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April 29, 2005

Mr. Norman Shopay Project Manager California Department of Toxic Substances Control Geology and Corrective Action Branch 700 Heinz Avenue Berkeley, California 94710

Subject: Groundwater Extraction Well PE-1 Installation Report Pacific Gas and Electric Company, Topock Project

Dear Mr. Shopay:

This letter transmits the *Groundwater Extraction Well PE-1 Installation Report* for the Pacific Gas and Electric Company (PG&E) Topock site. This summary report documents the installation, sampling, and testing of extraction well PE-1 in the Colorado River floodplain. The work was completed in March 2005 in compliance with your letter dated February 16, 2005.

If you have any questions, please do not hesitate to contact me. I can be reached at (805) 546-5243.

Sincerely,

Julie / Eating for Jeanne Meeto

cc: Kate Burger/DTSC

Groundwater Extraction Well PE-1 Installation Report

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas and Electric Company

April 29, 2005

Prepared by CH2MHILL 155 Grand Avenue, Suite 100 Oakland, California 94612

Groundwater Extraction Well PE-1 Installation Report

PG&E Topock Compressor Station Needles, California

Prepared for California Department of Toxic Substances Control

> On behalf of Pacific Gas and Electric Company

> > April 29, 2005

This report was prepared under supervision of a California-certified Engineering Geologist

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Paul Bertucci, C.E.G. Project Hydrogeologist



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Acronyms and Abbreviations

bgs	below ground surface
BLM	United States Bureau of Land Management
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
DTSC	Department of Toxic Substances Control
gpm	gallons per minute
IM	Interim Measures
µg/L	micrograms per liter
mg/L	milligrams per liter
NTU	nephelometric turbidity unit
PE	potential extraction
QAPP	quality assurance project plan
PG&E	Pacific Gas and Electric Company
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
TDS	total dissolved solids
EPA	United States Environmental Protection Agency

1.0 Introduction

Pacific Gas and Electric Company (PG&E) is addressing chromium in groundwater at the Topock Compressor Station in Needles, California under the oversight of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). In a letter dated February 16, 2005, DTSC directed PG&E to install and test a new groundwater extraction well in the vicinity of recent groundwater investigations conducted at the Topock site (DTSC 2005a). This summary report documents the extraction well installation and the results of sampling and testing of the well.

1.1 Project Background

The Topock Compressor Station is located in San Bernardino County, approximately 15 miles to the southeast of Needles, California (Figure 1-1). The primary constituents of concern at the Topock site are hexavalent chromium [Cr(VI)] and total chromium [Cr(T)]. DTSC is the lead administering agency for the project. Assisting DTSC and PG&E with the planning and review of interim remedial measures are the members of the Topock Consultative Work Group, constituted under California's site designation process, and consisting of representatives of DTSC, Colorado River Basin Regional Water Quality Control Board, the Arizona Department of Environmental Quality, Metropolitan Water District of Southern California, the various federal agencies who own or manage adjacent property, and other project stakeholders.

As directed by DTSC under Interim Measures (IM) No. 2, PG&E is currently pumping groundwater from one deep extraction well (TW-2D) located on a bench along the station access road and above the Colorado River floodplain. PG&E is also constructing an expanded treatment plant under IM No. 3, which is currently scheduled to be commissioned in May of 2005. Well TW-2D and the new extraction well are both located on United States Bureau of Reclamation lands that are managed by United States Bureau of Land Management (BLM).

As part of the current IM activities, PG&E installed, developed, and sampled new monitoring wells in the Colorado River floodplain in 2004 and early 2005. In a letter dated February 16, 2005, DTSC directed PG&E to install and test a new groundwater extraction well in the vicinity of recent groundwater investigations conducted in the Topock site (DTSC 2005a). The directive was issued in light of the detection of Cr(VI) at monitoring well MW-34-100 at a concentration of 357 micrograms per liter (μ g/L) during groundwater sampling in February 2005. Well MW-34-100 is located on the Colorado River floodplain, approximately 450 feet east of extraction well TW-2D and the treatment facilities operated as part of IM No. 2. Well MW-34-100 monitors the Lower zone of the Alluvial Aquifer near other locations in the floodplain where Cr(VI) has been previously detected.

1.2 Project Documents and Approvals

PG&E submitted an extraction well installation work plan to DTSC and the BLM that outlined the scope of work and schedule to site, install, and test a new extraction well (CH2M HILL 2005a-b). DTSC provided conditional approval of the extraction well installation work plan in a letter dated February 25, 2005 (DTSC 2005b).

BLM authorized the site activity under an Action Memorandum, dated March 3, 2004 (BLM 2004a) that authorized PG&E to site, install, and test new extraction wells as part of the time-critical removal actions (BLM 2004a). The BLM also authorized site activity in a letter dated December 29, 2004, approving the drilling at seven well locations including PE-1 (BLM 2004b).

Three areas were identified for exploration borings, including the location for extraction well PE-1. Site preparation for this drilling effort involved permitting from San Bernardino County for well installation and borehole drilling and access coordination with land agencies, the BLM, California Department of Fish and Game, and the United States Fish and Wildlife Service. Prior to moving equipment, the drilling sites and the access routes were surveyed for biological and cultural resources, and mitigation measures were established to protect these resources during the drilling activities.

Approval of other activities, such as pipeline and power supply installation on BLM-managed property, will be the subject of a separate authorization.

1.3 Purpose and Objective

The purpose of this report is to document the drilling, installation, and sampling and testing of new potential extraction well PE-1 and the sampling and logging of exploratory boreholes PE-1A and PE-B. It is intended that this report will be used by the DTSC to document baseline conditions at the new PE-1 extraction well location and aid in the review of plans to begin groundwater extraction from PE-1. At present, it appears that the installation of piping and operation of PE-1 may be scheduled in late summer 2005 after the end of the nesting season for the Willow Flycatcher and other threatened or endangered bird species that may be present on the Colorado River floodplain.

This report describes and documents the installation of new extraction well PE-1, the logging and groundwater quality screening sampling conducted at locations PE-1, and two exploration boreholes PE-1A and PE-1B. The drilling and well installation activities described herein were initiated on February 26, 2005 and completed in March 2005. The report presents:

- Soil boring logs and PE-1 well completion log.
- Results of borehole grab groundwater sampling.
- Documentation of extraction well development and specific capacity testing.
- Results of the initial groundwater quality sampling of new extraction well PE-1.



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2.0 Background

This section provides brief descriptions of the project site, the PE-1 area on the Colorado River floodplain, and the general site hydrogeology as background for this report.

2.1 Site Description

The drilling site for PE-1 is located on the Colorado River floodplain, approximately 1,500 feet to the northeast of the PG&E Topock Compressor Station. Figure 2-1 shows the PE-1, PE-1A, and PE-1B drilling locations and site features. Topography ranges from 450 to 500 feet above mean sea level from the Colorado River to the MW-20 bench. This drilling project area is located in the floodplain east of the MW-20 bench and north of the railroad bridge. The PE-1, PE-1A, and PE-1B drilling sites are located on Parcel 650-151-14, which is owned by the federal government and administered by the BLM.

2.2 Site Hydrogeologic Setting

For background to this report, the following hydrogeologic summary has been excerpted from the *Draft Resource Conservation and Recovery Act* (RCRA) *Facility Investigation/Remedial Investigation Report* (Draft RFI Report), dated February 28, 2005 (CH2M HILL 2005c).

Groundwater occurs under unconfined to semi-confined conditions within the alluvial fan and fluvial sediments beneath most of the Topock site. The saturated portion of the alluvial fan and fluvial sediments are collectively referred as the Alluvial Aquifer. In the floodplain area adjacent to the Colorado River, the fluvial deposits interfinger with, and are hydraulically connected to, the alluvial fan deposits. The unconsolidated alluvial and fluvial deposits are underlain by the Miocene conglomerate and pre-Tertiary metamorphic and igneous bedrock with very low permeability; therefore, groundwater movement occurs primarily in the overlying unconsolidated deposits.

The water table in the Alluvial Aquifer is very flat throughout the site and typically equilibrates to an elevation within 2 to 3 feet of the river level. The depth to groundwater at the PE-1 study area on the floodplain ranges from approximately 6 to 15 feet below ground surface (bgs).

The Colorado River has a strong influence on groundwater levels at the Topock site. The effects are most notable in the floodplain area, the IM extraction area, and adjacent inland area. The stage of the Colorado River varies both daily and seasonally in response to upstream dam discharges regulated for resource management and electricity production. The fluctuations in river stage cause the surface water-groundwater interaction in the floodplain to be very dynamic.



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This section provides documentation for:

- Drilling, core logging, and groundwater sampling at boreholes PE-1, PE-1A, and PE-1B.
- Well installation, development, step drawdown testing, and groundwater sampling of extraction well PE-1.

The results of the step drawdown/specific capacity testing and groundwater sampling are presented in Sections 4.0 and 5.0, respectively.

3.1 Drilling and Borehole Logging

The primary objective of the new extraction well is to extract groundwater from an additional location to maintain a landward gradient and hydraulic control of the lower zone of the Alluvial Aquifer in the vicinity of monitoring well MW-34-100. To best achieve this objective, it was desirable to screen the extraction well in the predominantly fluvial sand and gravel in the lower aquifer zone. The final location of the extraction well PE-1 was pre-selected based on prior BLM approval of that location only for well installation. BLM approved the locations of exploratory borings PE-1A and PE-1B to collect geologic and screening level groundwater data, but could not approve extraction wells at these locations within the time frame available prior to the start of the Willow Flycatcher nesting season.

Drilling was accomplished using rotosonic drilling methods that involve advancing a rotating and vibrating drill head or core barrel through the subsurface. This method was selected because it produces a continuous core from the land surface to the target drilling depth (approximately 100 feet bgs); generates minimal drilling wastes; and typically can drill through gravel, cobble, and competent bedrock formations. The continuous core obtained from sonic drilling was used to prepare core logs and collect subsurface soil samples and was subsequently added to the IM drilling program core archive. Table 3-1 presents the summary of drilling, sampling, and testing implemented in this drilling program.

Sonic drilling methods were used to drill the borings and install the PE-1 extraction well. The pilot borings were advanced using approximate 6-inch-outside-diameter drill casing. The well casing and screen for PE-1 were installed in a borehole enlarged using approximate 10-inch-outside-diameter sonic drill casing. The well specifications and construction details are provided in Table 3-1. Refer to the *Sampling, Analysis, and Field Procedures Manual* (CH2M HILL 2005d) for the drilling, well installation, and field methods and procedures.

Lithologic descriptions for each of the three borings were prepared under the supervision of a California-registered geologist based on visual inspection of the retrieved core. Soil boring logs are presented in Appendix A. The primary information recorded on the drilling and boring logs include:

- Soil boring or well identification.
- Location in relation to an easily identifiable landmark.

- Names of the drilling subcontractor and logger.
- Start and finish dates and times.
- Drilling method.
- Depth at which saturated conditions were first encountered.
- Lithologic descriptions (based on the Unified Soil Classification System).
- Other geologic information including clast rounding and lithology.
- Sampling-interval depths.
- Driller observations on drilling advance and coring.

As recommended by the Topock Consultative Work Group technical committee, a subset of core material from the saturated Alluvial Aquifer and Miocene conglomerate unit were preserved in the field. Selected core samples were collected during drilling at approximately 10-foot intervals within the saturated zone, sealed in aluminized Mylar[®] sleeves, and archived for potential future testing or analysis. Core samples for preservation were selected based on lithology. Any obvious gray- or black-colored potential reducing zones were sampled along with any obvious aerobic zones. One core sample from the unsaturated zone was also preserved.

After drilling was completed at the first two exploratory boring locations, PE-1A and PE-1B, the borings were abandoned following standard abandonment procedures. A tremie pipe was lowered to the base of the borehole, and the annular space was backfilled with Wyo-Ben Grout-Well[®], a bentonite-Portland cement grout.

3.2 Borehole Depth-Specific Groundwater Sampling

During drilling at PE-1, PE-1A, and PE-1B, groundwater samples were collected from the open borehole using the Isoflow[®] vertical aquifer profiling system at 20-foot intervals throughout the saturated zone, along with one sample in the zone just above the bedrock. The Isoflow[®] system isolates the lower portion of the open borehole, using a hard rubber packer, and discharges the groundwater to the surface with a submersible pump. The purging involved pumping one to three borehole volumes from the open interval being sampled and monitoring the field parameters (temperature, pH, specific conductance, and oxidation-reduction potential). After the field parameters were stabilized and at least one borehole volume was removed, groundwater samples were collected.

Samples were submitted to the field laboratory, currently set up at the batch treatment plant, for analysis to screen for the presence of dissolved Cr(VI). A sufficient quantity of sample was collected and filtered in the field so that confirmation samples could be submitted to an offsite certified laboratory if Cr(VI) was detected in any of the grab samples. The purpose of these samples was to assess the vertical distribution of chromium concentrations at the drilling sites and to assist in selecting well screens. These field sampling results are discussed in Section 5.0.

3.3 Extraction Well PE-1 Installation

The screen interval and other well information for extraction well PE-1 are summarized in Table 3-1. PG&E conferred with DTSC regarding gravel pack and screen size prior to well construction. The well completion log for PE-1 is included in Appendix A.

After drilling the pilot boring with 6-inch sonic casing to a maximum depth of 105 feet bgs, the PE-1 borehole was reamed with 10-inch sonic casing to a depth of 99 feet bgs. Well PE-1 was constructed in the 10-inch borehole. Six-inch-diameter, stainless-steel materials were used for the PE-1 screen and sump, and 6-inch-diameter Schedule 40 PVC blank casing was used for the blank well casing above the PE-1 screen. The sump extends from 89 to 99 feet bgs beneath the 0.060-inch-slot size louvered screen set at 79 to 89 feet bgs. PE-1 was completed with a concrete well pad at ground surface above the annular space seal and an aboveground 10-inch steel protective casing.

3.4 Well Development and Specific Capacity Testing

The installation of extraction well PE-1 was completed on March 3, 2005. Well PE-1 was developed on March 4 and 5, 2005, after allowing 24 hours for the annular space seal grout to cure. On March 4, 2005, well PE-1 was surged and bailed for 1.5 hours to remove fines and pumped at 10 gallons per minute (gpm) until approximately 500 gallons of water were removed. During development, temperature, pH, specific conductance, and turbidity were measured using field instruments. Well development continued until field parameters stabilized and turbidity was reduced to less than 50 nephelometric turbidity units (NTU). Then on March 5, PE-1 was bailed again for 1 hour before setting up for the step-drawdown test as a continuation of well development. Approximately 600 gallons of water were removed from PE-1 during development.

Initial hydraulic testing of well PE-1 was conducted to determine the specific capacity of the well and obtain preliminary information on the well's radius of influence. The initial test consisted of a step-drawdown test with four steps. Pumping rates ranged from 11 to 55 gpm. The duration of the steps ranged from 17 to 31 minutes. Because it was not possible to move large water-storage tanks onto the floodplain, the tank capacity for this initial testing was limited. Consequently, it was necessary to stop and empty the storage tanks between the first and second steps and between the third and fourth steps in the test. Approximately 3,000 gallons of groundwater were pumped from PE-1 during the step test. The results of specific capacity testing are presented in Appendix B and discussed in Section 5.0.

3.5 Extraction Well PE-1 Groundwater Quality Sampling

After development and immediately after the step-drawdown test, a groundwater sample was collected from PE-1 on March 5, 2005 for fixed lab analysis of Cr(T) and total dissolved solids (TDS). The sample was not field-filtered.

On March 21, 2005, well PE-1 was sampled after purging at a lower flow rate of approximately 5 gpm, and groundwater samples were collected for analyses of Cr(VI), Cr(T), specific conductance, barium, calcium, chloride, carbonate/bicarbonate, fluoride, magnesium, manganese, nitrate, potassium, sodium, sulfate, and iron. Groundwater samples

for metals analyses [except Cr(VI) and Cr(T)] were field-filtered to obtain dissolved concentrations. Field water quality parameters (temperature, pH, specific conductance, oxidation-reduction potential, and turbidity) were also measured. The laboratory analyses and field water quality results are described in Section 5.0.

TABLE 3-1 Summary of Extraction Well Drilling, Installation, and Testing Details Extraction Well PE-1 Installation Report PG&E Topock Compressor Station

Site Location	Explorator y Boring ID	Boring Depth (ft bgs)	Borehole Logging & Core Sampling	Well Installed	Approx. Water Level (ft bgs)	Screen Interval (ft bgs)	Well Logging and Testing
Floodplain	PE-1 97		Continuous core log	PE-1	9	79-89	Step Drawdown Test
Floodplain	PE-1A	90	Continuous core log	None	N/A	N/A	N/A
Floodplain	PE-1B	87	Continuous core log	None	N/A	N/A	N/A

Note: ft bgs = feet below ground surface. N/A = not applicable.

4.0 Extraction Specific Capacity Testing Results

This section presents initial hydrogeologic results for the new PE-1 extraction well based on the limited pumping test conducted after well development.

The step-drawdown test data from PE-1 are summarized in Table 4-1. The specific capacity of this well increased during the last two steps, with the specific capacity measured when the well was pumping at 35 gpm and 55 gpm greater than when the well was pumping at 11 gpm. This is most likely due to development of the well as it was being pumped. PE-1 was developed by bailing, surging, and pumping over approximately 4 hours. This is similar to the development effort at extraction well TW-2D. An abbreviated development effort was performed at both of these wells due to the limited storage capacity for large volumes of development water containing chromium prior to the wells being plumbed into the treatment plant. The specific capacity of TW-2D increased substantially after a few weeks of pumping. Based on the results of the step testing, it is anticipated that PE-1 will show a similar trend of increasing specific capacity as it develops during further pumping. At present, PE-1 appears capable of producing at least 40 gpm. Longer-term hydraulic testing will be conducted after piping is installed and the well is connected to the treatment system.

The surrounding monitoring wells were instrumented with transducers to measure any observed drawdown from the PE-1 pumping test. The maximum drawdown observed in the deep well screens at monitoring well clusters MW-36 and MW-34 during the PE-1 specific capacity pumping test was 0.3 to 0.5 feet. MW-34 and MW-36 are approximately 150 feet distant from PE-1. These initial results from the PE-1 pumping test are summarized in Appendix B.

TABLE 4-1

Summary of Results of Step Drawdown and Specific Capacity Test *Extraction Well PE-1 Installation Report* PG&E Topock Compressor Station

Step No.	Start Time (PST)	Stop Time (PST)	Step Duration (min)	Pumping Rate (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)
1	1246	1316	30	11	12.3	0.89
2	1330	1401	31	25	31.4	0.80
3	1406	1436	30	36	39.7	0.91
4	1453	1510	17	55	51.1	1.08

Notes:

PST = Pacific Standard Time.

gpm = gallons per minute.ft = feet.

This section presents the analytical results of groundwater samples collected from the boreholes and from well PE-1.

5.1 Borehole Depth-Specific Groundwater Sampling Results

The Isoflow[®] sampler was used to collect grab groundwater screening samples at approximately 20-foot intervals while drilling PE-1, PE-1A, and PE-1B. These grab groundwater samples were collected after purging an interval of open borehole below sonic outer casing; typically the length of open borehole was 5 feet. Groundwater quality indicator parameters were measured using a flow-through cell while purging. Groundwater samples were brought to the MW-20 bench lab for Hach[®] field instrument analysis for Cr(VI). The standard reporting limit for this method is 10 μ g/L Cr(VI). Sufficient sample volume was collected so that samples with reportable detections of Cr(VI) could be sent to the certified laboratory Truesdail Laboratories, Inc. for confirmation analysis of Cr(T).

Grab groundwater sampling results are summarized in Table 5-1. Cr(VI) was detected in only two samples: from boring PE-1 at 72 to 77 feet bgs, at 12 μ g/L, which is just above the Hach[®] method reporting limit, and from boring PE-1B at 80 to 84 feet bgs, at 35 μ g/L. The fixed-laboratory Cr(T) confirmation results for these samples were non-detect (less than 1 μ g/L) and 31.9 μ g/L, respectively.

The field parameters measured during purging show a trend of increasing specific conductance (measure of TDS) with depth at all three boreholes. Measured pH ranged from 5.33 to 7.52 with the four lowest pH measurements of 6.5 or less recorded for the most turbid samples. The oxidation-reduction potential field measurements of the groundwater samples were generally electronegative, ranging from -8 to -144 millivolts.

5.2 PE-1 Extraction Well Groundwater Sampling Results

Groundwater samples for initial water quality characterization were collected after PE-1 development and step testing on March 5, 2005 and after purging and sampling on March 21, 2005. Analytical results are summarized in Table 5-2. The March 5 samples were analyzed by Truesdail for Cr(T) and TDS. The March 21 samples were analyzed by Truesdail Laboratories for Cr(T), Cr(VI), and specific conductance and by EMAX Laboratories for general chemistry analytes, including TDS; alkalinity; the metals barium, calcium, iron, magnesium, manganese, potassium, and sodium; and the anions chloride, fluoride, sulfate, and nitrate. The March 21 metals analysis samples [except Cr(VI) and Cr(T)] were field-filtered to obtain dissolved concentrations.

5.2.1 Chromium Results

The March 5 groundwater sample, collected immediately after the step-drawdown test conducted at rates of up to 55 gpm, contained 293 μ g/L of Cr(T). The sample collected after

standard well-volume purging at 5 gpm on March 21 was reported non-detect (less than $1 \ \mu g/L$) for Cr (T) and Cr(VI).

5.2.2 General Chemistry Results

The TDS results for the PE-1 groundwater samples ranged from 6,500 milligrams per liter (mg/L) (March 5 sample) to 8,420 mg/L (March 21 sample). The specific conductance reported for the March 21 sample was 13,400 micromhos per centimeter, which is consistent with the TDS results. Alkalinity, nitrate, sulfate, chloride, and fluoride were detected at 193 mg/L, 0.623 mg/L, 1,260 mg/L, 4,100 mg/L, and 2.56 mg/L, respectively. Sodium was detected at 2,740 mg/L, which is consistent with the general chemistry of groundwater in the study area. Calcium detected at 356 mg/L was the second most abundant mineral in the sample, with magnesium, potassium, and manganese detected at 34 mg/L, 27.5 mg/L, and 2.28 mg/L respectively. Iron and barium were not detected (Table 5-2).

5.3 Data Quality Assessment

To assess the quality of the analytical data, the PG&E *Quality Assurance Program Plan* (QAPP) (Appendix D of the Draft RFI Report), individual method requirements, and July 2002 guidelines from the United States Environmental Protection Agency (USEPA) *Contract Laboratory National Functional Guidelines for Inorganic Data Review* were used. Data validation was performed as outlined in the QAPP, and all accuracy and precision objectives were achieved, resulting in no qualified sample data. Matrix interference was identified by the laboratory in the Cr(VI) Method SW7199 analysis of the sample collected on March 21. As a result of the matrix interference, the reporting limit was raised by the laboratory to 1 μ g/L, following the guidelines in the QAPP. The analytical data for the PE-1 well sampling are acceptable for project decision-making.

TABLE 5-1 Borehole Grab Groundwater Sample Analytical Results - Chromium and Field Water Quality Parameters Extraction Well PE-1 Installation PG&E Topock Compressor Station

			Concentra	itions in μg/L	Field Water Quality Parameters				
			Hach Test	Lab Data	_		Specific		
Location	Sample	Sample Depth	Hexavalent	Dissolved Total	Temperature	рН	Conductance	ORP	
ID	Date	(ft bgs)	Chromium	Chromium	(º Celsius)	(pH units)	(µS/cm)	(mV)	
PE-01	01-Mar-05	32 - 36	ND (10) S		25.1	7.50	9050	-142	
PE-01	01-Mar-05	42 - 46	ND (10) S		24.4	6.61	8570	-89	
PE-01	01-Mar-05	62 - 66	ND (10) S		25.2	6.61	8940	-144	
PE-01	01-Mar-05	72 - 77	12.0 S	ND (1.0)	24.9	5.33	12300	-14	
PE-01	01-Mar-05	82 - 86	ND (10) S		24.5	5.63	13100	-8.0	
PE-01A	27-Feb-05	22 - 27	ND (10) S		24.4	7.01	6280	-86	
PE-01A	28-Feb-05	42 - 47	ND (10) S		23.5	6.78	14800	-134	
PE-01A	28-Feb-05	62 - 67	ND (10) S		24.5	6.82	15600	-140	
PE-01A	28-Feb-05	72 - 77	ND (10) S		24.1	6.67	16500	-103	
PE-01A	28-Feb-05	82 - 87	ND (10) S		23.5	6.50	19600	-25	
PE-01B	26-Feb-05	22 - 26	ND (10) S		22.4	6.59		-109	
PE-01B	26-Feb-05	42 - 46	ND (10) S		22.5	7.52		-110	
PE-01B	27-Feb-05	62 - 66	ND (10) S		22.1	6.48	18000	-94	
PE-01B	27-Feb-05	72 - 76	ND (10) S		22.2	7.11	18000	-149	
PE-01B	27-Feb-05	80 - 84	35.0 S	31.9	22.3	6.45	20100	-115	

Notes:

µg/L results in micrograms per liter

ND parameter not detected at the listed reporting limit.

--- not applicable

S screening level data

J estimated value

Per the *Extraction Well Installation Work Plan* (CH2MHill, 2005), lab data was collected to verify Hach Test results greater than the detection limit of $10 \mu g/L$.

TABLE 5-2Groundwater Analytical Results for PE-1 Extraction WellExtraction Well PE-1 InstallationPG&E Topock Compressor Station

			After Purge	Following
Analytical Method	Analyte	Units	3/21/05	PE-1 3/5/05
Analytical Laboratory Re	esults			
1201	Specific conductance	µmhos/cm	13400	
1601	Total dissolved solids	mg/L	8420	6500
3101	Alkalinity, as carbonate	mg/L	ND (5.0)	
3101	Alkalinity, bicarb. as caco3	mg/L	193	
3101	Alkalinity, total as caco3	mg/L	193	
3533	Nitrate as nitrogen	mg/L	0.623	
3754	Sulfate	mg/L	1260	
4500B	Chloride	mg/L	4100	
4500FC	Fluoride	mg/L	2.56	
6010B	Barium (dissolved)	mg/L	ND (0.5)	
6010B	Calcium (dissloved)	mg/L	356	
6010B	Iron (dissolved)	mg/L	ND (0.5)	
6010B	Magnesium (dissolved)	mg/L	34.0	
6010B	Manganese (dissolved)	mg/L	2.28	
6010B	Potassium (dissolved)	mg/L	27.5	
6010B	Sodium (dissolved)	mg/L	2740	
6010B	Total chromium (dissolved)	μg/L	ND (1.0)	293
7199	Hexavalent chromium	μg/L	ND (1.0)	
Field Measurements				
FIELD	Dissolved oxygen	mg/L	0.19	
FIELD	Oxidation reduction potential	mV	-194	
FIELD	рН	pH unit	7.40	
FIELD	Salinity	%	0.90	
FIELD	Specific conductance	µmhos/cm	15200	
FIELD	Temperature	°C	26.3	
FIELD	Turbidity	NTU	1.20	

Notes:

mg/L results in milligrams per liter

ND parameter not detected at the listed reporting limit.

--- not applicable

6.0 Summary

Detection of hexavalent chromium in a newly-installed monitoring well MW-34-100 led the DTSC to request the installation of extraction well PE-1 on the Colorado River floodplain between well clusters MW-36 and MW-34 (Figure 2-1). Extraction well PE-1 was installed in a field program that included the drilling, logging, and sampling boreholes PE-1A and PE-1B in addition to the PE-1 borehole. Hydrogeologic interpretation of these results will be included in a future revision of the RFI Report.

Extraction well PE-1 was selectively screened in the lower aquifer zone from 79 to 89 feet bgs. PE-1 was tested after development at pumping rates of up to 55 gpm, with an initial specific capacity of approximately 1 gpm per foot of drawdown. The sustainable pumping rate from PE-1 is estimated to be at least 40 gpm.

The dissolved Cr(T) result in an initial sample collected from PE-1 after the pumping test was 293 μ g/L. A second sampling of well PE-1, conducted approximately 2 weeks later during standard well-volume purging, was reported non-detect for Cr(T) and Cr(VI).

Construction activities at well PE-1 for installation of discharge piping and connection to the IM No. 3 treatment system are on hold pending BLM approval, which is related to the bird-nesting season on the sensitive floodplain habitat.

California Department of Toxic Substances Control (DTSC). 2005a. Letter to PG&E. "Response to Elevated Levels of Hexavalent and Total Chromium Concentrations Reported in Newly Installed Monitoring Well MW-34-100 at Pacific Gas and Electric Company, Topock Compressor Station, Needles, California." February 16.

_____. 2005b. Letter to PG&E. "Conditional Approval of Floodplain Extraction Well Installation Workplan, Dated February 23, 2005, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California." February 25.

CH2M HILL. 2005a. Extraction Well Installation Work Plan, PG&E Topock Compressor Station, Needles, California. February 23.

_____. 2005b. Final Extraction Well Installation Work Plan, Pacific Gas and Electric Company, Topock Project. March 15.

_____. 2005c. Draft RCRA Facility Investigation/Remedial Investigation Report, PG&E Topock Compressor Station, Needles, California Volumes 1-3. February.

_____. 2005d. Sampling, Analysis, and Field Procedures Manual, Revision 1, PG&E Topock Compressor Station, Needles, California. March 31.

United States Bureau of Land Management (BLM). 2004a. *Time Critical Removal Action, Pacific Gas and Electric Topock Compressor Facility*. March 3.

_.2004b. Letter to PG&E from Patricia Taylor/BLM. December 29.

Appendix A Drilling and Well Construction Records



SHEET 1 of 4	4				BORING	NUMBER: PF-01			
						SOIL BORING LO	G		FC-01
PROJECT NAM	E:	orim Moo				HOLE DEPTH (ft):	DRILLING CONTRAC	CTOR:	
SURFACE ELEV		N: N	IORTH	ING (CCS	NAD 27 Z 5):	105.0 EASTING (CCS NAD 27 Z 5):	DATE STARTED:		X, AZ DATE COMPLETED:
467.0 ft. DRILLING MET	MSL FHOD:		2,1	02,550.25		7,616,345.31 WATER LEVEL (ft):	03/01/2005 DRILLING EQUIPME	ENT:	03/02/2005
Rotos	sonic		450 8			approx. 9 ft. bgs		Track Mount	ted Sonic
LOCATION: FIO		1 approx	450 ft. i		w-2D, Mw-20 D	ench	B.	Trebble, T. La	ae
	S	SAMPLE		1		SOIL DESCRIPTION			COMMENTS
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)	USCS CODE	PERCENT COI DENS	SOIL NAME, USCS SYMBOL, COLOR MPOSITION, GRADING, GRAIN SHAPB SITY/CONSISTENCY, STRUCTURE, MO	SOIL NAME, USCS SYMBOL, COLOR, POSITION, GRADING, GRAIN SHAPE, MINERALOGY, TY/CONSISTENCY, STRUCTURE, MOISTURE.		DESERVATIONS AND OPERATIONS, RT AND END TIMES , DRILL RATE, SAMPLING AND TESTING NOTES.
 - 5 		CC1	7		POORLY GR qtz rich sand - minor fi	RADED SAND (SP) - It yellow brn 2 l, organics top 5' ine gravel at ~6'	.5YR6/3, 100% fine	Sonic bor logging. preservec core sam testing.	ing continuously cored for Selected core samples were d for future testing. Selected ples also collected for USGS
 - 10 		CC2	10		- trace cla	ay at 10'		water lev	el approx. 9 ft. :1-USGS-10, PE1-PW-10
 - 20		ССЗ	10	SP	- It olive l	brn 2.5YR5/3, 100% fine qtz rich san	d	wet at 17 collect PE PE1-GS-2	ft :1-USGS-20, PE1-PW-20, 0
 <u>30</u> 		CC4	10		- trace sil	lt at 29' rganics		collect PE	:1-USGS-30, PE1-PW-30 soflow groundwater grab
35	V								
									CH2MHILL

SHEET 2 of	4					PROJECT NUMBER: 327061		BORIN	G NUMBER: PE-01
						SOIL BORING LO	G		
PROJECT NAM	I E: Iell Inte	erim Mea	sures -	PG&F Ton	ock	HOLE DEPTH (ft):	DRILLING CONTRA	CTOR:	nniv A7
SURFACE ELE	VATIO	N: N	ORTH	ING (CCS	NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	Corp. Price	DATE COMPLETED:
467.0 π. DRILLING ME	THOD:		2,1	02,550.25		7,616,345.31 WATER LEVEL (ft):	DRILLING EQUIPM	11/2005 03/02/2005 [LLING EQUIPMENT:	
Roto	sonic odplair		450 ft.	F of well T	W-2D. MW-20 h	approx. 9 ft. bgs Track Mounted Sonic		Inted Sonic	
							В.	Trebble, T.	Lae
	S	SAMPLE				SOIL DESCRIPTION			COMMENTS
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVER) (ft)	CODE	PERCENT COL DENS	SOIL NAME, USCS SYMBOL, COLO MPOSITION, GRADING, GRAIN SHAR SITY/CONSISTENCY, STRUCTURE, M	R, FE, MINERALOGY, DISTURE.	DRILLING DAILY ST REFUSAL	OBSERVATIONS AND OPERATIONS, ART AND END TIMES , DRILL RATE, S, SAMPLING AND TESTING NOTES.
 - 40 		CC5	10	SP	POORLY GF qtz rich sand	RADED SAND (SP) - It yellow brn I, organics top 5'	2.5YR6/3, 100% fine	sample	PE1-USGS-40, PE1-PW-40
 - 45				GW	WELL GRAE 5", 29% f-c s - gravel	DED GRAVEL WITH SAND (GW) sand, 1% fines. decrease to 45%, 54% f-c sand, 1%	- 60% f-c gravel up to 6 fines	PE1-44 sample Basalt,	Isoflow groundwater grab volcanics, metamorphic clasts
 		CC6	10	SW	WELL GRAI f-c sand, 5% - increase fines - 3" thick - decrease fines	DED SAND SAND (SW) - dk grayi o f-m rnd to subrnd gravel up to 2", ed gravel, 89% f-c sand, 8% subrnc c lens of plastic silty clay sed fines, 91% f-m sand, 8% f-m su	collect 1" clay	PE1-USGS-50, PE1-PW-50 lens at ~56'	
 - 60 		CC7	10	SW	WELL GRAI 63% f-c sand - decreas - trace cl - increase gravel, 1º	DED SAND WITH GRAVEL (SW) d, 35% f-c gravel, 2% fines sed gravel, 88% f-c sand, 10% f-m g ay ed gravel, 69% f-c sand, 30% well r % fines	- yellow brn 10YR5/4, gravel, 2% fines nd to subang f-m	1" clay collect GS-60 PE1-64 FeOx st metamo (rework	lens at ~59' PE1-USGS-60, PE1-PW-60, (Hex Cr) taining 65-67' orphic and volcanic rocks ted alluvial)
	<u>v 1</u>				1				CH2MHILL

SHEET 3 of 4	1		BORING NUMBER: PE-01					
						SOIL BORING LO	G	
PROJECT NAM Extraction W	E: ell. Inte	erim Mea	sures -	PG&F Top	ock	HOLE DEPTH (ft):	DRILLING CONTRAC	CTOR:
SURFACE ELEN		N: N			NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
DRILLING MET	HOD:		2,1	02,330.23		WATER LEVEL (ft):	DRILLING EQUIPME	ENT:
LOCATION: Flo	odplair	approx	450 ft.	E of well T	W-2D, MW-20 b	ench	LOGGED BY:	
							D.	
DEPTH BGS	: ب		≿	USCS		SOIL DESCRIPTION		COMMENTS
(feet)	INTERV/ TYPE/ NUMBEI		RECOVEF (ft)	CODE	PERCENT CO DENS	SOIL NAME, USCS SYMBOL, COLOR MPOSITION, GRADING, GRAIN SHAPI JITY/CONSISTENCY, STRUCTURE, MO	, , MINERALOGY, ISTURE.	DRILLING OBSERVATIONS AND OPERATIONS DAILY START AND END TIMES , DRILL RATE REFUSALS, SAMPLING AND TESTING NOTES
	$ \ /$				WELL GRAD	DED SAND WITH GRAVEL (SW) - d, 35% f-c gravel, 2% fines	yellow brn 10YR5/4,	collect PE1-USGS-70, PE1-PW-70
		CC8	10		- 85% f s	and, 10% c sand, 5% gravel		
	$\left \right\rangle$			SM	SILTY SANI organics pres	D (SM) - 80% f sand, 20% fines (sil sent	PE1-74.5 Isoflow groundwater grab sample	
	$/$ \setminus							fluvial floodplain deposit
				SP	POORLY GR gravel, trace	RADED SAND (SP) - 65% m sand, silt	30% c sand, 5% f	
80	$\left \right $			SW	WELL GRAI gravel, 7% fi	DED SAND (SW) - 85% f-c sand, 89 ines	% f-m rnd to subrnd	
	V	CC9	10	SW	WELL GRAD	DED SAND (SW) - 80% f sand, 150	% gravel to 3", 5% silt	
//					GRAVELLY subrnd grave	SAND (SW) - 30% f sand, 40% c s el to 4", 10% fines	and, 20% rnd to	PE1-84 Isoflow groundwater grab
				SW				sample
								slow, hard drilling at ~87.5
				SC		ND (SC) - with 5% m gravel	3/4 70% fines 15%	Ton Miocene Conglomerate at 89 ft
90	$\left \right\rangle$				sand, 15% g	ravel, hard, shattered, cemented, dr	/ /	
	$\left \right $	CC10	10	BR				
95								
	$ \rangle$							Installed PE-1 extraction well. See
						Boring Terminated at 97 ft		details.
					ABBREVIAT	IONS		
100					cc = continuc brn = brown	ous core run		
					lt = light			
					dk = dark vf = very fine	e-grained		
					f = fine-grain	ed		
					m = medium c = coarse-ar	-grained rained		
105								

SHEET 4 of 4	1					PROJECT NUMBER: 327061 BORING NUMBER: PE-01				IG NUMBER: PE-01
						NG LOO	G			
PROJECT NAM	E: ell Inte	erim Mea	sures -	PG&F Ton	ock	HOLE DEPTH (ft):		DRILLING CONTRA	CTOR:	
SURFACE ELEV		N: N		ING (CCS	NAD 27 Z 5):	EASTING (CCS NAD 2 7 616 345 3	27 Z 5):	DATE STARTED:		DATE COMPLETED:
DRILLING MET	HOD:		2,1	02,550.25		WATER LEVEL (ft): approx. 9 ft. t	as	DRILLING EQUIPM	ENT:	unted Sonic
LOCATION: Flo	odplair	approx	450 ft.	E of well T	W-2D, MW-20 b	ench		LOGGED BY:		
	5	SAMPLE	E			SOIL DESCRIP	SOIL DESCRIPTION			COMMENTS
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)	USCS CODE	PERCENT COL DENS	SOIL NAME, USCS SYM MPOSITION, GRADING, G SITY/CONSISTENCY, STR	BOL, COLOR, RAIN SHAPE JCTURE, MOI	, MINERALOGY, ISTURE.	DRILLING DAILY ST REFUSAL	OBSERVATIONS AND OPERATIONS, ART AND END TIMES , DRILL RATE, S, SAMPLING AND TESTING NOTES.
					vc = very coa ang = angula subang = sut subrnd = sub rnd = rounde br = bedrock ss = sandstor conglom = co comptd = co qtz = quartz	arse-grained r pangular prounded ed formation ne poglomerate mpacted				
										CH2MHILL

SHEET 1 of 3 PROJECT NUMBER: 327061									G NUMBER: PE-01A
						SOIL BORING LOO	G		
PROJECT NAM Extraction We	E: ell, Inte	erim Mea	sures -	PG&E Top	ock	HOLE DEPTH (ft): 90.0	DRILLING CONTRAC	CTOR: Corp. Phoe	nix. A7
SURFACE ELEV 461.2 ft.	ATION MSL	N: N	IORTH	ING (CCS 02,326.16	NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5): 7.616.405.15	DATE STARTED: 02/27/2005		DATE COMPLETED: 02/28/2005
DRILLING MET Rotos	HOD:		,			WATER LEVEL (ft): approx. 9.5 ft. bgs	DRILLING EQUIPME	NT: Track Mou	nted Sonic
LOCATION: Flo	odplain	approx	600 ft S	E of well T	W-2D, MW-20 b	pench	LOGGED BY:	Trebble, T.	Lae
	s	AMPLE				SOIL DESCRIPTION			COMMENTS
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)	USCS CODE	PERCENT CO DENS	SOIL NAME, USCS SYMBOL, COLOR, MPOSITION, GRADING, GRAIN SHAPE SITY/CONSISTENCY, STRUCTURE, MO	DRILLING DAILY ST REFUSALS	OBSERVATIONS AND OPERATIONS, ART AND END TIMES , DRILL RATE, S, SAMPLING AND TESTING NOTES.	
 		CC1	7	SP	POORLY GF qtz rich roun	RADED SAND (SP) - It yellowish brr d to subrnd sand, minor FeOx staining	n 10YR6/4, 100% f g, organics	Sonic be logging. preserv core sau testing.	oring continuously cored for . Selected core samples were ed for future testing. Selected mples also collected for USGS
 10	\setminus				- wet at /	~9', increase in organic content		PE1A-U	SGS-8, PE1A-PW-8 evel approx. 9.5 ft.
V			10	ML	rich, non stic	LT (ML) - very dk grey 2.5YR3/1, 104 ky	% v f sand, organic		
 	\bigwedge		10	SP	POORLY GF	RADED SAND (SP) - 100% f sand (
 _ <u>20 _</u>	$\backslash /$				- fine-gra	ined organics to ~19' RADED SAND (SP) - It yellowish brr	n 10YR6/4, 100% qtz	PE1A-U	SGS-20, PE1A-PW-20
 25	- CC3		10		rich round to	subrnd f sand		PE1A-24 sample)	4.5' (Isoflow groundwater grab
 30 35	30 					sh brn 10YR5/4,		PE1A-U	SGS-30, PE1A-PW-30 S-33
								•	CH2MHILL

SHEET 2 of 3	3					PROJECT NUMBER: 327061		BORING NUMBER: PE-01A
						SOIL BORING LO	G	
PROJECT NAM	E:	erim Mea	sures -	PG&F Ton	nck	HOLE DEPTH (ft):	DRILLING CONTRAC	CTOR:
SURFACE ELEN		N: N			NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
461.2 ft. DRILLING ME	MSL FHOD:		2,1	02,326.16		7,616,405.15	02/2//2005 DRILLING EQUIPME	02/28/2005
Rotos	sonic		600 ft S	E of well T	W-20 MW-20 F	approx. 9.5 ft. bgs	LOGGED BY:	Track Mounted Sonic
LOCATION. TO							В.	Trebble, T. Lae
	S	SAMPLE				SOIL DESCRIPTION		COMMENTS
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)	CODE	PERCENT COI DENS	SOIL NAME, USCS SYMBOL, COLOF MPOSITION, GRADING, GRAIN SHAP SITY/CONSISTENCY, STRUCTURE, MC	R, E, MINERALOGY, DISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
 40					POORLY GF rich round to	RADED SAND (SP) - It yellowish bi o subrnd f sand	m 10YR6/4, 100% qtz	
		CC5	10		- as abov	re		PE1A-USGS-40, PE1A-PW-40
				SP	- some o	rganics present		PE1A-44.5 (Isoflow groundwater grab sample)
		CC6	10		- 10% m	d to subrnd gravel to 2"		PE1A-USGS-50, PE1A-PW-50
 					WELL GRAE sand, 15% g lenses	DED SAND WITH GRAVEL (SW) ravel, 10% m sand, 5% c sand, trac	- brn 7.5YR5/4, 70% f e of reddish brn clay	
		CC7	10	SW	BOORY		10VD6/4_1000/	PE1A-USGS-60, PE1A-PW-60 PE1A-PW-63
65 				SP	rich sand (80	(AUCU SANU (SP) - It yellow brn : 10% fine and 20% medium)	ιυτκο/4, 100% qtz	PE1A-64.5' (Isoflow groundwater grab sample)
70								

SHEET 3 of 3	3					PROJECT NUMBER: 327061		BORIN	IG NUMBER: PE-01A
						SOIL BORING LO	G		
PROJECT NAM	E: ell Inte	erim Mea	sures -	PG&F Top	nck	HOLE DEPTH (ft):	DRILLING CONTRA	CTOR:	aniv AZ
SURFACE ELEV		N: r		ING (CCS	NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:		DATE COMPLETED:
DRILLING METHOD:						WATER LEVEL (ft):	DRILLING EQUIPMI	ENT:	02/28/2005
LOCATION: Flo	odplain	approx	600 ft S	E of well T	W-2D, MW-20 t	pench	LOGGED BY:	Track Mou	
							В.		
DEPTH BGS	۔ ب	~	≿	USCS		Sole Description			COMMENTS
(feet)	INTERV #	TYPE/ NUMBEF	RECOVEF (ft)	CODE	PERCENT COL DENS	SOIL NAME, USCS SYMBOL, COLO MPOSITION, GRADING, GRAIN SHAP SITY/CONSISTENCY, STRUCTURE, M	R, E, MINERALOGY, DISTURE.	DRILLING DAILY ST REFUSAL	OBSERVATIONS AND OPERATIONS, ART AND END TIMES , DRILL RATE, S, SAMPLING AND TESTING NOTES.
 		CC8	10	G	POORLY GF rich sand (80 - 25% m CLAY (CL)	RADED SAND (SP) - It yellow brn % fine and 20% medium) sand, 5% c sand, trace gravel - brn 7.5YR4/4, trace fine sand, plas	10YR6/4, 100% qtz	PE1A-U	ISGS-70, PE1A-PW-70
75 				SW	rolls easily GRAVELLY 10% c sand,	SAND (SW) - 40% f sand, 20% m 5% clay (rnd to subrnd)	sand, 15% gravel,	PE1A-7 sample	4.5 (Isoflow groundwater grab)
	- - - - - - - - - - - - - - - - - - -				WELL GRAI	DED GRAVEL WITH SAND (GW)	- 60% f-c rnd to subrnd	PE1A-U	ISGS-80, PE1A-PW-80
 - 85 _				GW	gravel, (meta sand - trace cla	amorphic, quartzite, granitic clasts), ay at 85'	<2% fines, >38% f-C	PE1A-8 sample	4.5 (Isoflow groundwater grab)
 - 90		CC10	3	BR	CONGLOME f sand, 10% dry	ERATE (BR) - dk reddish brn 2.5YF subang gravel, very hard, shattered	3/4, 80% fines, 10% , weakly cemented,	Top Mid Explora	ocene Conglomerate at 87 ft tory boring PE-1A grout-sealed
					ABBREVIAT cc = continue brn = brown It = light dk = dark vf = very fine f = fine-grain m = medium c = coarse-gr vc = very coa ang = angula subang = sub subrnd = sub rnd = rounde br = bedrock ss = sandstor conglom = co comptd = con qtz = quartz	Boring Terminated at 90 ff TONS bus core run e-grained -		location	
									CH2MHILL

SHEET 1 of 3	3					PROJECT NUMBER:		BORING NUMBER: PE-01B
						SOIL BORING LOC	G	
PROJECT NAM	E:	rim Moo	curoc	DC%E Ton	ock	HOLE DEPTH (ft):	DRILLING CONTRAC	CTOR:
SURFACE ELEN		N: N		ING (CCS	NAD 27 Z 5):	87.0 EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
458.6 ft. DRILLING MET	MSL HOD:		2,1	02,210.36		7,616,424.89 WATER LEVEL (ft):	02/26/2005 DRILLING EQUIPME	02/27/2005
Rotos	onic	annroy	650 ft S	F of well 1	W-20 MW-20 F	approx. 9 ft. bgs	LOGGED BY:	Track Mounted Sonic
LOCATION. NO		арріох					В.	Trebble, T. Lae
	S	SAMPLE				SOIL DESCRIPTION		COMMENTS
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)	CODE	PERCENT COI DENS	SOIL NAME, USCS SYMBOL, COLOR, MPOSITION, GRADING, GRAIN SHAPE ITY/CONSISTENCY, STRUCTURE, MO	, , MINERALOGY, ISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
 		CC1	7		POORLY GF rich sand, su	RADED SAND (SP) - yellowish brn 1 brnd to rnd, loose, damp, organic rich	10YR5/4, 100% f qtz h top 4 feet	Sonic boring continuously cored for logging. Selected core samples were preserved for future testing. Selected core samples also collected for USGS testing.
 _ 10 _ 		CC2	10		- very dk	gray at/near water table		PE1B-USGS-8, PE1B-PW-8 water table at approx. 9 ft. bgs
 - 20 		ССЗ	10	SP	- Intergra	ined organics to ~17		PE1B-USGS-20, PE1B-PW-20
 						an an international and a second	241	PE1B-24 Isoflow groundwater grab sample
 30 		CC4	10		- color ch	color changes to grayish brn 10YR4/2 from 27-34', organics		PE1B-USGS-30, PE1B-PW-30
	$ \rangle$				- color ch	ange to brn 10YR5/3, 100% f qtz ricl	h sand	PE1B-GS-34
					I			

SHEET 2 of	3					PROJECT NUMBER: 327061		BORING NUMBER: PE-01B										
						SOIL BORING LO	G											
PROJECT NAM	I E: Iell Inte	erim Mea	sures -	PG&F Ton	ock	HOLE DEPTH (ft):	DRILLING CONTRAC	CTOR:										
SURFACE ELEV	VATIO	N:	NORTH	ING (CCS	NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:											
458.6 π. DRILLING ME	THOD:		2,1	02,210.36		7,616,424.89	DRILLING EQUIPME	02/2//2005										
Roto: LOCATION: Flo	sonic odplain	approx	650 ft S	E of well T	W-2D, MW-20 b	bench	LOGGED BY:	Track Mounted Sonic										
	1						B.	Trebble, T. Lae										
SAMPL			>	uses		SOIL DESCRIPTION		COMMENTS										
(feet)	INTERVA	TYPE/ NUMBER	RECOVER (ft)	CODE	PERCENT CO DENS	SOIL NAME, USCS SYMBOL, COLOR MPOSITION, GRADING, GRAIN SHAP SITY/CONSISTENCY, STRUCTURE, MO	R, E, MINERALOGY, MISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.										
 40					POORLY GF rich sand, su - from 37 (1-2%)	RADED SAND (SP) - yellowish brn Ibrnd to rnd, loose, damp, organic ric 7-39', slightly darker grey brn 10YR4/	10YR5/4, 100% f qtz h top 4 feet '2, trace fines											
		CC5	10		- brn 10Y	- brn 10YR5/3, 100% f qtz rich sand, subrnd to rnd		PE1B-USGS-40, PE1B-PW-40										
45 				SP				PE1B-44 Isoflow groundwater grab sample										
 		CC6	10	10	10	10	10	10	10	10	10	10	10					PE1B-USGS-50, PE1B-PW-50
 					- 3" thick	gravel zone, c sand, half an inch thick clay layer												
 <u>60</u>				SW	GRAVELLY sand, 10% f	SAND (SW) - It olive brn 2.5YR5/3 rnd gravel, 10% c gravel, metamorp	, 60% f sand, 20% c hic, qtz, gneiss	PE1B-GS-58 PE1B-USGS-60, PE1B-PW-60,										
	V			CL	FAT CLAY (CL) - brn 7.5YR5/3, 100% clay ~ 6	' thick, soft, sticky	PE1B-GS-61										
 		CC7	10	SW	GRAVELLY 10% f sand	SAND (SW) - 30% f gravel, 30% c	sand, 30% m sand,											
 - <u>70</u>					POORLY GF sand, 10% g	RADED SAND (SP) - color as above gravel	e, 90% f rnd to subrnd											

SHEET 3 of 3	}					PROJECT NUMBER: 327061		BORING NUMBER: PE-01B													
						SOIL BORING LO	DG														
PROJECT NAM Extraction W	E: ell, Inte	erim Mea	asures -	PG&E Top	ock	HOLE DEPTH (ft): 87.0	DRILLING CONTRA Prosonie	ACTOR: ic Corp. Phoenix. AZ													
SURFACE ELEVATION: 458.6 ft. MSL 2.102.210.36						EASTING (CCS NAD 27 Z 5): 7.616.424.89	DATE STARTED: 02/26/2005	DATE COMPLETED: 02/27/2005													
DRILLING METHOD: Rotosonic						WATER LEVEL (ft): approx. 9 ft. bgs	DRILLING EQUIPM	IENT: Track Mounted Sonic													
LOCATION: Flo	odplain	approx	650 ft S	SE of well T	W-2D, MW-20 b	pench	LOGGED BY:	. Trebble, T. Lae													
	s	AMPLE				SOIL DESCRIPTION		COMMENTS													
DEPTH BGS (feet)	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)	USCS CODE	PERCENT COL DENS	SOIL NAME, USCS SYMBOL, COL MPOSITION, GRADING, GRAIN SHA SITY/CONSISTENCY, STRUCTURE, I	DRILLING OBSERVATIONS AND OPERATIO DAILY START AND END TIMES , DRILL RAT REFUSALS, SAMPLING AND TESTING NOTE														
 75		CC8	10	SP	POORLY GF sand, 10% g - 99% f s	RADED SAND (SP) - color as abo ravel sand, 1% f gravel	ove, 90% f rnd to subrnd	PE1B-USGS-70, PE1B-PW-70 PE1B-74 Isoflow groundwater grab sample													
				GW	WELL GRAI 68% f sand, volcanics	DED GRAVEL WITH SAND (GW) 30% f c gravel, trace clay (1-2%), - bro 10YR4/3, 5% gravel, trace si) - olive brn 2.5YR4/3, , qzite, gneiss,	sample													
 																		CL SC	CLAYEY SA gravel, 10%	ND WITH GRAVEL(SC) - 60% f c gravel, rnd, chert, volcanics, ign	sand, 20% clay, 10% f eous
 	$\left \right $	CC9	10		CONGLOME f sand, 15%	RATE (BR) - dk reddish brn 2.5YR3/4, 75% fines, 10% ubang gravel, very hard, shattered, weakly cemented,		PE1B-82 Isoflow groundwater grab sample Top Miocene Conglomerate 83.5 ft													
				BR	dry	Device Townsigned at 07	<u> </u>	Exploratory boring PE-1B grout-sealed after drilling; no well installed at this													
					ABBREVIAT cc = continuc brn = brown It = light dk = dark vf = very fine f = fine-grain m = medium c = coarse-gr vc = very coa ang = angula subang = sub subrnd = sub rnd = rounde br = bedrock ss = sandstor conglom = co comptd = con qtz = quartz	Boring Terminated at 87 TONS bus core run e-grained ied -grained arse-grained arse-grained ir bangular brounded ed formation ne bonglomerate mpacted	п														

Appendix B Well PE-1 Step Drawdown Test Results

Table B1Summary of Results of Step Drawdown and Specific Capacity TestExtraction Well PE-1, March 5, 2005

Step No.	Start Time (PST)	Stop Time (PST)	Step Duration (min)	Pumping Rate (gpm)	Drawdown (ft)	Specific Capacity (gpm/ft)	Volume Pumped (gallons)
1	1246	1316	30	11	12.3	0.89	330.00
2	1330	1401	31	25	31.4	0.80	775.00
3	1406	1436	30	36	39.7	0.91	1080.00
4	1453	1510	17	55	51.1	1.08	935.00 3120.0000

Notes:

11:10 test was started initially, only to be stopped to repair pump

13:18 test stopped again to fix a broken valve on the pump

14:11 transducer lowered approximately 3 feet, after drawdown dewatered transducer

14:38 pump stopped and well allowed to recover

The transducer was dewatered a couple more times during steps three and four, so no data is available.

Approximate Maximum Drawdown at Monitoring wells:

Well ID	Max Drawdown (ft)	Considered N	Negligible if <0.05 ft
MW-27-20	Negligible	MW-39-40	0.06
MW-27-60	Negligible	MW-39-50	0.08
MW-27-85	0.05	MW-39-60	0.09
MW-30-30	Negligible	MW-39-70	0.13
MW-30-50	0.07	MW-39-80	0.14
MW-34-55	0.12	MW-39-100	0.15
MW-34-80	0.33	MW-42-30	Negligible
MW-34-100	0.42	MW-42-55	Negligible
MW-36-20	0.08	MW-42-65	Negligible
MW-36-40	0.08		
MW-36-50	0.1		
MW-36-70	0.1		
MW-36-90	0.53		
MW-36-100	0.57		

460 Step 2 Step 3 Step 4 Step 1 60 gpm 25 gpm . 35 gpm PE-01 Transducer . 11 gpm SC 0.80 SC 0.91 SC 1.08 SC 0.89 PE-01 Manual Water Level gpm/ft gpm/ft gpm/ft gpm/ft 450 Ground Water Elevation (ft MSL)) 440 430 420 ٠ 410 400 11:00 11:30 12:00 12:30 13:00 13:30 14:00 14:30 15:00 15:30 16:00 PG & E TOPOCK COMPRESSOR STATION Time NEEDLES, CALIRFORNIA

Figure B-1: Drawdown in PE-1 Extraction Well During 3/5/2005 Step Test



Figure B-2: Drawdown in MW-34 Cluster During PE-1 Extraction Well Step Test

Figure B-3 Drawdown in MW-36 Cluster During PE-1 Extraction Well Step Test





Figure B-4: Drawdown in MW-30 Wells During PE-1 Extraction Well Step Test

Figure B-5: Drawdown in MW-39 Cluster During PE-1 Extraction Well Step Test





Figure B-6: Drawdown in MW-27 Cluster During PE-1 Extraction Well Step Test

Figure B-7: Drawdown in MW-42 Cluster During PE-1 Extraction Well Step Test

