GWR-02

E N T R I X
Environmental and Natural Resource Management Consultants

via email

August 22, 2008

Mr. Drew Squyres
Senior Project Manager
Pacific Gas and Electric Company, Environmental Services
4325 South Higuera Street
San Luis Obispo, CA 93401

RE: Pacific Gas & Electric (PG&E) Company, Diablo Canyon Power Plant (DCPP) Water Resources Evaluation: Well Installation and Aquifer Testing

Dear Drew:

Please find enclosed the revised Water Resources Evaluation Phase II report for Diablo Canyon Power Plant. We are providing this to you in accordance with PG&E Contract #4600016684 and Contract Work Authorization #3500798313. This draft includes results from additional aquifer testing conducted in June, 2008 which improve and expand upon the assessment of any connectivity between groundwater pumping and flows within Diablo Creek.

We have enjoyed working with you on the important project, and look forward to providing additional support in the future.

Sincerely,

Timothy Thompson
Vice President – Water Resource Sciences

cc: Mr. Mark Coleman, Diablo Canyon Power Plant
Mr. John Giambastiani, ENTRIX, Concord

DIABLO CANYON POWER PLANT

WATER RESOURCES EVALUATION PHASE II REPORT: WELL REHABILITATION, MONITORING WELL INSTALLATION, AND AQUIFER TESTING

Prepared by:

ENTRIX

Environmental and Natural Resource Management Consultants

August 22, 2008

TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

Executive Summary

The PG&E Diablo Canyon Power Plant ("DCPP") has historically utilized three independent water supplies for plant water needs, listed in order of volumetric priority: (a) seawater, treated by a large reverse osmosis system ("SWRO"), (b) diversions from Diablo Creek, and (c) groundwater produced by a single on-site well ("Well #2"). As a result of a directive by the California Coastal Commission, diversions from Diablo Creek will be ceased. This change in supply options increases the dependence upon groundwater and therefore generates a need for the groundwater to be both more reliable and pumped at a slightly greater rate than historically. Given this context, the purpose of this Water Resources Evaluation is to develop a better understanding of on-site groundwater resources in terms of potential yield, water quality and relationship between groundwater pumping and flows in Diablo Creek. This work is based in part on a 2007 study ("Phase I: Evaluation of Groundwater and Surface Water Data") that was prepared to identify appropriate steps for refurbishing and testing existing groundwater production facilities, evaluating groundwater water quality issues, and installing monitoring wells.

The Phase II scope-of-services included: (1) installation of two monitoring wells (Well #4 and Well #5), (2) evaluation and rehabilitation of Well #2, (3) aquifer testing at Well #2, and (4) water quality sampling and analysis. The proposed new monitoring wells will provide valuable information needed for (a) understanding current groundwater basin conditions, (b) assessing future groundwater production potential and water quality at the proposed locations, and (c) comparing groundwater water levels with flow levels in Diablo Creek to demonstrate if any hydraulic connection is apparent.

The two monitoring wells, known as Wells #4 and #5, were drilled and completed to 500 ft and 400 ft, respectively. The wells were logged, tested and evaluated for water quality. Well #4 was pumped for two hours at a rate of 30 gallons per minute, had 21 ft of drawdown and has a potential yield of 80 gallons per minute (gpm) or more. Water quality at Well #4 was satisfactory, but poorer than the other wells. Well #5 was pumped for over two hours at a rate of 49 gallons per minute, had a drawdown of approximately 8 ft and has a potential yield of 150 gpm or more. Water quality at Well #5 was better than that at Well #2 in many, but not all, respects.

The pre-existing and historically productive Well #2 was rehabilitated, including cleaning of the casing, and replacement of the pump, motor, column pipe and surface controls. The well was tested and sampled to determine if the well's inflow rates and water quality differed at different depths. Based upon the results of this work, it is evident that significant inflow rates occur at different depths within the well and that the water quality at these various depths is also different in certain respects. The majority of the well's water enters in the 190-275 ft zone, and is of reasonably good water quality. A shallower zone was identified as contributing approximately 20% of the well's flow and containing elevated concentrations of total dissolved solids, chloride, iron and silica.

Well #2 was initially tested from November 26 through December 7, 2007, a 10-day constant rate pumping test that included monitoring at Well #2, three monitoring wells and in Diablo Creek. The test was run at 150 gpm which proved to be an acceptable long-term, sustainable pumping rate for the well, even with the preceding years of limited rainfall and associated lowered water levels. During wetter climatic periods, the well has a capacity to produce at a greater flow rate.

A second constant rate pump test was conducted at Well #2 from June 25 to July 2, 2008 to evaluate the relationship between groundwater pumping and creek water levels. Well #2 was pumped at a rate between 150 and 200 gpm for seven days. Changes in water levels were monitored in Wells #2 and #5 as well as at two locations in Diablo Creek. Just before the end of the test, water quality samples were collected from Well #2 and the creek. The data collected do not show a correlative water level response between water levels in Diablo Creek and pumping water levels in Well #2. During the course of the pumping test, water levels in the Creek did not exhibit a drawdown or rebound signature corresponding to the start and end of the pump test, respectively. If the creek and well were connected, measurable changes in the creek water levels would likely occur. The absence of these trends supports the conclusion that there is no discernable connection between creek water levels and pumping at Well #2.

Water quality comparisons were also conducted to determine if a relationship exists between groundwater pumping at Well #2 and flows within Diablo Creek. Concentrations of several key constituents from samples collected contemporaneously during the multiple tests were markedly different indicating distinct water sources.

Finally, a water resource monitoring program was initiated to collect and track hydrologic data in an effort to ensure adequate understanding of this valuable resource is developed and maintained.

Recommendations of this work include continuance of the water resources monitoring program, evaluating factors associated with future production use of Wells #4 or #5, and evaluate implementation of downhole well modifications to improve water quality in Well #2.

1. Introduction

This report provides a summary of well rehabilitation, monitoring well installation, aquifer testing, and water quality analyses conducted at the PG&E Diablo Canyon Power Plant ("DCPP") from October 2007 through July, 2008. The services were conducted as part of the Phase II and Phase III Water Resources Evaluation scope of work which, in turn, is based upon the June 30, 2007 technical report entitled: "Phase I: Evaluation of Groundwater and Surface Water Data". The work provides data and recommendations to support increased reliability of groundwater production and an evaluation of whether a connection exists between groundwater pumping from the existing Well #2 and flows associated with Diablo Creek. Also included is a section of the report that summarizes recommendations for groundwater use and facilities management and provides elements of a long-term groundwater resource monitoring program.

This work is part of a larger effort by DCPP staff to increase reliability of available water supplies, which also includes modifications to the DCPP seawater reverse osmosis ("SWRO") treatment plant system. Properly managed and monitored development of local groundwater resources can provide a highly reliable water supply that will continue to supplement the SWRO supply. As part of this ongoing groundwater development activity, groundwater monitoring data will be collected to establish a body of information to better understand the water resources of the area. Appropriate work to follow the tasks summarized in this document includes implementation of a groundwater monitoring program to initiate the collection of water related data that will increase the understanding and forecasting of this valuable resource. Additional phases of work may also include the conversion of one or both of the new monitoring wells to production wells depending upon future determination of DCPP groundwater supply needs.

1.1 Background

Water supply for DCPP steam generation is currently acquired from three sources: reverse osmosis treatment of seawater ("SWRO"), surface diversions from Diablo Creek, and pumped groundwater. SWRO is the primary water supply source, with the surface water and groundwater resources used in supporting roles for augmentation during normal SWRO operations or for temporary backup supply during SWRO outages. Because of a regulatory mandate to cease Diablo Creek diversions, groundwater will be elevated in its relative importance to meet the water supply needs of DCPP and it is therefore appropriate to increase groundwater production capability and reliability.

Given that context, a study was prepared ("Phase I: Evaluation of Groundwater and Surface Water Data") to identify appropriate steps for refurbishing and testing existing groundwater production facilities, evaluating groundwater water quality issues, and installing monitoring wells.

The monitoring wells were recommended to gain a broader understanding of the groundwater conditions present at the DCPP site and to develop information on future production well locations. These wells will provide information needed for (a) understanding current groundwater basin conditions, (b) assessing future groundwater production potential and water quality at the proposed locations, and (c) comparing groundwater water levels with flow levels in Diablo Creek to demonstrate if any hydraulic connection is apparent. If replacement of the existing Well #2 or augmentation of the existing DCPP groundwater pumping capacity is needed at a future date, one or both of these monitoring wells could be converted to production wells.

In order to comply with the aforementioned regulatory mandate to cease Diablo Creek diversions, increased groundwater production will be needed. The cessation of creek diversions generates two considerations:

1. Increased dependence upon Well #2 to provide all the water needed to augment the SWRO system; and,
2. The technical concept of demonstrating that both existing and future groundwater pumping does not extract subsurface water associated with Diablo Creek flows.

For these considerations, a series of diagnostic aquifer tests were conducted. These tests involved pumping at Well #2 at similar rates to historical and planned usage and contemporaneous water level monitoring at other wells and at locations within Diablo Creek.

1.2 Hydrogeology

The primary aquifer established by existing groundwater extractions is the fractured sandstone (possibly dolomitic) of the lower to middle Miocene-aged Obispo Formation. This unit also contains siltstones and finer grained beds that are less productive than the fractured sandstones. The brittle nature of the sandstones produces discrete fracture sets that can form a prolific bedrock aquifer. Because the aquifer material in this region is relatively hard and locally brittle bedrock, essentially all groundwater production will be derived from fractures within the rock, not from the pore spaces between the sand grains as occurs in an alluvial (i.e., uncemented, unlithified) aquifer.

1.3 Well Site Selection

Site selection in bedrock aquifers is highly dependent upon the existence of fractured zones that allow groundwater collection and conveyance from upgradient source areas. For the purpose of monitoring well site selection, a local and regional scale fracture study was conducted, as described in the Phase I report. This study combined with site access and other considerations resulted in the identification of three (3) favorable drilling locations, two (2) of which (site "4" and site "5b") were selected by PG&E staff for the monitoring wells installed as part of this Phase II work. (see Table 1, Figure 1). Site "5b" of the Phase I report will be referenced as site "5" in this report and all future references.

As a historical note, Well #3 was drilled contemporaneously with wells 1 and 2, yet because of insufficient yield was abandoned before well completion. It is located in the small turn-around circle near the current Diablo Creek diversion and pumping facilities (see Figure 1). The wellhead is no longer visible in the field, and its elevation in Table 1 is approximate.

Table 1. DCPP Well Locations

Well No.	Descriptive Location	North Coordinate*	East Coordinate*	Elevation*
				ft msl
Well #1	Near Diablo Creek	2277056.86	5711903.64	251.36
Well #2	On Deer Trail Rd.	2276517.11	5712241.45	333.3
Well #3	On Turnaround near Lower Weir	See map	See map	~285
Well #4	On Deer Trail Rd. at turnoff to water tank	2276209.20	5712999.92	452.35
Well #5	Near Man Camp area	2276658.80	5712413.70	303.93

**Coordinates and Elevations were surveyed by Granite Construction staff. Coordinates are consistent with other DCPP surveying data. Elevations represent the top of the concrete pad at each well.*

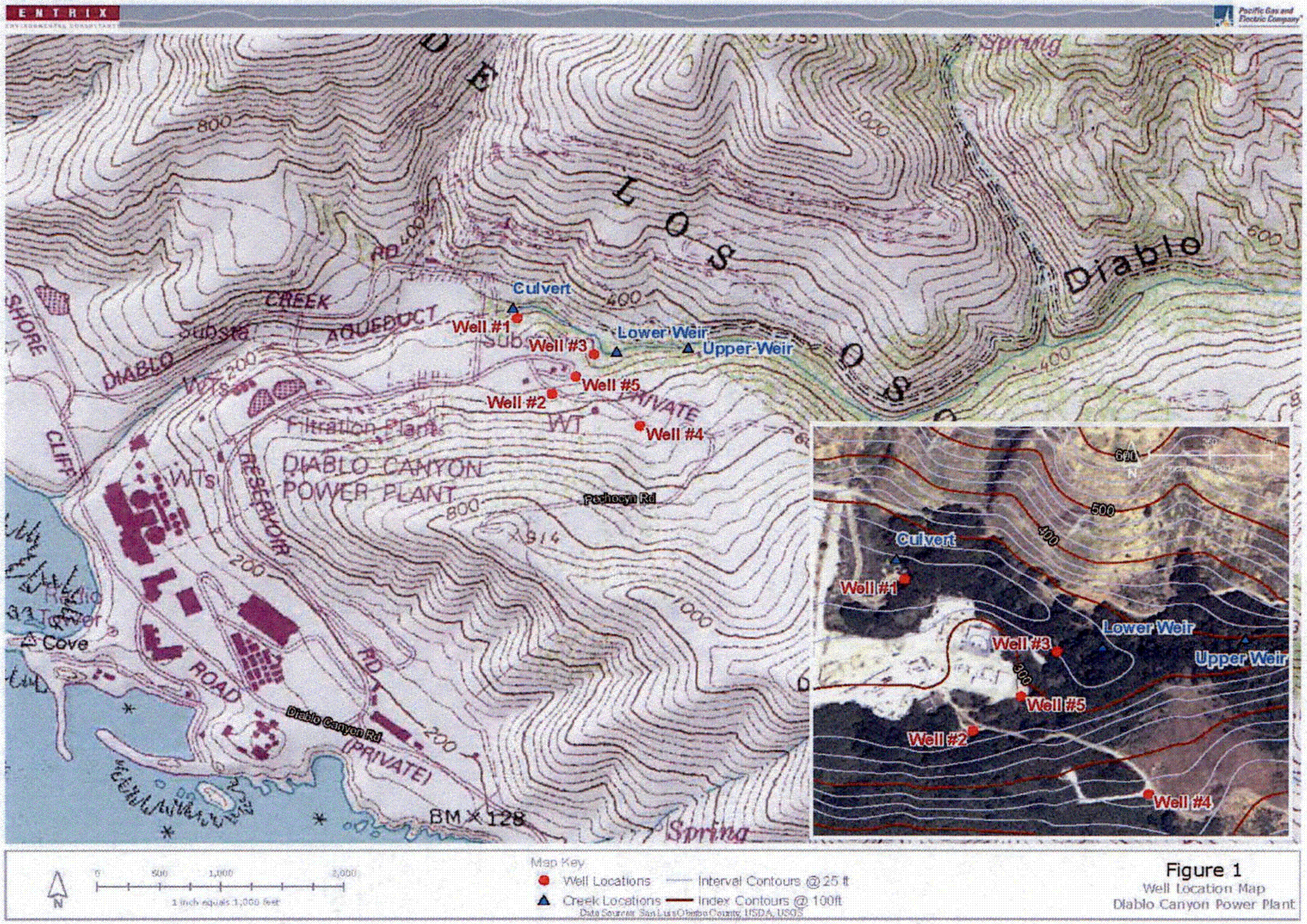

Figure 1. Map of project site showing location of monitoring stations.

2. Monitoring Well Installation (Well #4 and Well #5)

The initial task conducted during this phase of the project involved the installation of two (2) monitoring wells. The design and installation approach for the wells included the provision that each monitoring well could be converted to a production well at a future date. Therefore, careful monitoring was conducted during drilling of the monitoring wells to assess the potential well yield and water quality. Additionally, upon completion of each well, a short-term pumping test was conducted to provide an estimate of yield and allow for collection of a water sample for water quality analysis.

Both wells were drilled to relatively deep depths (506 ft and 409 ft, respectively) to allow for penetration of a significant depth of bedrock, which greatly increases the potential to intersect fracture zones that have regional connectivity and hence increased yield and drought-period tolerance. Also, deep sanitary seals were installed at the wells to provide increased assurance that shallow groundwater that could potentially be tributary to Diablo Creek is not captured by the wells. Additional details of well construction are provided in Table 2 and Figures 3 and 6, below.

Table 2. Construction Parameters for Well #4 and Well #5.

Well Construction Parameter	Well #4	Well #5
Drilled Depth	506 ft	409 ft
Borehole Diameter	10.5 inches	10.5 inches
Drilling Method	Direct Air Rotary	Direct Air Rotary/ Mud Rotary
Sanitary Seal	230 ft	75 ft
Casing Size (OD)	5 inch	5 inch
Casing Material	PVC (Sch. 80)	PVC (Sch. 80)
Screen Interval	250 - 500 ft	100 - 400 ft
Slot size	0.050 in	0.050 in
Gravel Pack	#8 mesh sand	#8 mesh sand
Initial Water Level (below ground)	219 ft	40 ft
Wellhead Elevation (ft MSL)	452.35 ft	303.93 ft
Geophysical Logs	SP, Resistivity, Sonic	SP, Resistivity, Sonic

2.1 Driller and Drilling Methods

Cascade Drilling of La Habra, CA was contracted to conduct the monitoring well installation based upon previous experience, qualifications, safety record and familiarity with PG&E projects. Cascade was directed to employ rotary air-hammer drilling methods which are appropriate for hard, fractured bedrock aquifer materials as present at the site. Cascade provided a crew of 3, an auxiliary air compressor and other ancillary drilling equipment for the installation of the two (2) monitoring wells. Geophysical well logging at Wells #4 and #5 was conducted by Welenco of Bakersfield, CA.

2.2 *Well #4*

2.2.1 Site Description

Well #4 (Figure 2) is located 0.2 miles up Sky View Road from its intersection with Deer Run Road near the Man Camp, and is at the junction of Sky View Road and the water tank road. This site was selected because it represents a high potential for sufficient flow rates to provide supplemental water production, it will likely have at most a limited effect on the existing Well #2, and its effect on Diablo Creek will likely be very limited. It is also at a sufficient distance from Well #2 and Diablo Creek to allow monitoring of up-gradient aquifer conditions that can support development of a broader understanding of aquifer water levels and possible variability in aquifer water quality.

2.2.2 Well Construction

Well #4 was drilled from October 24 to October 26, 2007 to a total depth of 506 ft beneath ground surface. Water was first encountered at 245 ft, and stabilized to a static level of 219 ft. In consideration of the depth to water, and the interest in ensuring limited connectivity to Diablo Creek, the sanitary seal was constructed to 230 ft deep. Perforated PVC casing was installed from 230-500 ft. By the time the total depth of drilling was reached, the well was naturally producing approximately 40 gpm, as evidenced by the flow resulting from the air injection employed as part of the air-hammer drilling method.

2.2.3 Well Logging

Sediments encountered during drilling included abundant clay, shale and siltstone with interspersed layers of sandstone (see State Well Drillers Report, Attachment A). Evidence of fracturing increased below 240 feet and correlates with increased water production of the well during drilling. This observation is particularly relevant because in fractured bedrock aquifers, essentially all the groundwater that is available to enter the well will be derived from fractures within the rock, rather than from the pore spaces between the sand grains. Geophysical logs run in the hole included electrical log (resistivity and spontaneous potential [SP]), gamma, sonic velocity and temperature. These logs illustrate the stratified nature of the formation and an increase in the proportion of sandstone-rich beds in the lower 60 feet of the well. The indications provided by the e-logs are largely corroborated with the lithologic monitoring conducted by ENTRIX during well drilling.

Initial stabilized water levels in the well were measured at 219 ft deep. Confined aquifer conditions are evident based upon this static water level in relation to the 230 ft depth of the sanitary seal and top of slotted casing at 250 ft deep.

Figure 2. Photo of Monitoring Well #4

2.2.4 Well Development and Testing

Well #4 was developed for a full day following well construction, including several iterations of surging and bailing at deep, medial and shallow portions of the well. Development was continued until the produced water was clear. Next, in an effort to establish potential well yield, Well #4 was pumped for two hours at a rate of 30 gallons per minute, which results in a drawdown of approximately 21 ft. Based on these data, the specific capacity of the well is approximately 1.4 gpm/ft of drawdown. Given that there are at least 200 feet of additional available drawdown, flow rates of 80 gpm are attainable if needed at a future date; although the pumping lift would be substantially greater than that needed at either Well #2 or Well #5 for this production rate.

As indicated in Table 3 below, by the end of the test, the turbidity in the water was greatly reduced and the pumping water level had nearly stabilized (Table 3, Figure 4). A water quality sample was collected at Well #4 at the end of the test, on November 8, 2007. Water quality results are provided below in Section 4.

If it is determined in the future that production from this well is needed, we suggest conducting, depth-specific water quality sampling to determine if a portion of the well's produced water is of the poorer quality than from other depths. If it is determined that a specific zone (i.e. the deepest zone, for example) is of particularly poor water quality, changes in well construction parameters may aid in controlling water quality from this well, although production rates will likely be reduced. Also, although this well still has a lower specific capacity than Well #5, it is sufficiently distant from Well #2 so as to reduce the potential for interfering cones of depression from multiple pumping wells, and is worthy of consideration to meet future production needs.

Table 3. Development of Well #4 on November 8, 2007.

Time	Elapsed Time *(min)*	Depth to Water *(ft bgs)*	Electrical Conductivity	Turbidity *(NTU)*	Volume Pumped *(gallons)*
12:49	0	217			0
12:50	1	221.85	1635	53	1
13:10	21	234.44	1488	271	600
13:30	41	237.03	1463	10.9	1200
13:50	61	237.05	1483	0	1800
14:10	81	237.69	1464	0	2400
14:30	101	238.05	1465	0.7	3000
14:50	121	238.3	1478	0	3600

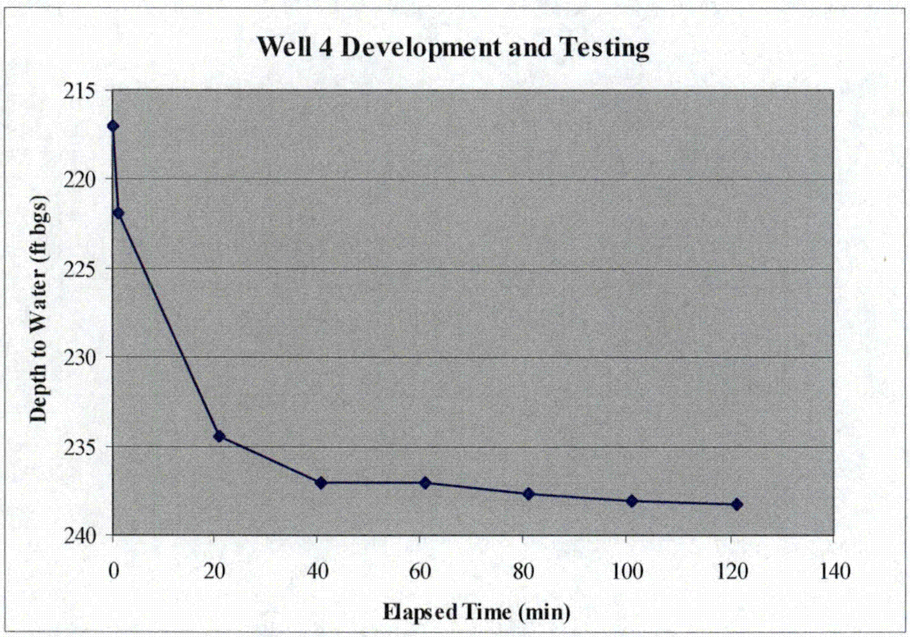

Figure 4. Drawdown at Well #4 during development and testing.

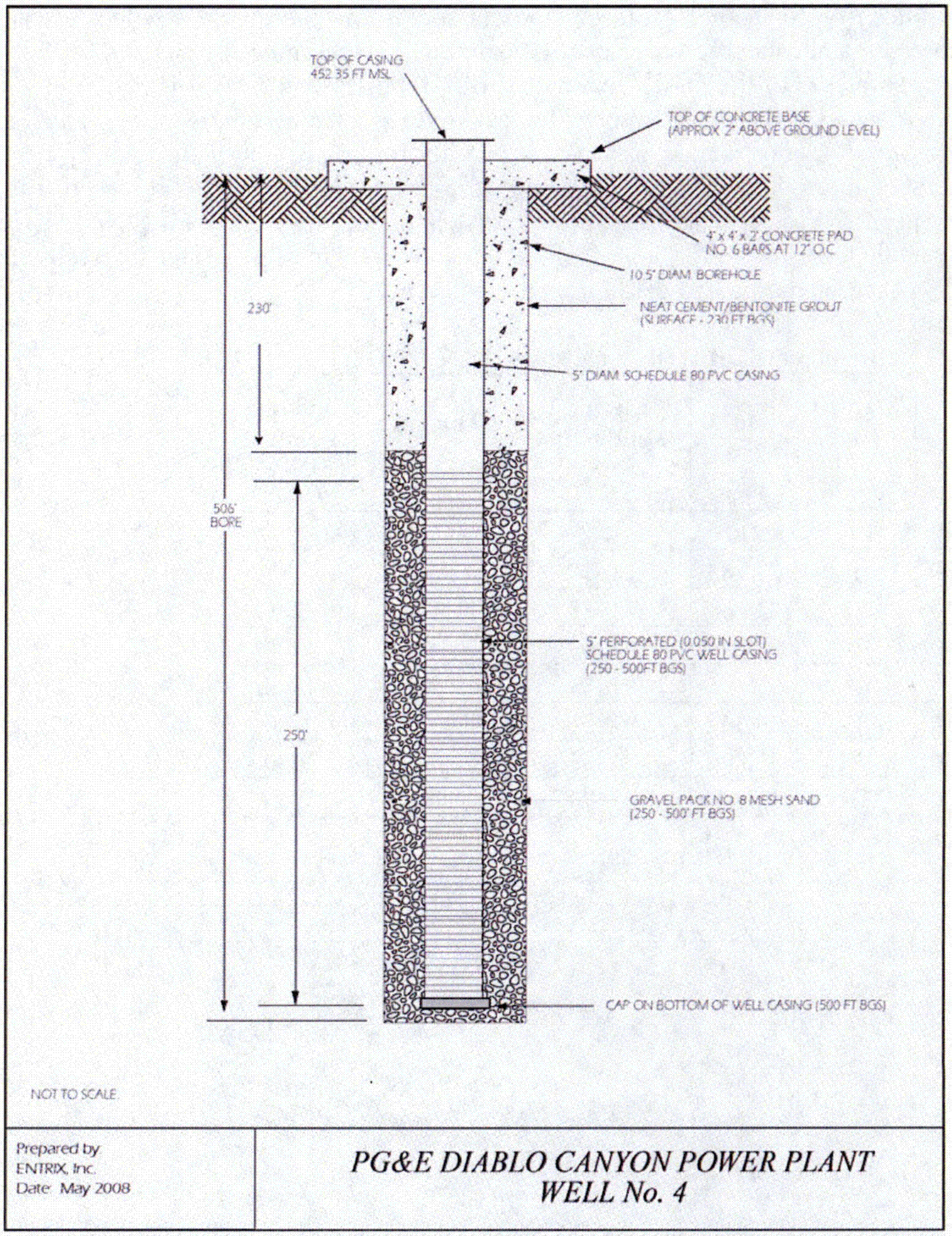

Figure 3. Schematic diagram showing Well #4 construction and lithology.

2.3 Well #5

2.3.1 Site Description

Well #5 (Figure 5) is located in the northeast corner of the Man Camp yard. Based upon the structural geologic work conducted in the Phase I study, this site is located southeast of a throughgoing N75°E structure which may represent a hydrologic barrier, and therefore the well likely encountered favorable aquifer materials with groundwater production characteristics similar to Well #2. Also, because this monitoring well is relatively close to Well #2, drawdown during the Well #2 pumping will be evident and thereby helpful in the aquifer analysis efforts.

2.3.2 Well Construction

Well #5 was drilled from October 28 to November 2, 2007 to a total depth of 409 ft beneath ground surface. Unstable downhole conditions between 50 and 250 ft required conversion from air rotary drilling methods to bentonite mud-based drilling methods. Using drilling mud is a common solution to bedrock wells having unstable sections that won't stay open with the viscosity of water only. Water was first encountered at 45 ft, and stabilized to a static level of 40 ft. In consideration of the depth to water, and the interest in ensuring limited connectivity to Diablo Creek, the sanitary seal was constructed to 75 ft deep. Blank PVC casing was installed from 75 to 100 ft; perforated PVC casing was installed from 100-400 ft. By the time the total depth of drilling was reached, the well was naturally producing over 100 gpm, as evidenced by the flow resulting from the air injection employed as part of the air-hammer drilling method.

2.3.3 Well Logging

Near surface sediments encountered during drilling of Well #5 included both siltstone with clay and/or sandy components as present at Well #4 and also a larger proportion of poorly-lithified sandstone beds (see State Well Drillers Report, Attachment B). Overall, the sediments in the upper 100 ft+ in this well were poorly consolidated which resulted in unstable hole conditions as mentioned above. Evidence of fracturing was present from approximately 50 feet and throughout the depth of the hole, and likely corresponds with the structural geologic evidence from analysis of aerial photographs that this site is within a northeast-trending fracture system.

Figure 5. Photograph of Well #5.

Geophysical logs run in the hole included electrical log (resistivity and spontaneous potential), gamma, sonic velocity and temperature. Collectively, these logs illustrate the stratified nature of the formation and an increase in the proportion of sandstone-rich beds in the upper and lower portions of the well. The indications provided by the e-logs are largely corroborated with the lithologic monitoring conducted by ENTRIX during well drilling.

Initial stabilized water levels in the well were measured at approximately 80 ft deep. Confined aquifer conditions are evident based upon this static water level in relation to the 250 ft depth to the top of slotted casing.

2.3.4 Well Development and Testing

Well #5 was developed for 7.5 hours following well construction, including several iterations of surging and bailing at deep, medial and shallow portions of the well. Development was continued until the produced water was clear. Next, in an effort to establish potential well yield, Well #5 was pumped for over two hours at a rate of 49 gallons per minute, which resulted in a drawdown of approximately 9 ft (Figure 7). Based on these data, the specific capacity of the well is approximately 5.9 gpm/ft of drawdown, which represents a higher specific capacity than that measured at Well #4. Based upon this, albeit limited, production test, this well likely has a production capacity equal to or greater than that of Well #2. Given that there are at least 300 feet of additional available drawdown, flow rates of 150 gpm may be possible if needed at a future date. Note that the initial recovery of the well's water level is illustrated in the graph to show the rapid water level response when pumping stopped.

For the second half of the test, the measured turbidity in the water was "0" (see Table 4) indicating that the well development was successful to remove turbid material from both the drilling process and from the use of drilling mud.

A water quality sample was also collected at Well #5 on November 10, 2007. Water quality results are provided in Section 4 below.

Based on this pumping test and water quality data, Well #5 has a higher specific capacity and better water quality than Well #4, and represents a more viable alternative if at a future date conversion to a production well is needed. However, because Well #5 is located near the existing Well #2, and approximately 9 feet of drawdown was observed at Well #5 during the pump test of Well #2, consideration and planning of the combined drawdown effects is needed to adequately forecast the combined yield of the two wells operating together.

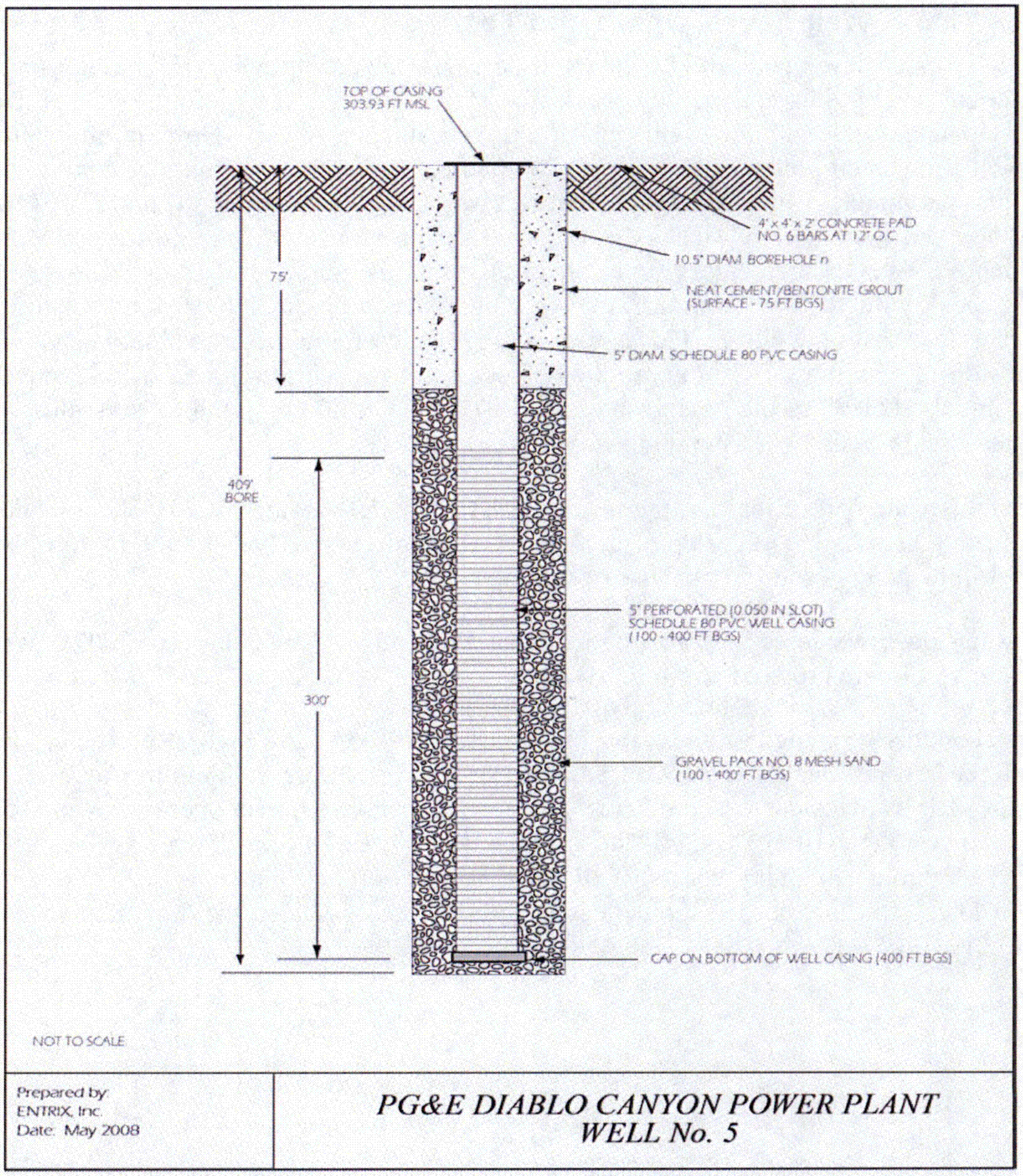

Figure 6. Schematic diagram showing Well #5 construction and lithology.

Table 4. Development of Well #5 (November 10, 2007).

Time	Elapsed Time	Depth to Water	Electrical Conductivity	Turbidity	Volume Pumped
	(min)	*(ft bgs)*		*(NTU)*	*(gallons)*
7:25		80			
7:30	0	80			
7:50	20	85.3	1020	3.31	1000
8:10	40	86.35	962	1.65	2000
8:30	60	87.12	948	1.3	3000
8:50	80	88.31	943	1.2	4000
9:10	100	88.4	941	0	5000
9:30	120	88.41	935	0	6000
9:52	142	83.55	930	0	7000

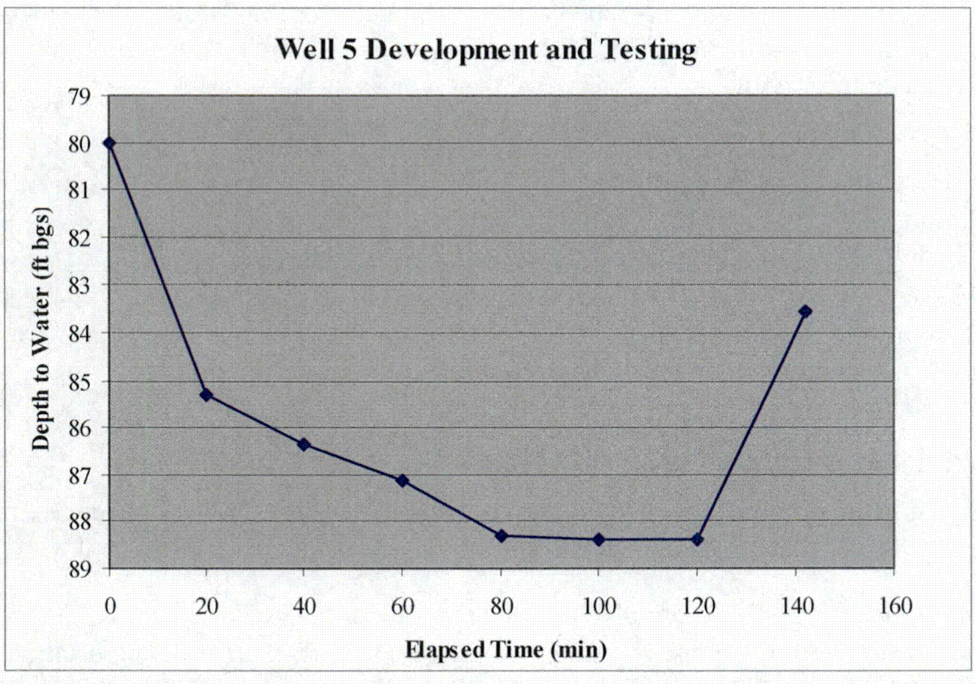

Figure 7. Drawdown at Well #5 during development and testing on November 10, 2007.

3. Well #2 Rehabilitation and Testing

3.1 Well Rehabilitation

Well #2 was rehabilitated to provide a series of benefits such as increased reliability, potential for increased yield, and increased operating efficiency of the well. With cessation of Diablo Creek diversions, the increased dependence upon groundwater can be supported by ensuring Well #2 is mechanically and physically sound.

Well #2 was originally installed in 1985 to a total depth of 350 feet by Floyd V. Wells, Inc of Santa Maria, California. The 10-inch diameter Schedule 200 PVC casing is perforated from 90 ft bgs to total depth, with 0.040 full-flow horizontal-slot well screen.

3.1.1 Results of Pump, Motor, and Column Pipe Inspection

The existing pump and motor on Well #2 were removed by Fisher Pump of Santa Maria, CA, under contract to Woodward Drilling Co. of Rio Vista, CA. The motor, pump and pump column although marginally operational all exhibited signs of wear and debilitation typical of 20-year old equipment. It was determined that replacement of these components was in the best interest of DCPP and a greater reliability of the groundwater supply produced by this facility.

3.1.2 Video Log Results

Following pump removal, a video logging tool was used to visually inspect the downhole conditions of Well #2. This video file provided evidence of the presence of encrustation of the well casing, mainly below 238 ft, and the existence of an approximately 20 ft thick pile of debris at the bottom of the well (Attachment C). Using these data, well rehabilitation was recommended to include swabbing, brushing, air jetting and bailing.

3.1.3 Description of Well Rehabilitation Tasks Performed

Based upon results of the video investigation, described above, the following steps were performed:

- Bail out most of accumulated sediment from bottom of well.
- Brush well with plastic-bristle brush to remove major areas of encrustation.
- Additional sediment removed by bailing followed by air lifting.
- Swab well with dispersant and detergent to clean casing encrustation and re-open clogged perforations.
- Re-develop well with swab tool and conduct additional air lifting to remove all dispersant and suspended material.

3.2 Spinner Test

Upon completion of well rehabilitation work, velocity logging of the well was conducted by Pacific Surveys of Claremont, CA to determine the depth-distribution of groundwater inflow into the well. This involves lowering a flow-metering logging tool into the well and pulling it up past the productive zones during active pumping. The relative inflow rates at the various depths of the well are evident from this effort and can provide valuable information if certain zones exhibit dominant flow rates and/or associated water quality issues. The actual logs provided by the contractor are included as Attachment C.

For the spinner test, the well was pumped at a rate of 90 gpm for 2.5 hours prior to and during the survey. During the test; the pumping water level was 149 ft bgs. The results of the velocity logging, summarized in Table 5, indicate that there are two primary productive zones that produce over 90% of the flow into the well. The top logged interval, from the top of the perforations at 100 ft bgs to 158 ft bgs, produces approximately 30% of the flow. This zone is underlain by an approximately 30-foot thick low productivity zone. The most productive zone is located from 190-275 ft bgs.

Water quality samples were collected at 158 ft bgs, 190 ft bgs, and 275 ft bgs. The pump was set at a depth of 160 ft bgs during this test, which is a fundamental consideration because the pump set-depth influences flow direction within the well, and this is an important consideration for assessing the representativeness of depth-specific water quality samples. Given the direction of flow within the well, the water quality sample collected at 158 feet represents water from the 100-158 foot interval; the sample collected at 190 feet represents water from the 190-275 foot flow zone; and water collected at 275 ft bgs represents the lowest flow zone sampled (275-350). Discussion of the water quality sample analytical results is provided in section 4 below.

Table 5. Well #2 Spinner Log Analysis

Flow Rate = 90 gpm				
Zone Depths	**Production**	**% of Flow Zones**	**gpm/ft**	**Thickness**
(ft bgs)	***(gpm)***			***(ft)***
100-158	20	26%	0.34	58
158-190	4	4%	0.13	32
190-275	63	67%	0.74	85
275-350	3	3%	0.04	75

3.3 Pump Tests for Evaluating Well Yield

A series of diagnostic pumping tests were conducted to evaluate the Well #2 yield, as well as its water quality. Results for these tests were used to establish the well's sustainable yield, specify a new submersible well pump and motor, evaluate if groundwater pumping effects flows in Diablo Creek, and assess groundwater water quality.

A step drawdown test and a constant rate test were performed at Well #2 between November 20 and December 6, 2008 using a temporary test pump, installed at a depth of 300 ft bgs. For over 4 weeks prior to this test, monitoring of water levels was conducted at Well #1, #2, and at the Diablo Creek facilities. Monitoring data was also collected at the newly constructed Wells #4 and #5 soon after their respective completion dates. These data provide a trend and variation history of water levels at these various locations which is useful to establish the natural variability of these water resources in comparison with the stresses imposed by the pumping tests.

A final pumping test was run in June and July, 2008 to provide specific data to evaluate if groundwater pumping affects water levels in Diablo Creek and also to compare groundwater water quality between these two water bodies.

3.3.1 Step Drawdown Test

A step drawdown test was conducted to assess the Well #2 optimal and maximum potential sustainable yields. This test involved pumping the well at a series of four (4) increasingly higher pumping rates for 60 minutes each. The graph of the drawdown and production data was used to determine the well's highest sustainable yield and also to determine the optimal pumping rate for the multi-day constant rate test.

On November 20, 2007, a step-rate test was conducted at the rehabilitated Well #2. The pump set depth was 300 ft bgs. A total of 36,300 gallons were pumped during the course of the test. The rates used in the test are provided below in Table 6.

A graph of the results of the step drawdown test is provided in Figure 8. Drawdown stabilized during the two lower flow rate portions of the test, but not at the two higher flow rate portions. As is relatively common for wells producing from fracture systems of a bedrock aquifer, extended time is needed at moderate to high flow rates to achieve stabilized pumping water levels.

In this well, during the 175 gpm pumping of Step 3, water levels continued to decline from 208.2 ft bgs after 5 minutes of pumping to 216 ft bgs after 58 minutes of pumping. It is possible, but not assured that the well could have stabilized its drawdown over a longer duration. Additionally, the well was unable to sustain the 215 gpm pumping rate for Step 4, which is useful information to understand the upper limit of the well's potential yield. The well recovered quickly after the pump was shut down. At the end of the step-rate test, the water level in the well was 268 ft bgs. The well achieved 90% recovery within 10 minutes after pumping ceased and water levels in the well fully recovered in approximately four (4) hours. Based upon these data, it was determined that a rate of 150 gpm would be sustainable for the duration of the planned constant rate pump test.

Table 6. DCPP Well #2 – Step Rate Test

	Date	**Start Time**	**Pumping Rate** *(gpm)*
Step 1	11/20/2007	10:00	75
Step 2		11:00	125
Step 3		12:00	175
Step 4		13:00	215
		13:03	215
		13:05	205
		13:10	200
		13:20	195
		13:40	195
		13:55	195

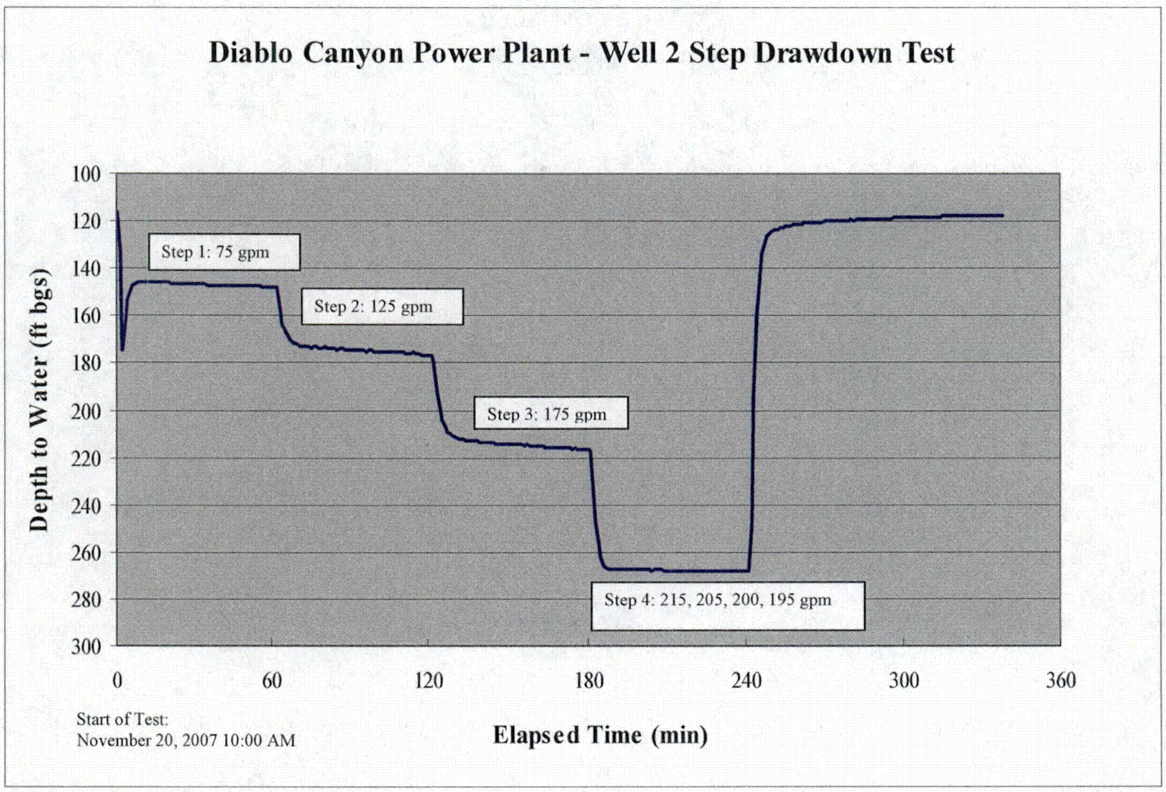

Figure 8. Graph of Step Drawdown Test at Well #2.

3.3.2 Constant Rate Tests

A constant rate pumping test was conducted at Well #2 starting at 14:30 on November 26, 2007 and ending at noon on December 6, 2007. The static water level at Well #2 at the start of the test was 112.7 ft bgs and the water level just before the pump was stopped was 238.6 ft bgs. A total of 2,321,000 gallons were pumped during the 10-day constant rate test at a relatively constant rate of 150 gpm. Based on these data, the specific capacity of the well is 1.2 gpm/ft of drawdown.

As illustrated in Figure 9, the pumping water level at the well dropped steadily and stabilized at approximately 223 ft bgs by the second day of the test. Two additional, discrete steps in the drawdown occur at approximately 48 hours and at approximately 214 hours. These are related to minor adjustments of the gate valve on the discharge pipe in an effort to re-establish the target pumping rate of 150 gpm. The well achieved 80% recovery within three (3) hours of the end of the constant rate test, and 94% recovery on week later.

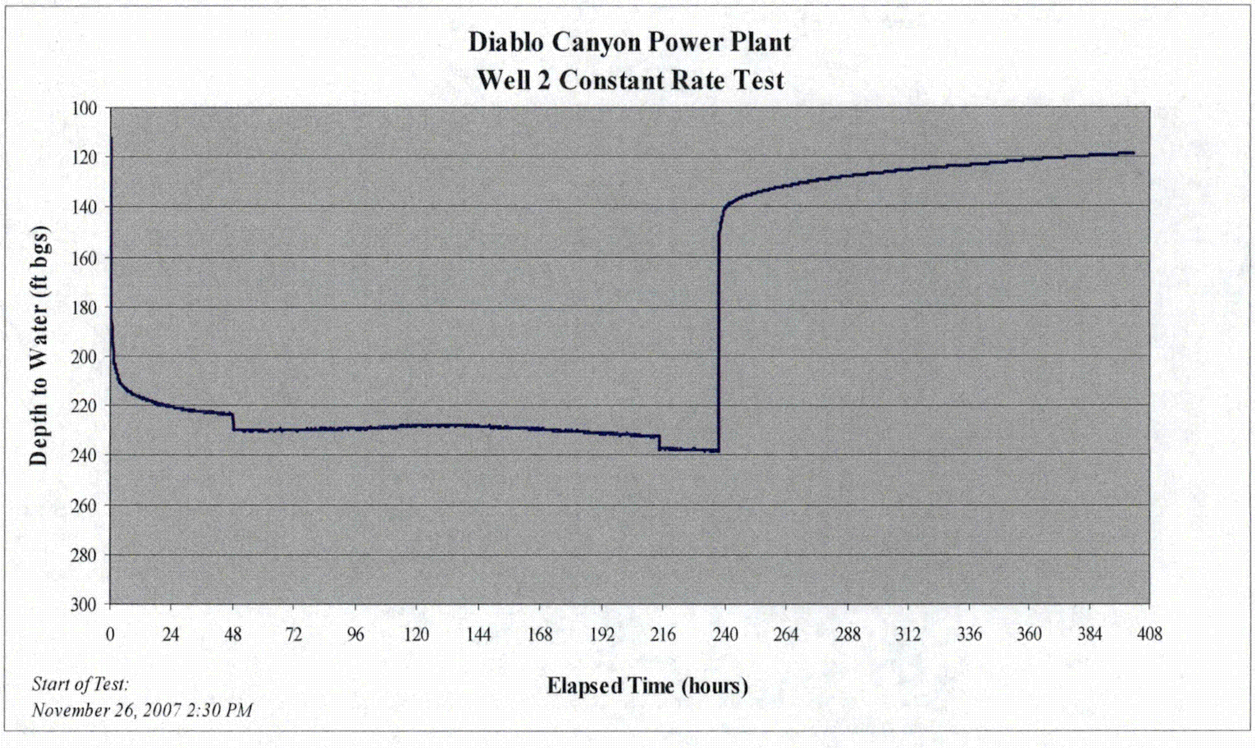

Figure 9. Water levels at Well #2 during the constant rate pumping test.

In addition to recording pumping water levels at Well #2, several other wells on the property and two surface water monitoring stations on Diablo Creek were monitored before and during the constant rate test. A further discussion of water level monitoring results at these monitoring stations is provided in Section 4.

Water quality sampling was conducted during the test at the middle and just before shut-down. Results are provided and analyzed in Section 5.

Collectively, these data indicate the firm reliability of Well #2 to produce 150 gpm on a long-term basis under normal operating conditions. Currently, normal well operations require the well to be operated at intervals of several hours per day. With the future decommissioning of the Diablo Creek diversion, an increased demand may be established on Well #2 for water supply. Based upon the results of these tests, Well #2 could be operated at its design flow rate of 150 gpm for significantly longer periods per day while still maintaining acceptable margins of safety with respect to pumping water levels.

Importantly, because of the limited rainfall in the years preceding this test, drought-type conditions exist and the results of this testing can be considered representative of limited water availability conditions. Although not necessarily worst-case conditions, the yield of the well and response of the aquifer will not be any worse than that exhibited during this test except during periods of even more extreme drought conditions. In a multi-year drought, if a greater amount of groundwater is needed than is produced from the well under its typical operating patterns, the well could be (a) run for more hours per day and/or (b) retrofitted with a higher capacity pump set at a deeper level. Finally, during periods of higher rainfall and therefore more "average" water supply within the aquifer, the yield of the well as currently equipped will likely be greater and the associated drawdown effects on the aquifer will be less.

3.5 Pump Specifications

Upon inspection, the condition of the pump, motor and column pipe were determined to be sufficiently degraded to warrant replacement. A replacement pump, motor and column pipe was specified, as described below. Installation and operability testing of these components was conducted on April 18, 2008 by Fisher Pump of Santa Maria, CA.

Pump:	Grundfos Submersible model #150S150-7
Pump Serial Number:	07L19-06-6129
Motor:	15 hp Franklin
Motor Protector:	Franklin SubMonitor
Control Panel:	Siemens, Class 87
Column Pipe:	300 ft of 4-inch
Probe access tube:	1-inch PVC (300 ft)

4. Aquifer Response to Pumping Test

The response of the aquifer to pumping at Well #2 was evaluated using water level data collected from Wells # 1, #4, and #5 during the constant rate pumping test conducted in 2007. In addition, a second constant rate pumping test was conducted from June 25 to July 2, 2008 to evaluate the response of water levels in Diablo Creek to pumping water from Well #2. As part of this analysis, groundwater and creek water level data were collected before, during and after a test with contemporaneous measurements from the pumping well. Data collected during the 2008 pumping test were also compared with data from the 2007 pump test to further evaluate the aquifer response to pumping at Well #2.

4.1 Monitoring Locations

Water levels at several wells and two surface water monitoring sites on Diablo Creek were monitored before and during the constant rate tests at Well #2 (Figures 10 and 11). In addition, meteorological conditions were noted at the site and were also reviewed as available from the nearest gauging station, the Nipomo CIMIS station. The Nipomo station provides comprehensive data, but its inland setting records different climatologic conditions than the coastal conditions at DCPP.

4.1.1 2007 Constant Rate Pumping Test

During the first constant rate test water levels were monitored in Well #1, near Diablo Creek; Well #4, up the hill from Well #2; and Well #5, near the Man Camp. These wells were outfitted with pressure transducer devices that automatically collected water level data at a programmed frequency of one measurement every 30 minutes.

Data was also collected at two locations in Diablo Creek during this test. However, DCPP water diversions from the creek during the pumping test created water level variations that prevented determination of any relationship between pumping at Well #2 and creek flow.

4.1.2 2008 Constant Rate Pumping Test

Water levels at wells #1, #2, #4, and #5, and two surface monitoring sites on Diablo Creek were monitored before and during the 2008 constant rate test. Wells #2 and #5 as well as the two creek locations were monitored with pressure transducers that automatically collect and record water level data at programmed frequencies. Water levels in Well #1 and Well #4 were measured manually with a water level meter just prior to the start of the test and periodically during the pump test. For the duration of the pumping test, diversions from the Lower Weir pond were stopped.

Diablo Creek water levels were monitored throughout the test at the Lower Weir and approximately 1,000 feet downstream of the Lower Weir, before the creek enters a drainage culvert. Where the stream enters the drainage culvert a notched wooden plank establishes a small pool which flows into the drainage culvert.

4.1.3 Effect of Constant Rate Pumping Test at Monitoring Wells

4.1.3.1 2007 Constant Rate Pump Test

Water levels in Monitoring Wells #1 and 4 did not show drawdown effects related to pumping at Well #2 during the course of the constant rate pumping test (Figure 10). The greatest observed effect was approximately 9 feet of drawdown at Well #5, which is the closest monitoring well to the pumping well, at a distance of approximately 250 feet.

Water levels in Well #4 remained unchanged throughout the test. This is indicative of both the source of the Well #2 water being largely from aquifer zones that may not be physically connected to Well #4, and also because the upgradient position and distance of Well #4 relative to #2 minimizes the influence of the Well #2 drawdown.

Water levels in Well #1 show a slight and very gradual rise that corresponds in timing with the pumping at Well #2. This is likely related to the discharge point of the pumped water which occurred approximately 200 feet southwest of Well #1, and therefore probably induced recharge to the shallow, unconfined sediments in which Well #1 is completed.

4.1.3.2 2008 Constant Rate Pump Test

Water levels in Monitoring Wells #1 and #4 dropped from approximately 27.4 ft bgs and 223 ft bgs, respectively, just before the test down to 31.8 ft bgs and 232.4 at the end of the test (Figure 11). During the second constant rate test the discharge point of the pumped water was relocated to a point inside a drainage culvert which is downstream of all sampling locations. This a distinct difference in the response of Well #1 water levels between the two constant rate tests.

The water level in Well #5 dropped from approximately 80 ft bgs before the test to approximately 98 feet just before the test was halted. This is greater drawdown as compared with the 2007 test is a result of the higher Well #2 pumping rate maintained during the 2008 test which resulted in approximately 20 ft more drawdown in that well as compared with the 2007 test.

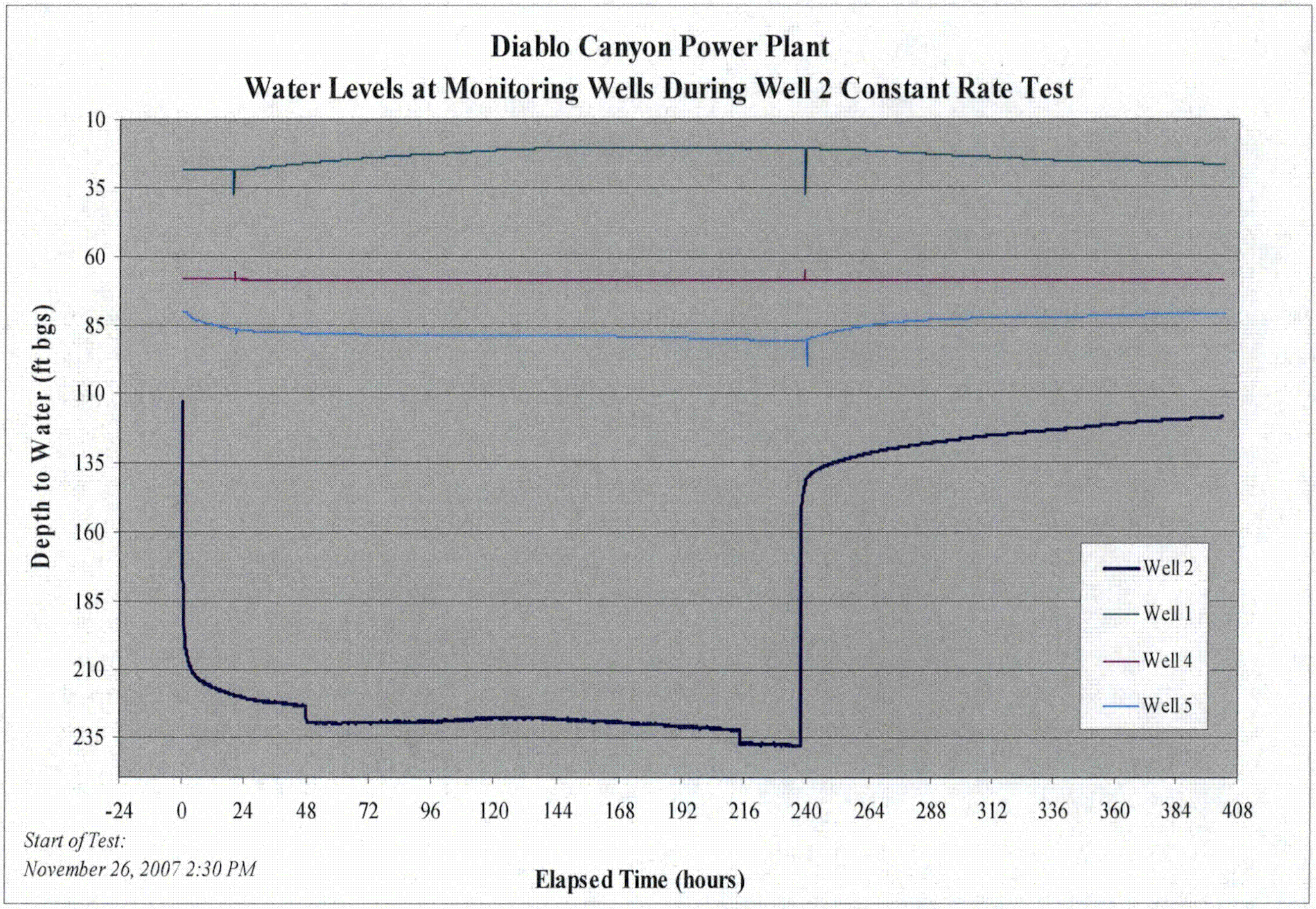

Figure 10. Water levels in DCPP Wells during November 2007 constant rate test.

4.1.4 Effect of Constant Rate Pumping Test at Surface Water Monitoring Locations

A pumping test was conducted from 13:30 on June 25, 2008 to 13:45 July 2, 2008 to investigate any existing relationships between water levels in Diablo Creek and pumping water from Well #2.

Data were collected in both creek locations using pressure transducers automatically programmed to collect water level data. Data collection began on April 18, 2008 and was terminated on July 3, 2008. An overall saw-tooth trend of declining water levels can be seen in the data set, consistent with a baseline-recession trend of a stream in transition from the wet to dry season (Figure 12a).

The data collected before the pumping test show correlations between water levels at the Lower Weir and the culvert with frequent drops in water levels at the lower weir, presumably resulting from diverting water from the Lower Weir to the holding tanks on-Site. For the duration of the pumping test, diversions from the Lower Weir pond were stopped. The characteristic drop in water levels at the Lower Weir is not present and the water levels at both creek sampling points follow the same trend (Figure 12b).

Creek water level variability during the pump test is within the normal range captured in the dataset. Approximately 26 hours into the pumping test, a water level drop of approximately 0.16 feet occurred. Because fluctuations of this magnitude over similar timescales are present in the non-pumping background data extending back to April 18, 2008, this water level change is not related to the groundwater pumping. Additionally, when the pump test was terminated at 13:45 on July 2, 2008, water levels in the creek continue in a downward trend for approximately 5 hours without a significant rebound or change in water levels compared to levels seen over the duration of the test (Figure 12b).

Based upon these test data, there is no evidence that creek water levels are affected by pumping at Well #2.

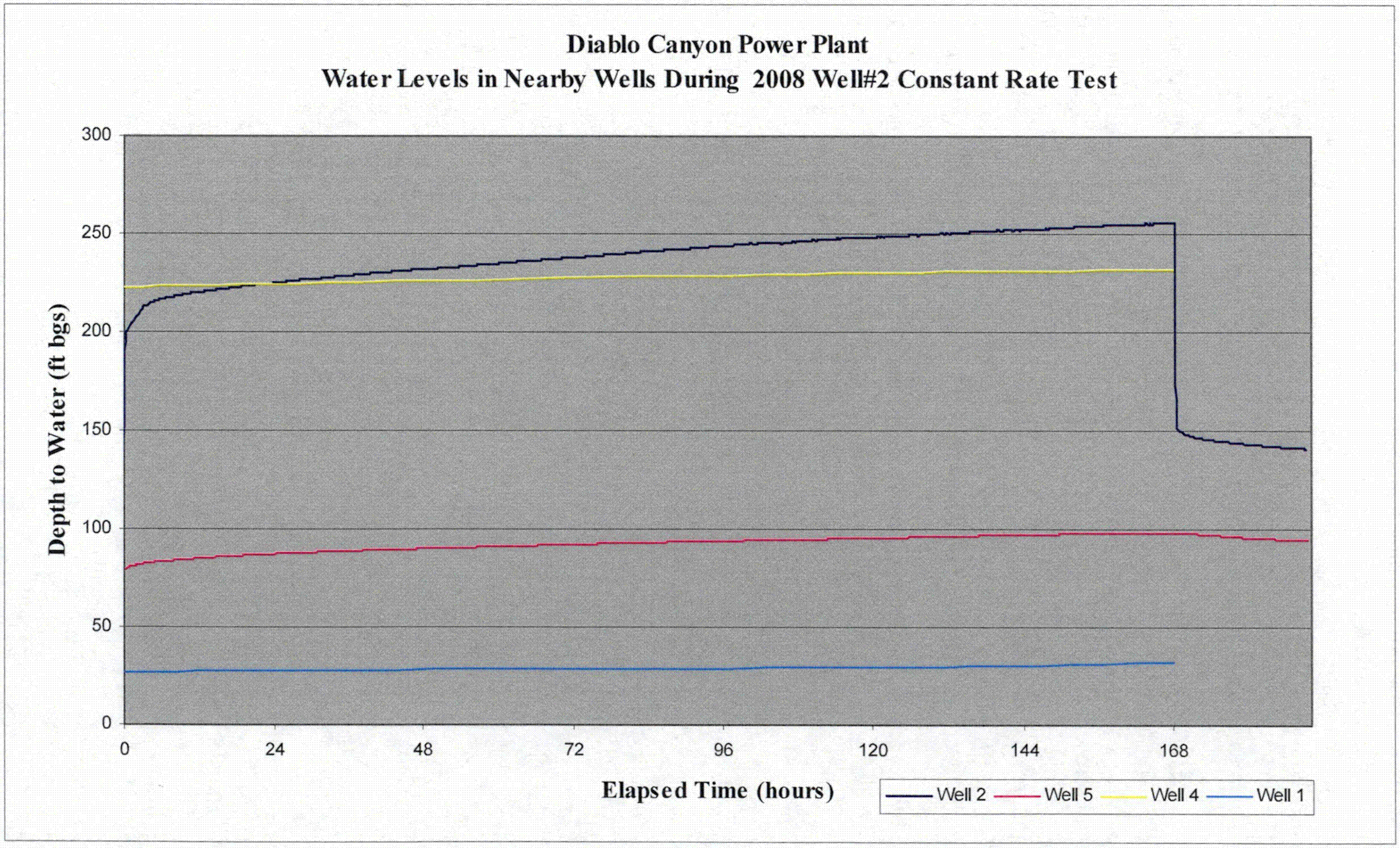

Figure 11. Water Levels in DCPP wells during June 2008 Constant Rate Test.

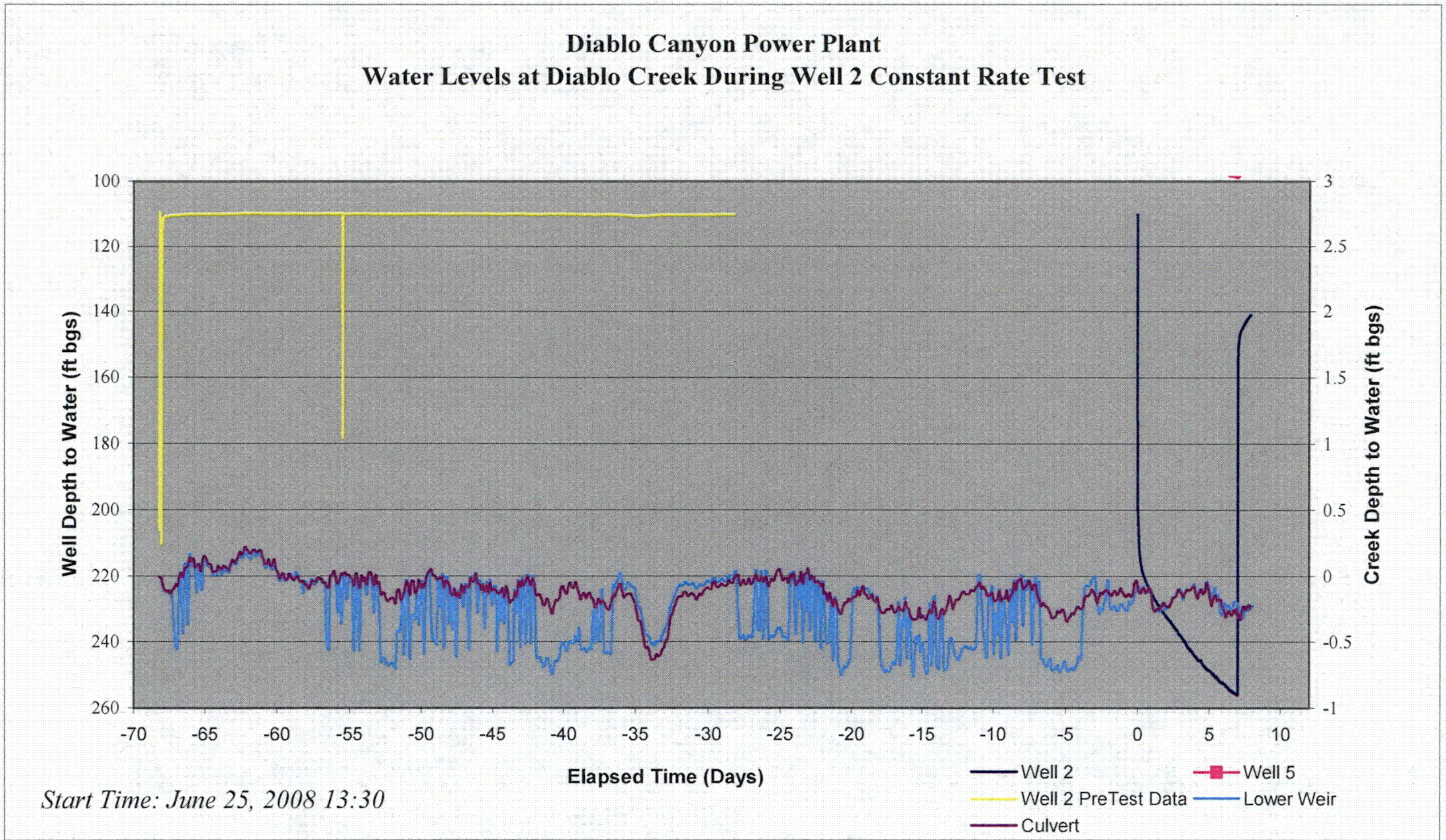

Figure 12a. Water levels at pumping well and Diablo Creek locations (0 hour represents Test start on 6/25/08).

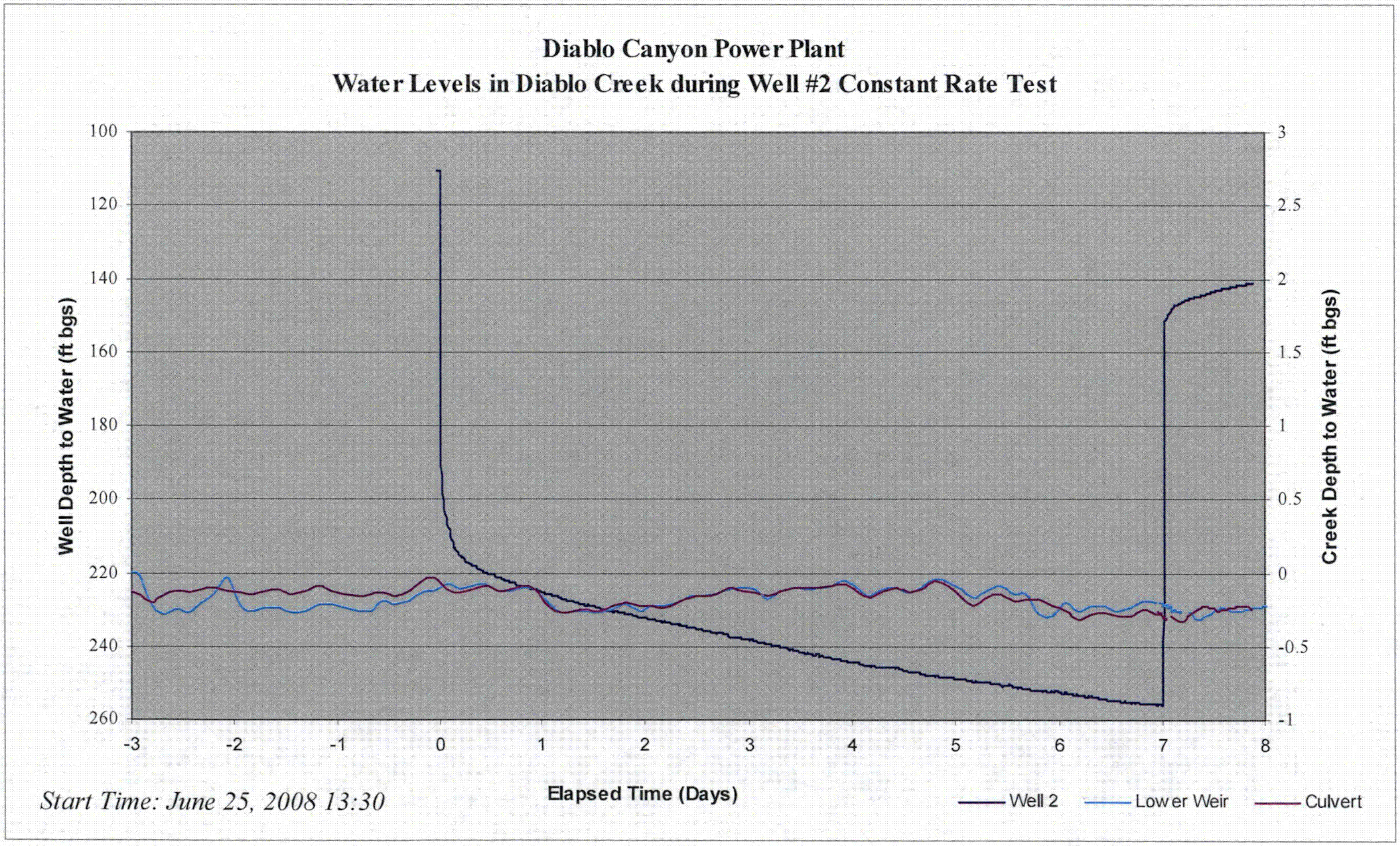

Figure 12b. Water levels at pumping well and Diablo Creek locations focused on time period of test (0 hour represents Test start on 6/25/08).

4.2 Water Quality

Water quality samples were collected at several intervals throughout the study period. Samples were collected at wells #4 and #5 during development and pumping tests. Multiple samples were collected at Well #2, as follows:

- Three sets of paired discrete depth-specific and surface (composite) samples were collected during the spinner test;
- Four samples were collected during the step test, near the end of each pumping step;
- Two paired samples from Well #2 and Diablo Creek Upper Weir were collected at the mid-point and at the end of the first constant rate pumping test (December 3 and December 6, 2007); and,
- Samples were collected at Well #2 and at Diablo Creek Lower Weir during the second constant rate pumping test (June 30, 2008).

The water quality data were then reviewed to evaluate:

- Similarity of the groundwater extracted from Well #2, Well #4 and Well #5 to assist in future water resources planning decisions;
- Water quality as a function of depth at Well #2; and,
- Similarity of surface water and groundwater composition.

A comprehensive series of tables listing all water quality data collected in this phase of the project are provided in Attachment D of this report.

4.2.1 Relative Water Quality of Wells #2, #4 and #5

In general, constituent concentrations in the water extracted from Well #5 are similar to those of the water extracted from Well #2 (Table 7). For most constituents, concentrations are lower at Well #5 than at Well #2. Water chemistry of Well #4 differs significantly from that of Wells #2 and #5 for many of the constituents sampled. Water from Well #4 is harder (it has a higher specific conductivity, and higher concentrations of total dissolved solids, alkalinity, bicarbonate, total hardness, calcium, chloride, magnesium, potassium, sodium, and sulfate) than Well #2. Water from Well #5 has a lower concentration than Well #2 for all of these constituents.

There are a few other notable differences in the water quality signature of the Well #4 water. Water from Well #4 was the only groundwater sample that was found to have a detectable odor. Nitrate was detected in all groundwater samples except for the Well #4 sample. The concentration of chromium at Well #4 was more than double the next highest concentration detected, as found at Well #2.

Well #2 was the only well with detectable arsenic concentrations and Well #2 also had significantly higher (by a factor of 4) nickel concentrations than Well #4 or #5, although both nickel and arsenic were below detection limits in the samples collected on June 30, 2008.

Iron and aluminum concentrations are quite variable (by an order of magnitude) from well to well, and among the various samples collected at Well #2. A more detailed review of concentrations of these constituents with regard to aquifer depth is provided in the following section.

Well #2 had the highest silica concentration of any of the wells (at 27 mg/l). Well #2 and Well #4 had concentrations ranging from 19-27 mg/l.

Table 7. Comparison of Well #4, Well #5 and Well #2 Composite Samples

Analyte	Units	PQL	Well #2 Composite 1 (Surface) 11/15/07 15:40	Well #2 Composite 2 (Surface) 11/15/07 15:50	Well #2 Composite 3 (Surface) 11/15/07 16:05	Well #2 12/3/07	Well #2 12/6/07	Well #2 6/30/08	Well #4 11/8/07	Well #5 11/10/07
pH	S.U.	-	6.6	6.7	6.7	6.9	6.5	7.3	6.6	6.9
Color	Color Unit	5	<5	<5	<5	<5	<5	<5	<5	<5
MBAS Surfactants	mg/L	0.1	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Odor	T.O.N.	1	ND	ND	ND	ND	ND	ND	2	ND
Spec. Conductivity	umhos/cm	1	1300	1300	1290	1280	1270	1200	1610	1050
T.D.S.	mg/L	10	790	790	790	760	780	810	1020	640
Turbidity	N.T.U.	0.1	4.5	0.69	1.4	0.39	0.4	0.1	1.4	1.8
Nitrate (as N)	mg/L	0.1	0.2	0.2	0.2	0.3	0.5	0.1	BQL	0.2
Alkalinity ($CaCO_3$)	mg/L	10	410	400	410	390	390	400	520	380
Bicarbonate($CaCO_3$)	mg/L	10	410	400	410	390	390	400	520	380
Carbonate ($CaCO_3$)	mg/L	10	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Hardness (as CaCO3)	mg/L	10	520	510	520	580	560	590	710	440
Hydroxide (as CaCO3)	mg/L	10	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Aluminum	ug/L	5	170	46	100		5.8	BQL	52	120
Antimony	ug/L	1	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Arsenic	ug/L	0.5	2.2	1.8	2		0.66	BQL	BQL	BQL
Barium	ug/L	0.5	30	27	28		38	BQL	33	30
Beryllium	ug/L	0.5	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Cadmium	ug/L	0.5	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Calcium	mg/L	0.1	97	94	95	120	110	120	150	90
Chloride	mg/L	0.2	100	100	100	94	95	91	120	69
Chromium	ug/L	1	2.8	1.7	1.9		1.3	BQL	6.1	2.2
Copper	mg/L	0.02	BQL	BQL	BQL	0.024	BQL	BQL	BQL	BQL
Fluoride	mg/L	0.1	0.4	0.4	0.4	0.5	0.5	0.7	0.3	0.4

Table 7. Comparison of Well #4, Well #5 and Well #2 Composite Samples (cont'd.)

Analyte	Units	PQL	Well #2 Composite 1 (Surface) 11/15/07 15:40	Well #2 Composite 2 (Surface) 11/15/07 15:50	Well #2 Composite 3 (Surface) 11/15/07 16:05	Well #2 12/3/07	Well #2 12/6/07	Well #2 6/30/08	Well #4 11/8/07	Well #5 11/10/07
Iron	mg/L	0.1	0.71	0.12	22	BQL	BQL	BQL	0.13	0.11
Lead	ug/L	0.5	1.5	0.63	0.62		BQL	BQL	0.65	BQL
Magnesium	mg/L	0.1	61	60	60	70	68	69	91	57
Manganese	mg/L	0.005	0.041	0.017	0.018	0.028	0.026	0.02	0.015	0.021
Mercury	ug/L	0.5	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Nickel	ug/L	1	9.5	8.2	8.5		7.8	BQL	1.5	2.6
Potassium	mg/L	0.2	2.7	2.7	2.7	2.9	2.8	3.1	8.2	2.3
Selenium	ug/L	1	2.7	2.1	2.4		3.2	BQL	BQL	15
Silica	mg/L		20	20	19			27	20	25
Silver	ug/L	0.5	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Sodium	mg/L	0.5	70	69	68	53	50	63	83	51
Sulfate	mg/L	0.5	140	150	150	160	170	150	210	87
Thallium	ug/L	0.5	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Zinc	mg/L	0.05	0.15	0.11	0.11	0.43	0.32	0.32	0.2	0.34

4.2.2 Well #2 - Water Quality vs. Depth

Three pairs of depth-specific and composite water quality samples were collected at Well #2 during the velocity logging of the well conducted on November 15, 2007. These discrete depth samples provide an opportunity to evaluate water quality from specific depths within the aquifer and to determine whether changes in pumping practices and/or changes to well construction parameters may be appropriate for improving the quality of the pumped water.

Water quality samples were collected at 158 ft bgs, 190 ft bgs, and 275 ft bgs. The pump was set at a depth of 160 ft bgs during this test. Because the pump set depth influences flow direction within the well, this is an important consideration for assessing the representativeness of depth-specific water quality samples. Given the direction of flow within the well, the water quality sample collected at 158 feet represents water from the 100-158 foot interval (which represents approximately 26% of the flow into the well); the sample collected at 190 feet represents water from the 190-275 foot interval (which produces approximately 66% of the flow into the well); and water collected at 275 ft bgs represents the deepest zone in the well from 275-350 ft bgs (which represents approximately 3% of the flow in the well).

Based upon these data (Table 8), the shallow productive zone (from 100-158 feet bgs) has substantially higher turbidity and higher concentrations of silica, total dissolved solids, nickel, aluminum and iron than the deeper productive zone (190-275 ft bgs). Figures 12a and 12b below illustrate these values. Arsenic and bicarbonate concentrations are slightly lower in the shallow productive zone as compared to the deeper productive zone. For other constituents sampled, concentrations do not differ significantly between these two production zones.

Considering these water quality differences between the uppermost zone and the lower zones, economic analysis may be needed to determine the costs and benefits of specific well construction modifications to isolate zones. If in the future one or more of these constituents adversely affects the water treatment operations, well modification approaches can be considered. First, a temporary packer could be installed to prevent the shallowest zone of poor water quality groundwater from entering the well. This device is an elongated, thick-rubber balloon that is attached to a section of column pipe and can be inflated or deflated using an air value at the wellhead. Materials and installation for this device would cost approximately $10,000. Second, the well screen adjacent to the shallowest zone of poor water quality groundwater could be permanently sealed with cement. This is a more complex operation than installation of the packer but is still viable. This approach has a similar cost to the packer option, but has an advantage of being a permanent solution, whereas the packer may need to be rehabilitated or replaced every 5 to 10 years.

In both cases, the well's produced water quality would improve and its drawdown would increase to maintain the target flow rate of 150 gpm. Because the pump operates at a fixed rate, the well would operate at a flow rate approximately 10-20 gpm less and from a pumping water level of approximately 5 to 10 feet deeper.

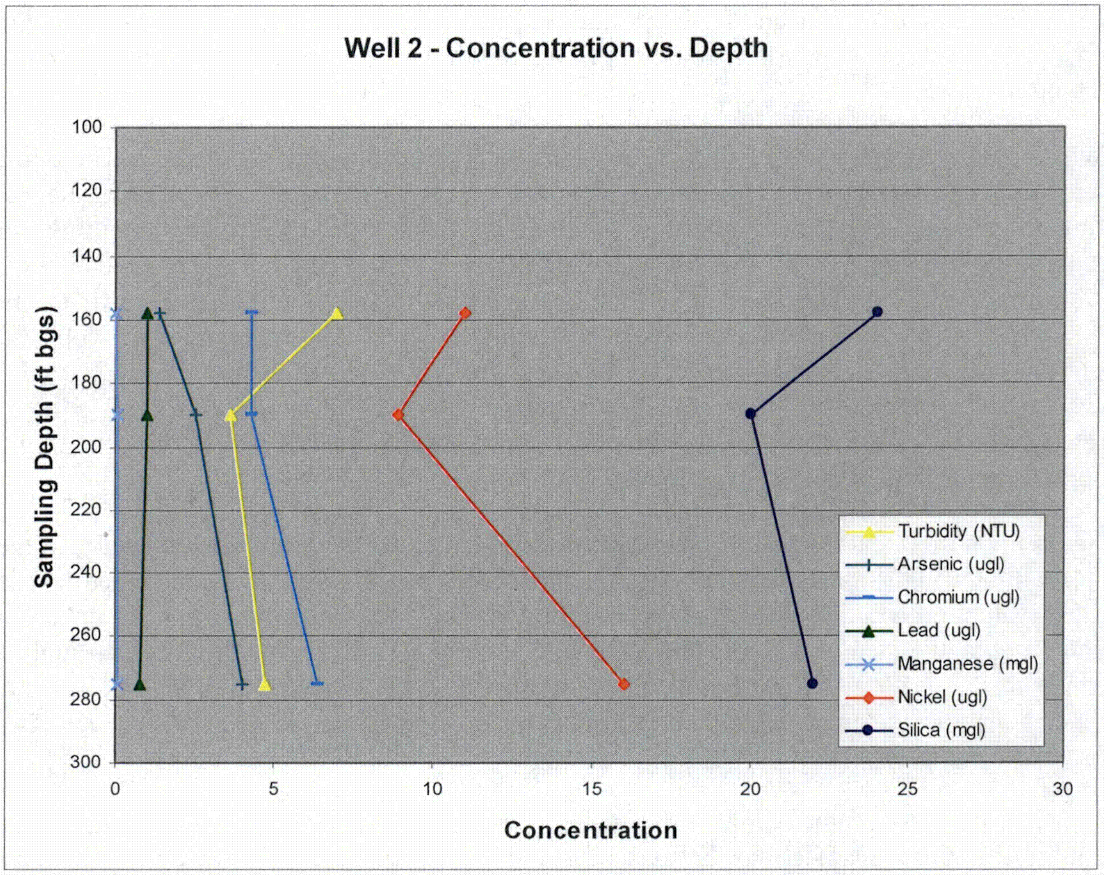

Figure 13a. Constituent concentrations as a function of depth at Well #2.

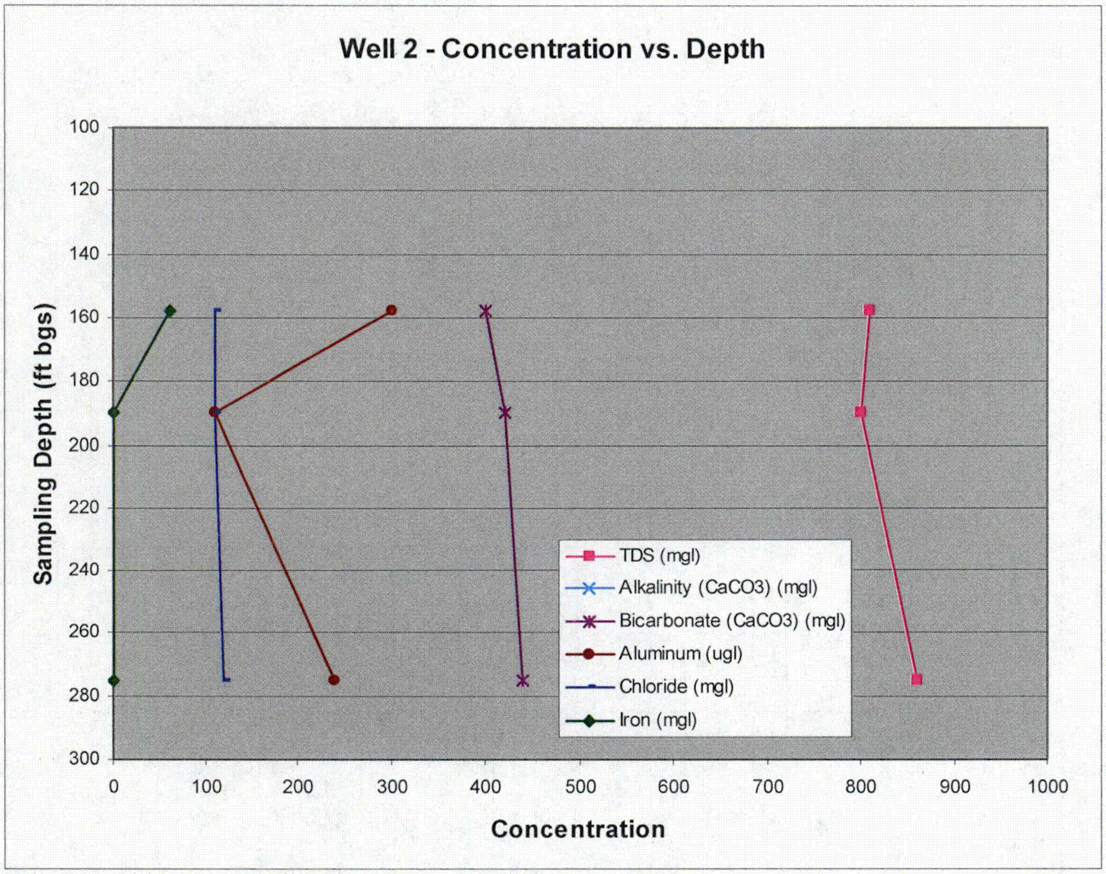

Figure 13b. Constituent concentrations as a function of depth at Well #2.

Table 8. Well #2 Depth-Specific Water Quality Results

Analyte	Units	PQL	Composite 1 (Surface) 11/15/07 15:40	Discrete 1 (275 Ft.) 11/15/07	Composite 2 (Surface) 11/15/07 15:50	Discrete 2 (190 Ft.) 11/15/07	Composite 3 (Surface) 11/15/07 16:05	Discrete 3 (158 Ft.) 11/15/07
Depth (or Pumping Water Level)				**275**		**190**		**158**
pH	S.U.	-	6.6	6.9	6.7	6.8	6.7	6.7
Color	Color Unit	5	<5	<5	<5	<5	<5	<5
MBAS Surfactants	mg/L	0.1	BQL	BQL	BQL	BQL	BQL	BQL
Odor	T.O.N.	1	ND	ND	ND	ND	ND	ND
Spec. Conductivity	umhos/cm	1	1300	1420	1300	1340	1290	1300
T.D.S.	mg/L	10	790	860	790	800	790	810
Turbidity	N.T.U.	0.1	4.5	4.7	0.69	3.6	1.4	7
Alkalinity ($CaCO_3$)	mg/L	10	410	440	400	420	410	400
Bicarbonate($CaCO_3$)	mg/L	10	410	440	400	420	410	400
Carbonate ($CaCO_3$)	mg/L	10	BQL	BQL	BQL	BQL	BQL	BQL
Hardness (as CaCO3)	mg/L	10	520	530	510	520	520	530
Hydroxide (as CaCO3)	mg/L	10	BQL	BQL	BQL	BQL	BQL	BQL
Aluminum	ug/L	5	170	240	46	110	100	300
Antimony	ug/L	1	BQL	BQL	BQL	BQL	BQL	BQL
Arsenic	ug/L	0.5	2.2	4	1.8	2.5	2	1.4
Barium	ug/L	0.5	30	26	27	27	28	35
Beryllium	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL
Cadmium	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL
Calcium	mg/L	0.1	97	95	94	96	95	100
Chloride	mg/L	0.2	100	120	100	110	100	110
Chromium	ug/L	1	2.8	6.4	1.7	4.3	1.9	4.3
Copper	mg/L	0.02	BQL	0.037	BQL	BQL	BQL	BQL
Fluoride	mg/L	0.1	0.4	0.5	0.4	0.4	0.4	0.5

Table 8. Well #2 Depth-Specific Water Quality Results (cont'd.)

Analyte	Units	PQL	Well 2 Composite 1 (Surface) 11/15/07 15:40	Well 2 Discrete 1 (275 Ft.) 11/15/07	Well 2 Composite 2 (Surface) 11/15/07 15:50	Well 2 Discrete 2 (190 Ft.) 11/15/07	Well 2 Composite 3 (Surface) 11/15/07 16:05	Well 2 Discrete 3 (158 Ft.) 11/15/07
Depth (or Pumping Water Level)				**275**		**190**		**158**
Iron	mg/L	0.1	0.71	0.73	0.12	0.43	22	62
Lead	ug/L	0.5	1.5	0.78	0.63	0.99	0.62	1
Magnesium	mg/L	0.1	61	64	60	62	60	69
Manganese	mg/L	0.005	0.041	0.056	0.017	0.03	0.018	0.0087
Mercury	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL
Nickel	ug/L	1	9.5	16	8.2	8.9	8.5	11
Potassium	mg/L	0.2	2.7	3.2	2.7	3.1	2.7	2.1
Selenium	ug/L	1	2.7	3.2	2.1	2.2	2.4	6
Silica	mg/L		20	22	19	20	19	24
Silver	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL
Sodium	mg/L	0.5	70	100	69	80	68	59
Sulfate	mg/L	0.5	140	150	150	150	150	160
Thallium	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL
Zinc	mg/L	0.05	0.15	0.07	0.11	0.069	0.11	0.099
Total Sulfide	mg/L							
Ammonia (as N)	mg/L	0.1						
Nitrate (as N)	mg/L	0.1	0.2	BQL	0.2	BQL	0.2	0.9
Nitrate (as NO3)	mg/L	1						
o-Phosphate-P	mg/L	0.05						
T.K.N.	mg/L	1						

4.2.3 Comparison of Surface Water and Groundwater Composition

A significant aspect of this study is to determine if a connection exists between groundwater from the existing DCPP production well and surface water in Diablo Creek. In addition to reviewing water level data during the pumping tests in an effort to detect trends that might indicate a significant connectivity between the extracted groundwater and the Creek, water *quality* data were reviewed to assess if any connectivity exists between the surface water and the shallow groundwater production zone.

Two methods are used to review the water quality data that were collected from Well #2 and the creek. The first is the comparison of paired water quality samples collected at the pumping well and at the creek on December 3, 2007, December 6, 2007 and June 30, 2008 (Table 9). For these sampling dates which occurred during the constant rate pumping tests at Well #2, samples were collected contemporaneously, so as to provide an instantaneous snapshot of water quality at both locations for comparison purposes.

The second method used to examine the water quality data for trends that indicate the degree of connectivity between extracted groundwater at Well #2 and the Creek was to compare the depth-specific water quality samples collected at Well #2 with water quality samples collected at the Upper Creek sampling site (Figure 14a and Figure 14b, below). If there is a significant degree of connectivity between water in the upper productive zone of Well #2 and surface water, it would be expected that the shallowest water quality sample collected from the well could have a geochemical composition similar to that of the surface water sample for a number of constituents (or more similar to the surface water than that of the deeper groundwater).

The most definitive result of this water quality comparison is the considerable variation in several key constituents, such as TDS, Chloride, Sodium, Iron, which are all substantially lower in concentration in the creek water than in groundwater. The difference is evident in comparison to both the various composite well samples as well as the depth-specific samples. The water quality difference evident in these constituents, most of which are generally considered "conservative" (i.e., they do not tend to vary with time or reactions in the subsurface), is diagnostic of largely if not entirely different water source. As one line of evidence, these data indicate limited, if any, connection between the groundwater pumping at Well #2 and creek flows.

Also, the presence of bacteria (Total Coliform and E Coli) in the creek water and its absence in well #2 water (although the Total Coliform results from the December 6, 2007 well sample was "present" but this could be a contaminated sample and therefore anomalous), is additional corroboration that groundwater pumping at Well #2 is not directly extracting water from the creek.

Table 9. Water Quality in Diablo Creek Compared to Groundwater

Analyte	Units	PQL	Well 2 Composite 1 11/15/07 15:40	Well 2 Discrete 1 (275 Ft.) 11/15/07	Well 2 Composite 2 11/15/07 15:50	Well 2 Discrete 2 (190 Ft.) 11/15/07	Well 2 Composite 3 11/15/07 16:05	Well 2 Discrete 3 (158 Ft.) 11/15/07	Well 2 12/3/07	Well 2 12/6/07	Well 2 6/30/08	Upper Weir 12/3/07	Upper Weir 12/6/07	Culvert 6/30/08
pH	S.U.	-	6.6	6.9	6.7	6.8	6.7	6.7	6.9	6.5	7.3	8.2	7.9	8.2
Color	Color Unit	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	10	10	30
Spec. Conductivity	umhos/cm	1	1300	1420	1300	1340	1290	1300	1280	1270	1200	870	870	860
T.D.S.	mg/L	10	790	860	790	800	790	810	760	780	810	530	540	540
Turbidity	N.T.U.	0.1	4.5	4.7	0.69	3.6	1.4	7	0.39	0.4	0.1	2.1	2	9.5
Alkalinity ($CaCO_3$)	mg/L	10	410	440	400	420	410	400	390	390	400	350	340	370
Bicarbonate($CaCO_3$)	mg/L	10	410	440	400	420	410	400	390	390	400	350	340	360
Carbonate ($CaCO_3$)	mg/L	10	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	10
Hardness (as CaCO3)	mg/L	10	520	530	510	520	520	530	580	560	BQL	430	430	420
Hydroxide (as CaCO3)	mg/L	10	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Aluminum	ug/L	5	170	240	46	110	100	300		5.8	BQL		63	0.25
Arsenic	ug/L	0.5	2.2	4	1.8	2.5	2	1.4		0.66	BQL		2.1	BQL
Barium	ug/L	0.5	30	26	27	27	28	35		38	BQL		57	BQL
Cadmium	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL		BQL	BQL		0.61	0.001
Calcium	mg/L	0.1	97	95	94	96	95	100	120	110	120	99	89	90
Chloride	mg/L	0.2	100	120	100	110	100	110	94	95	91	33	33	33
Chromium	ug/L	1	2.8	6.4	1.7	4.3	1.9	4.3		1.3	BQL		1.7	BQL
Copper	mg/L	0.02	BQL	0.037	BQL	BQL	BQL	BQL	0.024	BQL	BQL	BQL	BQL	BQL
Fluoride	mg/L	0.1	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.7	0.3	0.3	0.4
Iron	mg/L	0.1	0.71	0.73	0.12	0.43	0.22	0.62	BQL	BQL	BQL	BQL	0.00011	0.27
Lead	ug/L	0.5	1.5	0.78	0.63	0.99	0.62	1		BQL	BQL		BQL	BQL
Magnesium	mg/L	0.1	61	64	60	62	60	69	70	68	69	54	50	47
Manganese	mg/L	0.005	0.041	0.056	0.017	0.03	0.018	0.0087	0.028	0.026	0.02	BQL	BQL	BQL

Table 9. Water Quality in Diablo Creek Compared to Groundwater (cont'd.)

Nickel	ug/L	1	9.5	16	8.2	8.9	8.5	11		7.8	BQL		11	0.01
Potassium	mg/L	0.2	2.7	3.2	2.7	3.1	2.7	2.1	2.9	2.8	3.1	2.9	2.6	2.5
Selenium	ug/L	1	2.7	3.2	2.1	2.2	2.4	6		3.2	BQL		1.2	BQL
Silica	mg/L		20	22	19	20	19	24	24	23	27	31	29	33
Silver	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL		BQL	BQL		BQL	BQL
Sodium	mg/L	0.5	70	100	69	80	68	59	53	50	63	22	19	23
Sulfate	mg/L	0.5	140	150	150	150	150	160	160	170	150	88	89	82
Thallium	ug/L	0.5	BQL	BQL	BQL	BQL	BQL	BQL		BQL	BQL		BQL	BQL
Zinc	mg/L	0.05	0.15	0.07	0.11	0.069	0.11	0.099	0.43	0.32	0.32	0.13	0.065	BQL
Nitrate (as N)	mg/L	0.1	0.2	BQL	0.2	BQL	0.2	0.9	0.3	0.5	0.1	BQL	BQL	BQL
E. Coli										absent	absent		present	present
Total Coliform										present	absent		present	present

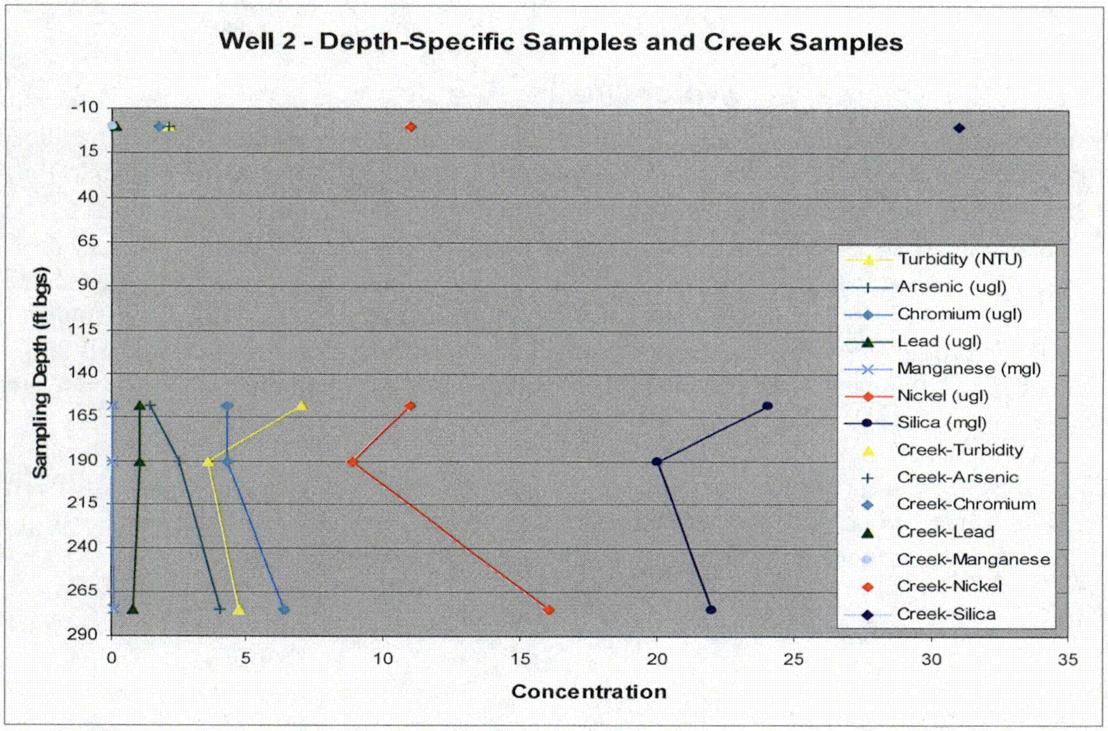

Figure 14a. Constituent concentrations as a function of depth at Well #2 and Diablo Creek.

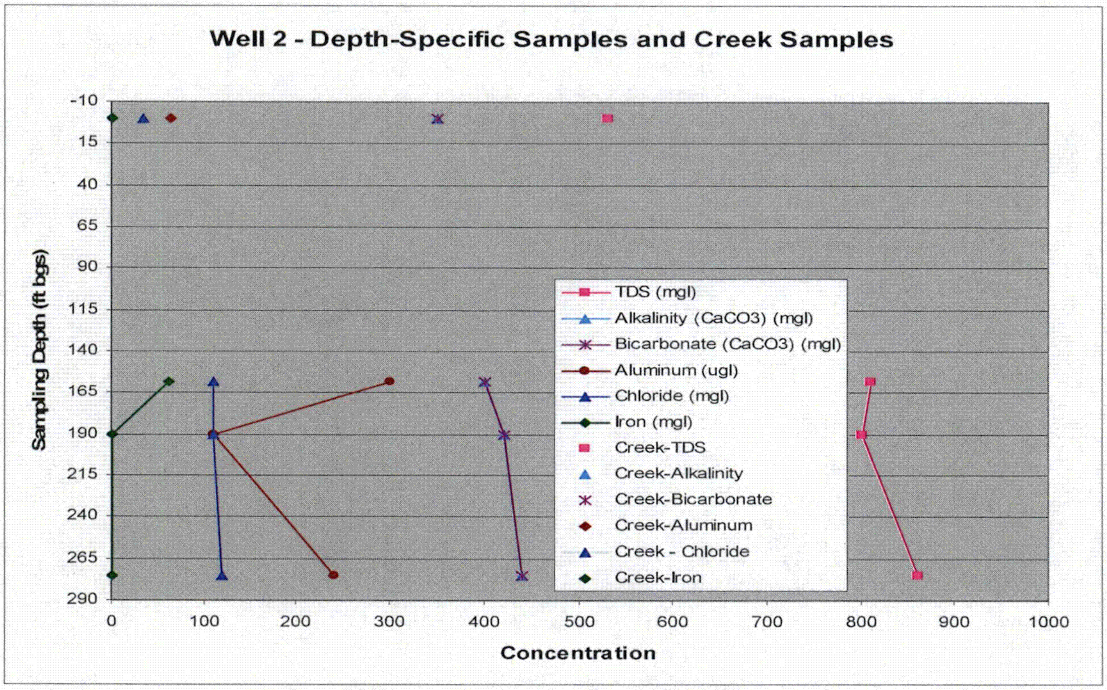

Figure 14b. Constituent concentrations as a function of depth at Well #2 and Diablo Creek.

4.2.4 Summary of Water Quality Results

Depth-specific water quality testing indicates that the water extracted from the deep production zone is higher quality (i.e., generally lower in constituent concentrations important to plant operations) than water extracted from the shallow production zone. In order to reduce concentrations of certain constituents in extracted groundwater, such as silica, the upper screened portion of Well #2 could be temporarily or permanently sealed. Doing so would improve the quality of pumped groundwater from Well #2. However, this upper productive zone represents approximately 20% of the flow in the well and if this portion of the well is sealed, DCPP can expect a 10-20 gpm reduction in groundwater production.

The presence of a series of diagnostic constituents with significantly different concentrations in Diablo Creek compared with Well #2 groundwater represents a strong line of evidence that groundwater pumping does not draw from Diablo creek.