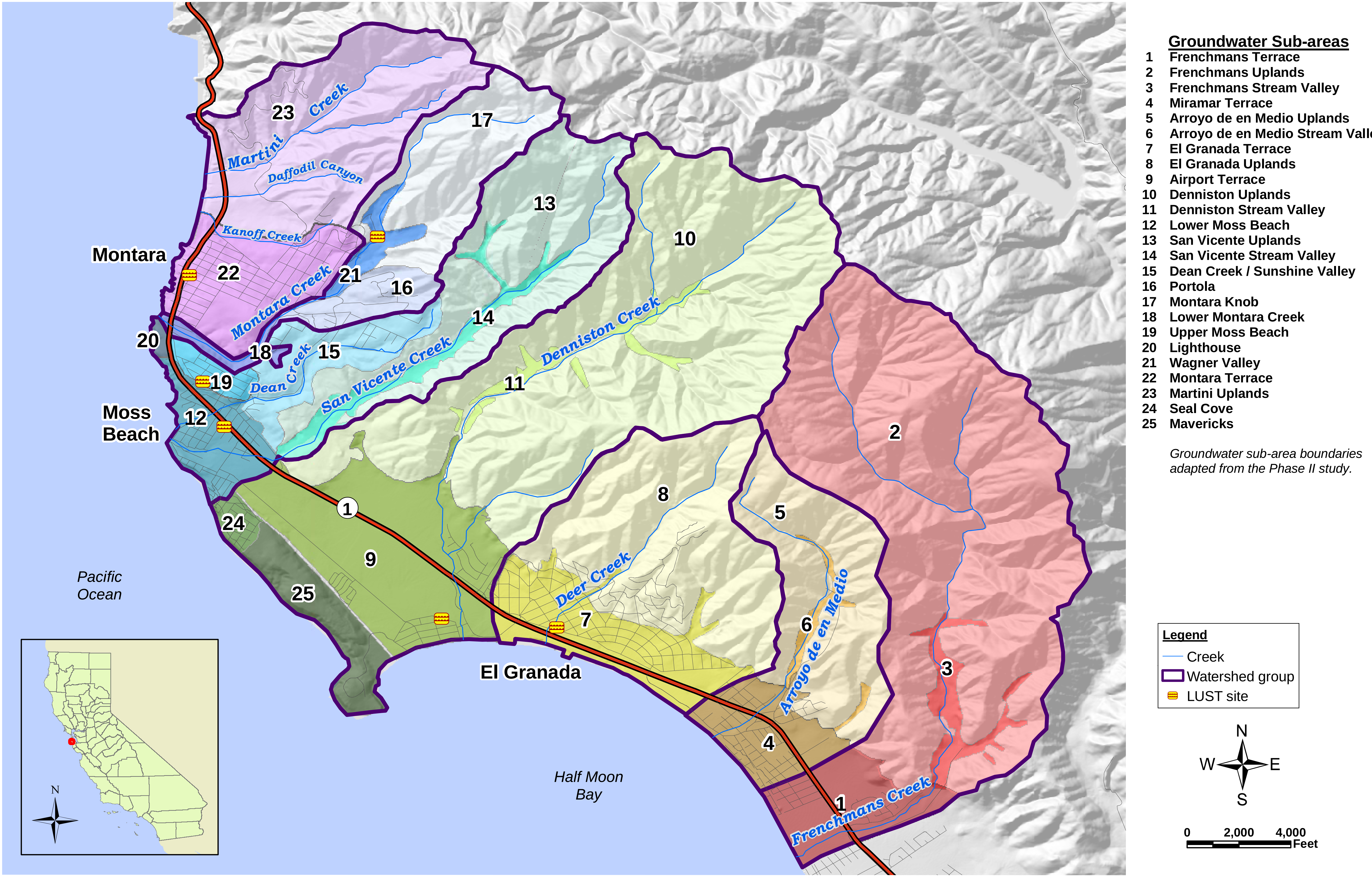


Figure D1: Current groundwater monitoring at LUST sites, Midcoast Groundwater Study Phase III, San Mateo County, California.

Balance Hydrologics, Inc.

209093 figures.mxd

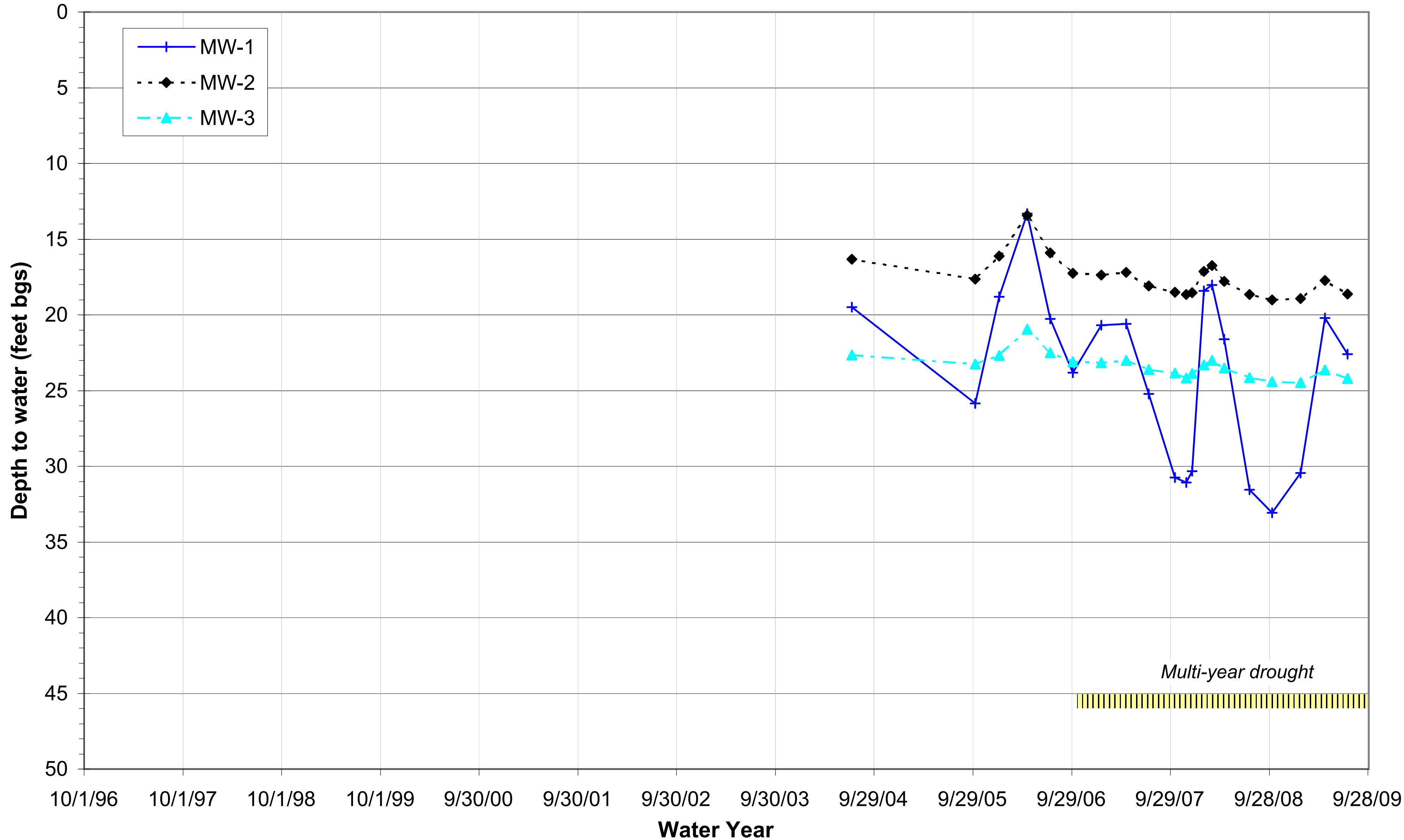
Table D1. Groundwater remediation and monitoring wells LUST sites, Midcoast San Mateo County, California.

Site Information						Groundwater Summary *(feet)*		
Source	**Organization**	**Site Name/Address/No**	**Site City**	**Well ID**	**RP Elev.**	**Dates of Data**	**Min. Depth**	**Max. Depth**
LUST	Technology, Engineering & Construction, Inc.	Neighborhood Gas Mart, 8445 Hwy 1, Site No. 010036	Montara	MW-1	72.60	2004 - 2009	13.31	33.07
				MW-2	71.39		13.43	19.00
				MW-3	71.92		20.95	24.29
				MW-4	72.35		dry	dry
				MW-5	not reported		dry	dry
LUST	Environmental Management Services	Coast Wholesale Florist, 771 Riviera, Site No. 010025	Montara	EW-2	309.31	1999 - 2009	4.98	6.60
				MW-2	309.24		1.86	5.98
				MW-3	302.83		2.68	13.12
				MW-4	304.90		4.35	16.74
				MW-5	309.72		3.18	12.71
LUST	Stantec Consulting Corp.	KN Property II, 9500 Hwy 1, Site No. 230016	Moss Beach	MW-1	61.01	2004 - 2009	7.16	13.20
				MW-4	63.38		5.26	10.84
				MW-5	63.42		2.46	9.76
				MW-6	62.76		4.58	10.85
				MW-7	60.80		3.01	9.98
				MW-8	61.01		1.25	10.68
				P-1	64.18		3.53	9.79
				P-2	60.81		2.68	8.84
LUST	Technology, Engineering & Construction, Inc.	Mannon Property, 619 Stetson, Site No. 018041	Moss Beach	MW-1	131.24	2007 - 2009	17.92	20.30
				MW-2	130.04		17.68	18.28
				MW-3	129.62		18.70	19.39
LUST	ATLAS, Engineering Services Incorp.	El Granada Market, 400 Ave. Alhambra, Site No. 010013	El Granada	MW-1	53.60	2004 - 2009	22.39	39.15
				MW-2	49.04		24.40	40.37
				MW-3	51.06		21.93	45.50
				MW-4	52.96		23.18	42.56
				MW-5	53.92		22.62	43.15
LUST	ATLAS, Engineering Services Incorp.	SMCo Dept of Public Works, 239 California, Site No. 010007	El Granada	MW-1	20.40	2003 - 2009	2.30	8.73
				MW-2	18.38		3.15	9.08
				MW-3	21.37		1.42	8.20
				MW-4	21.34		0.97	7.90

Notes:

1) Data aquired from the Geo Tracker website, accessed March.2010; http://www.geotracker.waterboards.ca.gov/map/

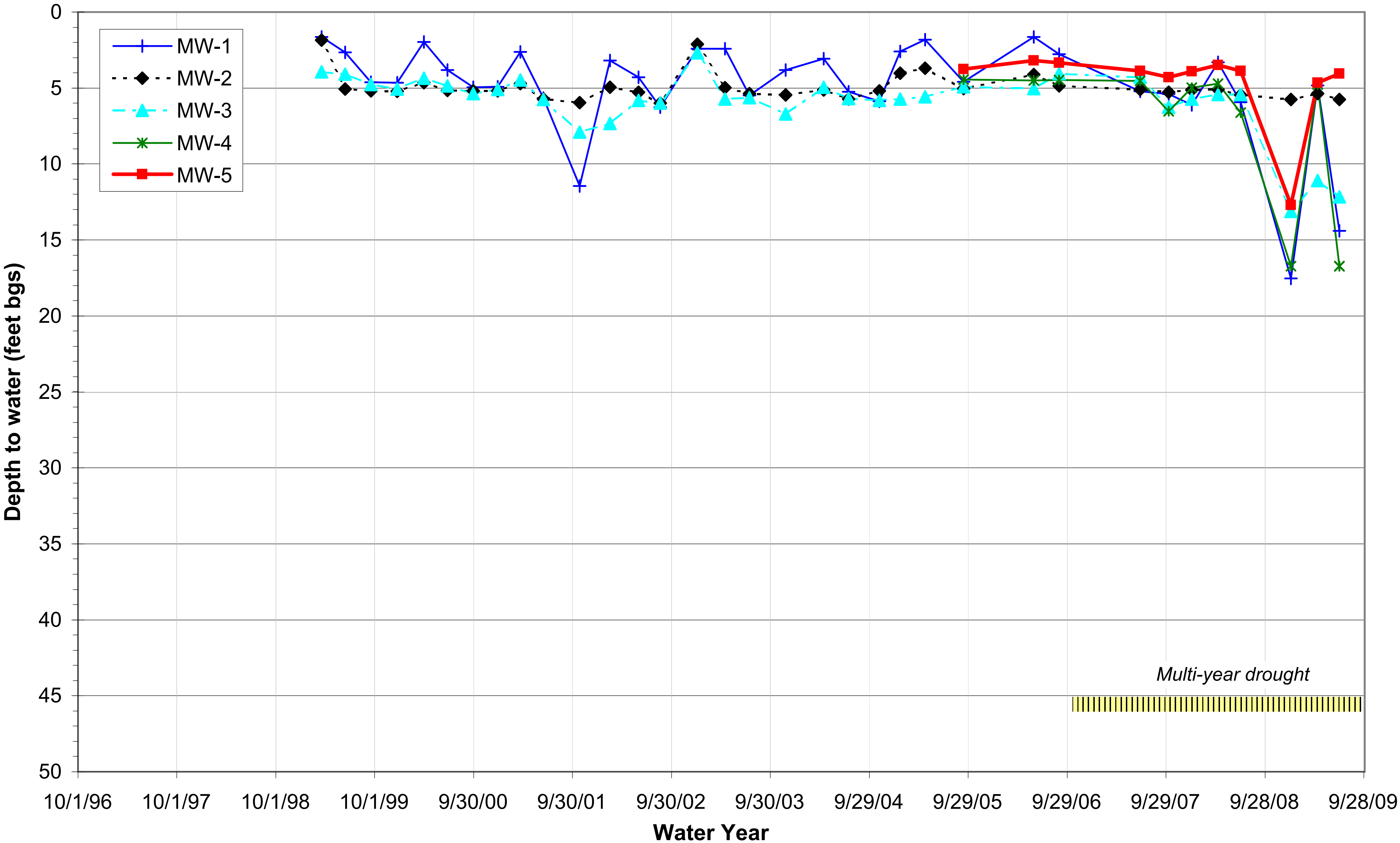
2) RP Elev. = reference point elevation in feet-Mean Sea Level, usually from the top of casting



Balance Hydrologics, Inc.®

Figure D2. Depth to groundwater in environmental monitoring wells at LUST site Neighborhood Gas Mart, Montara, San Mateo County, California. Data source: California State Resources Control Board GeoTracker website, http://www.geotracker.waterboards.ca.gov/map/

209093 geotracker data 3-17-10.xls;gas-c



Balance Hydrologics, Inc.®

Figure D3. Depth to groundwater in environmental monitoring wells at LUST site Coast Wholesale Florist, Montara, San Mateo County, California. Data source: California State Resources Control Board GeoTracker website, http://www.geotracker.waterboards.ca.gov/map/

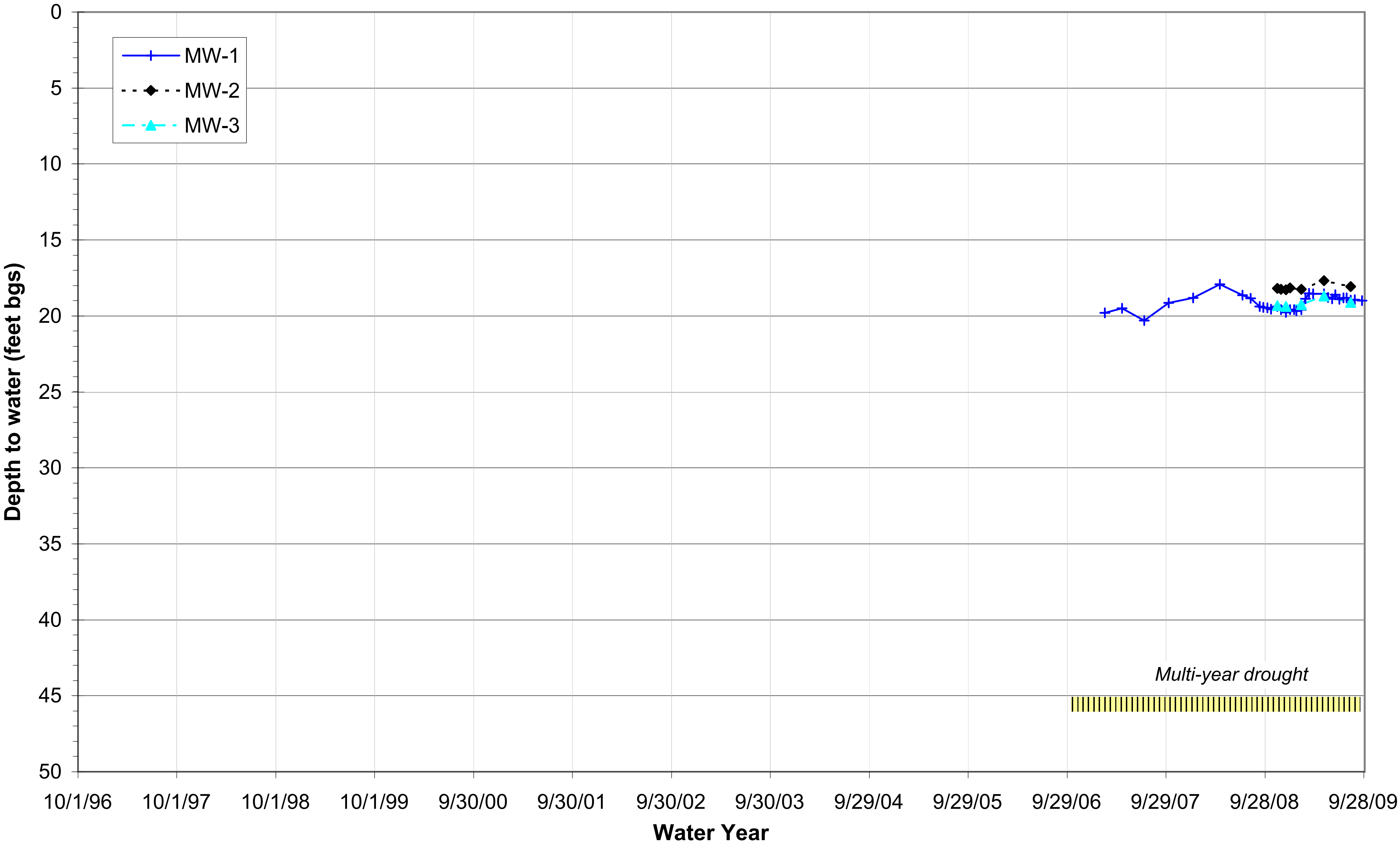


Figure D4. Depth to groundwater in environmental monitoring wells at LUST site Mannon Property, Moss Beach, San Mateo County, California. Data source: California State Resources Control Board GeoTracker website, http://www.geotracker.waterboards.ca.gov/map/

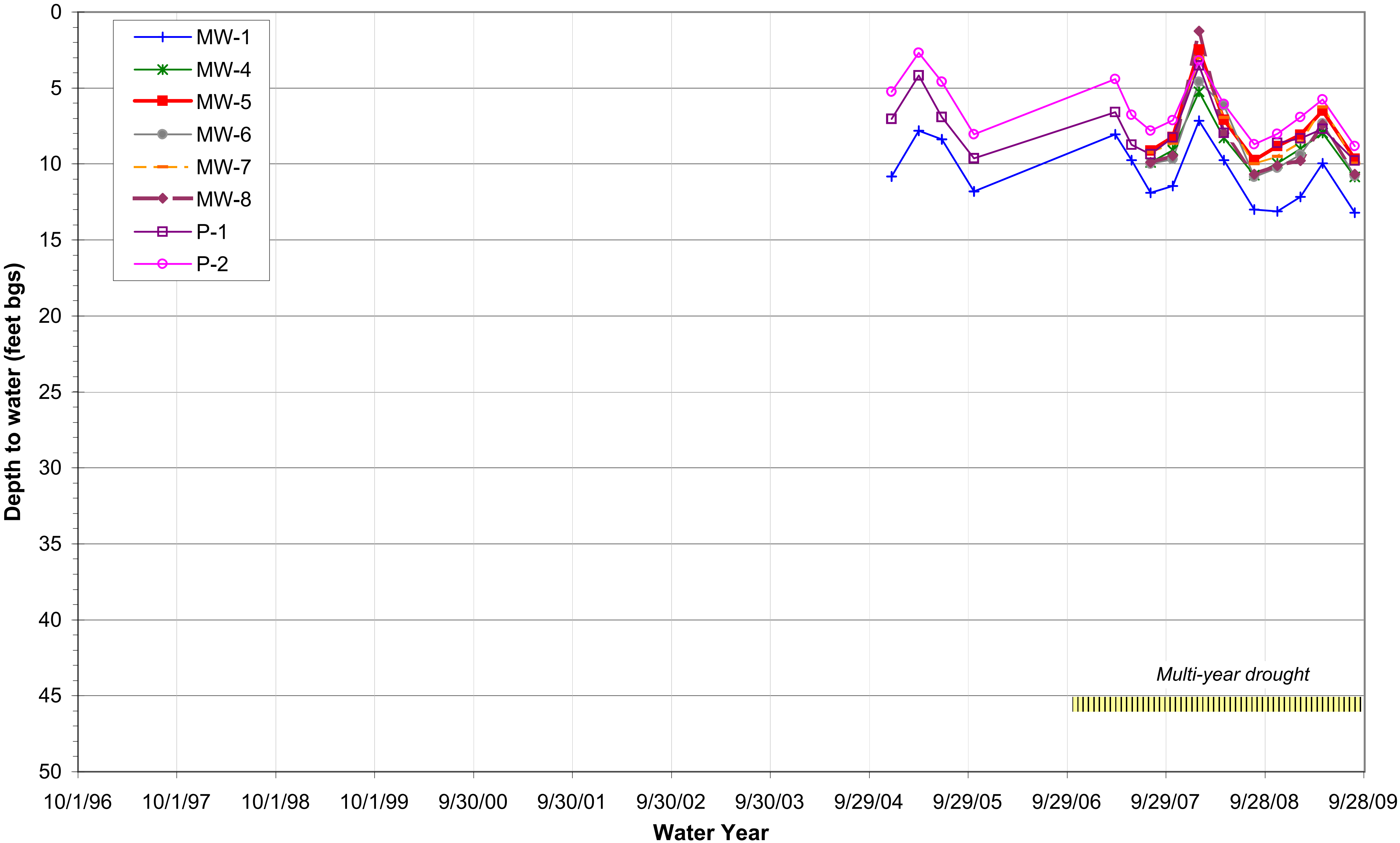
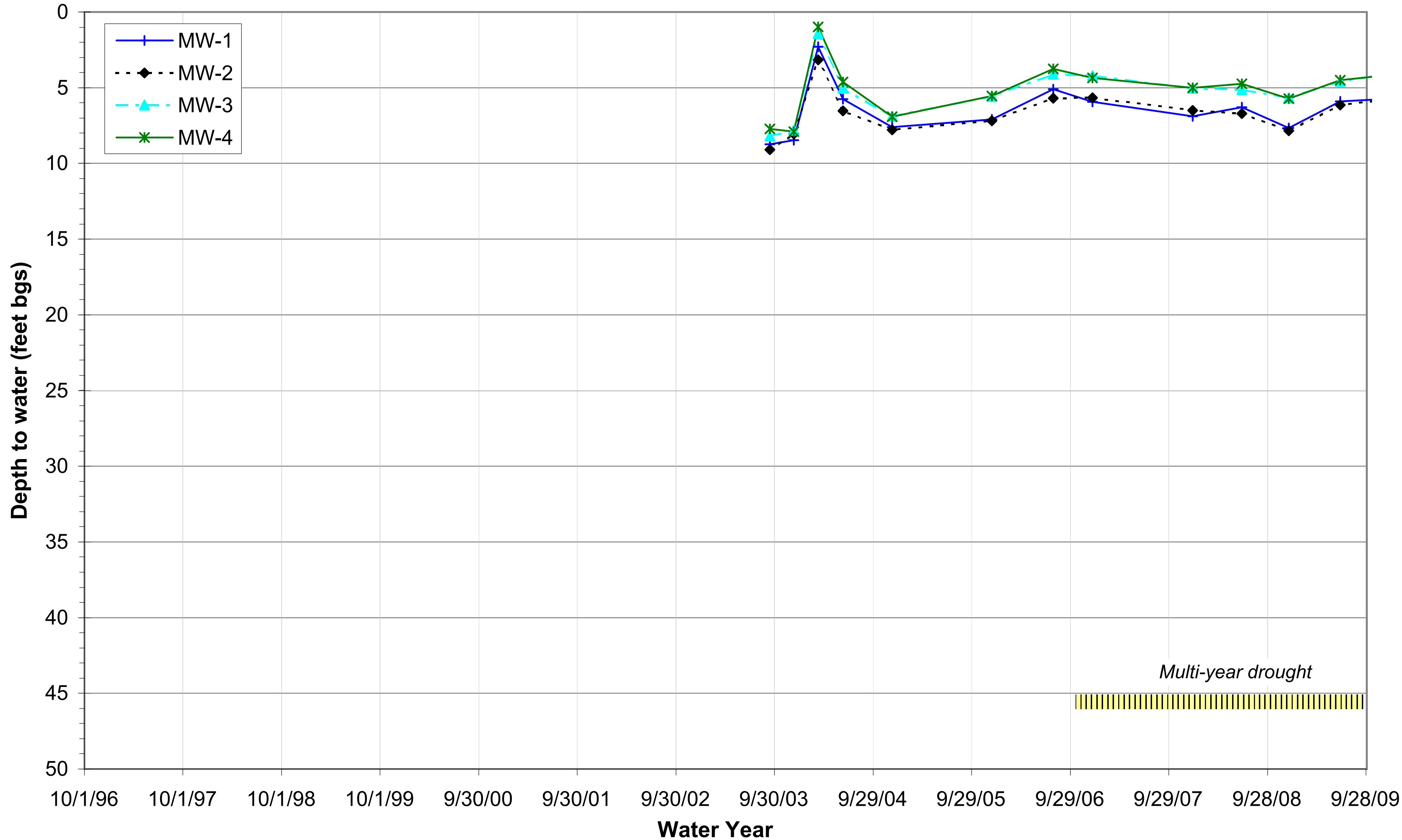


Figure D5. Depth to groundwater in environmental monitoring wells at LUST site KN Property II, Moss Beach, San Mateo County, California. Data source: California State Resources Control Board GeoTracker website, http://www.geotracker.waterboards.ca.gov/map/

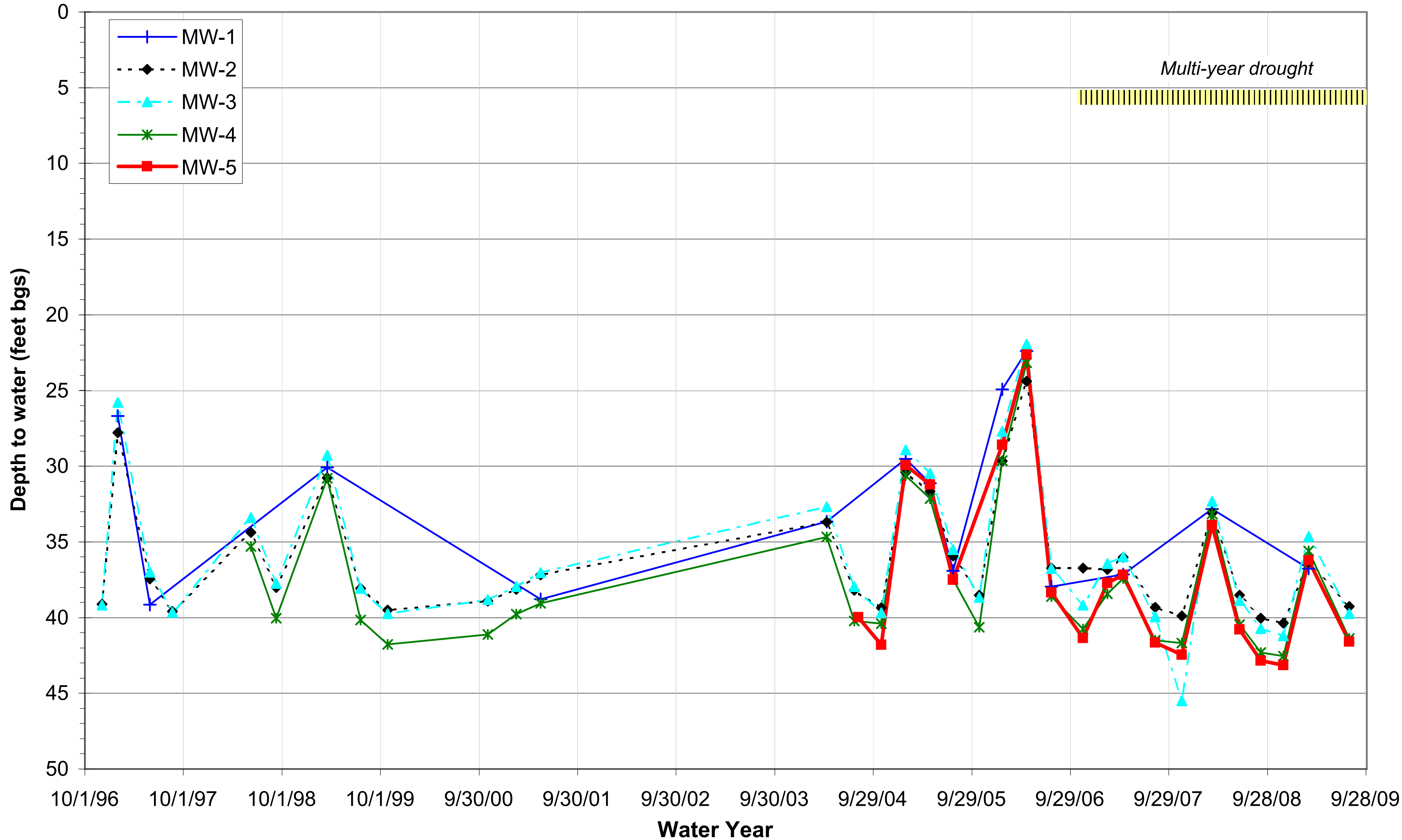
Balance Hydrologics, Inc.®

209093 geotracker data 3-17-10.xls;KN-c



Balance Hydrologics, Inc.®

Figure D6. Depth to groundwater in environmental monitoring wells at LUST site San Mateo Co. Dept. of Public Works, El Granada, San Mateo County, California. Data source: California State Resources Control Board GeoTracker website, http://www.geotracker.waterboards.ca.gov/map/



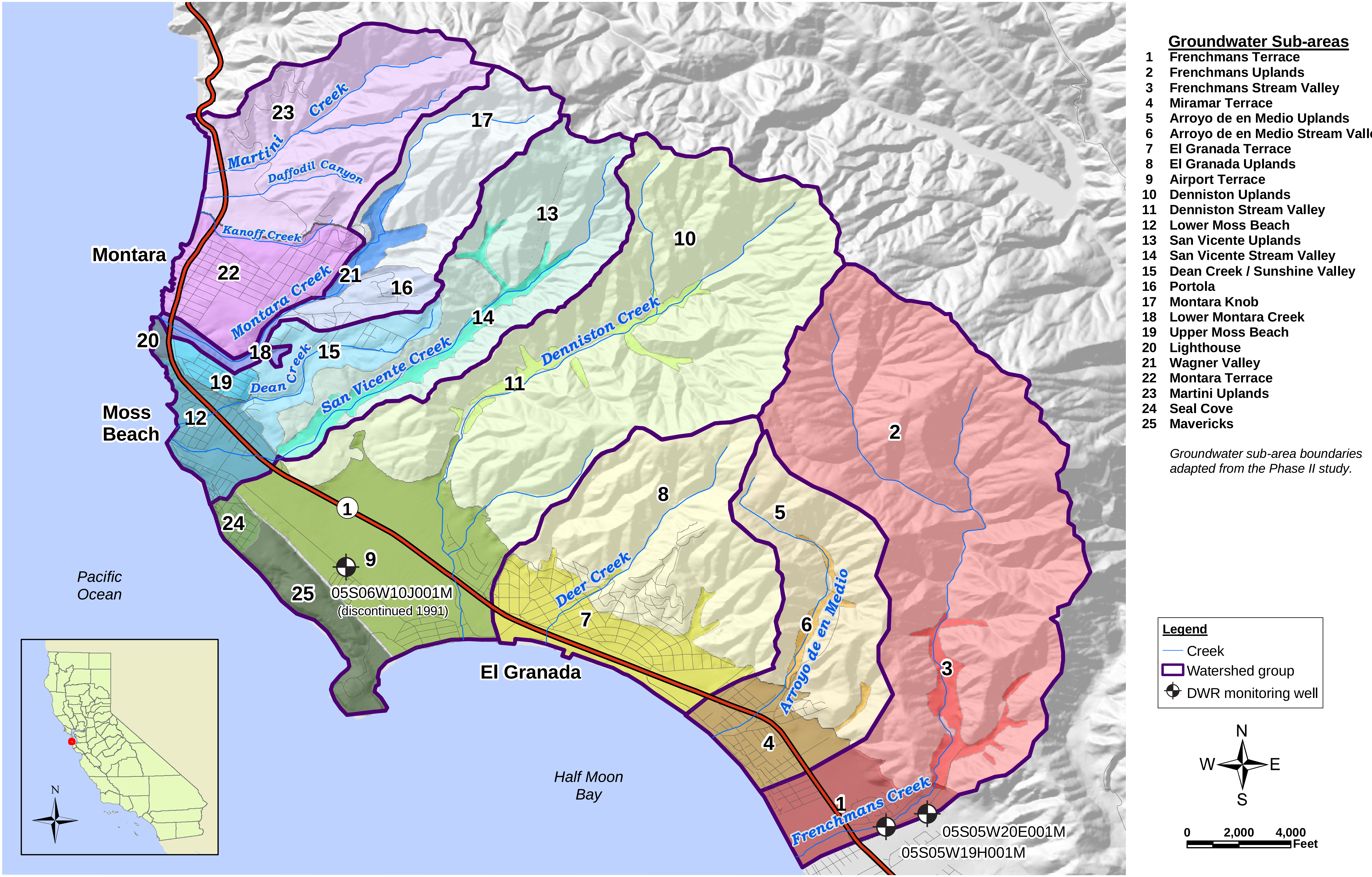
Balance Hydrologics, Inc.®

Figure D7. Depth to groundwater in environmental monitoring wells at LUST site El Granada Market, El Granada, San Mateo County, California. Data source: California State Resources Control Board GeoTracker website, http://www.geotracker.waterboards.ca.gov/map/

209093 geotracker data 3-17-10.xls;El Granda-c

APPENDIX E

Long-term Groundwater Levels in DWR Monitoring Wells as far Back as Water Year 1953, Midcoast San Mateo County, California



Balance Hydrologics, Inc.

Figure E1: California Department of Water Resources monitoring well data, Midcoast Groundwater Study Phase III, San Mateo County, California.

209093 figures.mxd

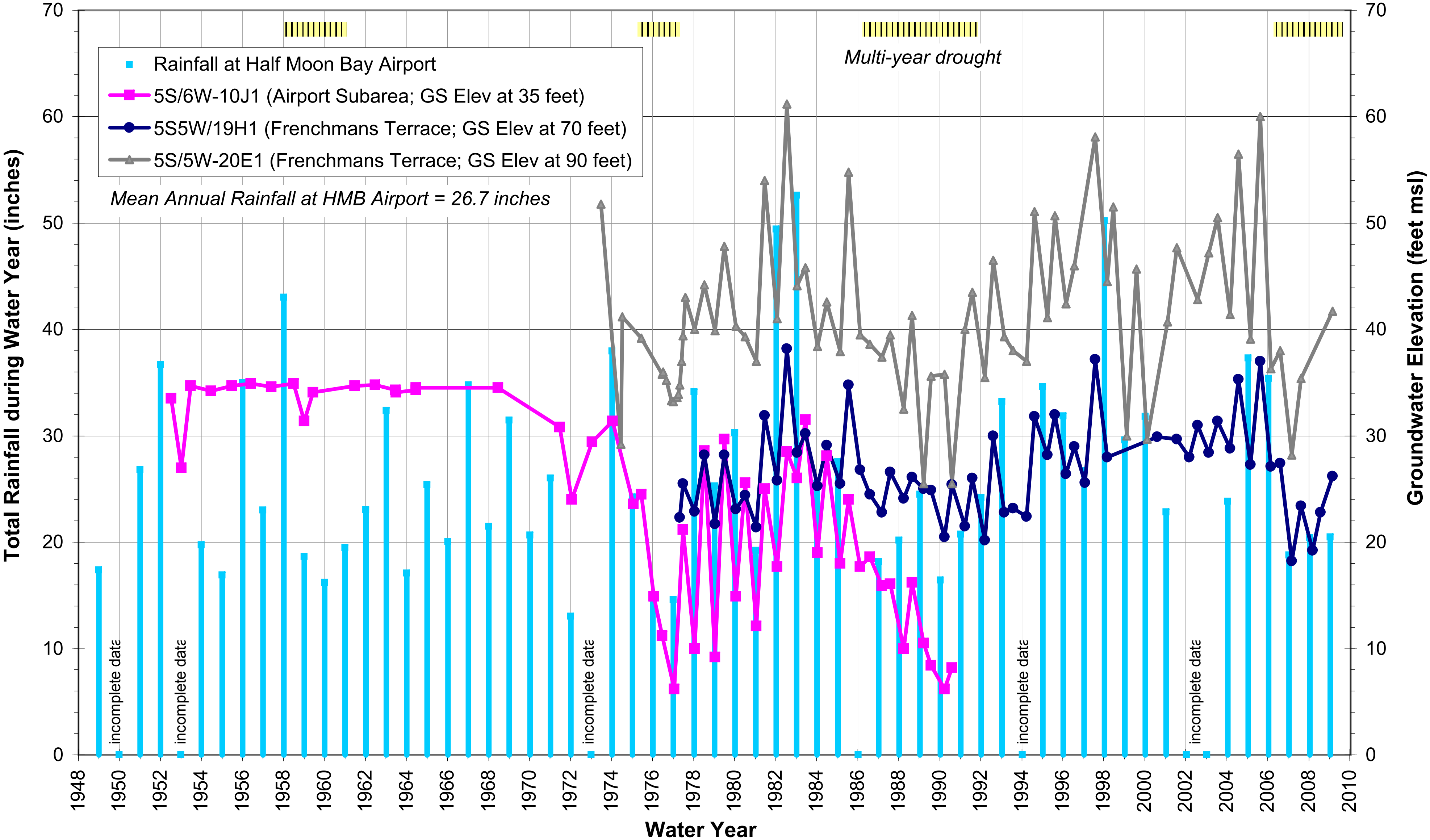


Figure E2. Long-term record of groundwater elevations in the Airport Subarea and Frenchmans Terrace, Midcoast Groundwater Study Phase III, San Mateo County, California. Source: Groundwater level data downloaded from DWR Water Data Libarary (www.water.ca.gov/waterdatalibrary). 5S/6W-10J1 abandoned in 1991. Rainfall data from Half Moon Bay Airport (NOAA NCDC Station 43714), annual totals not shown for years with missing data.

Balance Hydrologics, Inc.®

209093 longterm record.xls, Chart1, 3/25/2010