

Pacific Gas and Electric Company

## **TW-01 AQUIFER TEST PLAN**

Topock Compressor Station  
Needles, California

First Draft: December 23, 2020, Revision 3 April 2, 2021





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# TW-01 AQUIFER TEST PLAN

Topock Compressor Station

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Date:  
First Draft: December 23, 2020  
Revision 2: March 25, 2021

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## ACRONYMS AND ABBREVIATIONS

$\mu\text{g/L}$	micrograms per liter
$\theta_i$	immobile porosity
$\theta_m$	mobile porosity
amsl	above mean sea level
AOC	Area of Concern
bgs	below ground surface
BOD Report	Basis of Design Report
btoc	below top of casing
CH2M Hill	CH2M HILL, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C/RAWP	Construction/Remedial Action Work Plan
Cr(T)	total dissolved chromium
Cr(VI)	hexavalent chromium
CSM	conceptual site model
DO	dissolved oxygen
DOI	United States Department of the Interior
DTSC	Department of Toxic Substances Control
DTW	depth to water
gpm	gallons per minute
HDPE	high-density polyethylene
IM-3	Interim Measure 3
mS/cm	microsiemens per centimeter
ORP	oxidation reduction potential
OUL	Ozark Underground Laboratory
PG&E	Pacific Gas and Electric Company
ppm	parts per million
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
Regional Board	Regional Water Quality Control Board
ROI	radius of influence

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RWT	rhodamine WT
SWMU	Solid Waste Management Unit
$t_{com}$	time for arrival of the center of mass
TCS	Topock Compressor Station
TDS	total dissolved solids
$V_{ave}$	average velocity
$V_m$	mobile velocity
WDRs	Waste Discharge Requirements

# 1 INTRODUCTION

Pacific Gas and Electric Company (PG&E) is implementing the final groundwater remedy (Project) to address chromium in groundwater near the PG&E Topock Compressor Station (TCS or the site), located in eastern San Bernardino County 15 miles southeast of the City of Needles, California.

Construction of the Project began in October 2018, following the plans and procedures within the Construction/Remedial Action Work Plan (C/RAWP) (CH2M Hill, Inc. [CH2M Hill] 2015a). Per the C/RAWP, construction includes the installation of remedial wells and monitoring wells and testing of select wells to provide additional hydraulic data to update the conceptual site model, groundwater model, and the design (C/RAWP Section 3.2.1.5).

Data collected during well installation and testing has been reported in the monthly progress reports per the C/RAWP. Interpretation of the data has been discussed during a series of meetings with the Technical Work Group (TWG) on 7/16, 7/21, 8/13, 8/27, 9/9, and 9/23/2020. PG&E concluded that aquifer test at TW-01 would provide valuable information on the contaminant distribution for planning and possible design improvements for the Phase II remedy. In order to fully evaluate this proposal, DTSC directed PG&E to prepare a TW-01 Aquifer Test Work Plan.

This work plan presents the plans and procedures for aquifer testing at extraction well TW-01, located on the TCS (Figure 1). The workplan was first submitted in December 2020. Comments/feedback were received from Tribes, DTSC, CA SHPO, and AZ SHPO. A comment clarification was held on February 23, 2021, and subsequent to the meeting, DTSC directed PG&E to prepare a revised work plan include a Response to Comments (RTC) table. The workplan has been revised in response to comments received from agencies and stakeholders, and clarifications to select comments. Appendix H provides responses to comments received.

PG&E is consulting with the Regional Water Quality Control Board (Regional Board) on the applicable substantive requirements for the injection of tracers, in addition to a possible Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) permit exemption. PG&E understands that in the event the Regional Board concurs that no separate permit would be required pursuant to CERCLA Section 121(e)(1), PG&E will be required to comply with the substantive requirements of the Regional Board's Waste Discharge Requirements (WDRs).

## 1.1 Work Plan Organization

The work plan is organized as follows:

- Section 1 introduces the project and this work plan, as well as presents the background and conceptual site model (CSM) that provides the basis for well testing at the TCS.
- Section 2 lists the objectives for testing TW-01 at the TCS and provides an overview of the testing plan.
- Section 3 details activities planned or in progress to prepare for well testing.
- Section 4 provides procedures for conducting the testing.

- Section 5 provides the designs and plans for temporary conveyance piping and water management for the testing.
- Section 6 contains the schedule for upcoming testing events.
- Section 7 provides a list of references cited throughout this work plan.

## 1.2 Background and Conceptual Site Model

Provided below is an overview of the TCS CSM, including site geology, hydrogeology, and hexavalent chromium (Cr(VI)) distribution in groundwater. For additional information about site geology and hydrogeology, refer to the Basis of Design Report/Final (100%) Design Submittal for the Final Groundwater Remedy (BOD Report; CH2MHill 2015b) and RCRA Facility Investigation/Remedial Investigation Report (CH2MHill 2009).

### 1.2.1 Geology

The site is situated in the Basin and Range geomorphic province in the Mohave Valley and lies upon a north-sloping piedmont terrace along the northern margin of the Chemehuevi Mountains. Across most of the site, Miocene Conglomerate and pre-Tertiary metamorphic and igneous bedrock are overlain by younger, unconsolidated sedimentary deposits, referred to as the Alluvial Aquifer (CH2MHill 2009, 2015b). The Alluvial Aquifer consists of alluvial sands, gravels, and fines shed from the local mountain chains surrounding the valley and fluvial material deposited by the Colorado River (CH2MHill 2015b).

Figure 2 shows the alignment of three cross sections, F-F', I-I' and J-J', and Figures 3 through 5 show cross-sectional views of the geology oriented north to south (F-F' – Figure 3), northwest to southeast (I-I' – Figure 4) through the TCS, and northeast to southwest (J-J' – Figure 5) from the TCS towards the Colorado River Floodplain. As shown in the cross-sections, the contact between bedrock and the overlying Alluvial Aquifer is deeper to the north (approximately 246 feet above mean sea level [amsl] at monitoring well MW-83) and intersects the water table between monitoring wells MW-68 and MW-70.

### 1.2.2 Hydrogeology

The site is located at the southern end of the Mohave Valley groundwater basin. On a regional scale, groundwater in the northern and central area of the valley is recharged primarily by the Colorado River; however, in the southern end of the valley where the site is located, groundwater is recharged primarily from mountain runoff. Under natural conditions, groundwater beneath the site flows from the west/southwest to the east/northeast across the site (CH2M Hill 2015b).

Groundwater occurs in the Alluvial Aquifer, which is underlain by the Miocene Conglomerate and pre-Tertiary metamorphic and igneous bedrock. Because the bedrock typically has a lower permeability, groundwater primarily flows in the overlying unconsolidated deposits. The alluvial sediments are generally silty sand with little to some gravel or gravelly sand with little to some silt. Although groundwater primarily flows through the Alluvial Aquifer, groundwater in the bedrock occurs in irregularly distributed, highly localized, and discontinuous water-bearing zones that is characteristic of fractured crystalline rocks (CH2M Hill 2014). Gradients are upward between bedrock and the overlying Alluvial Aquifer (CH2M Hill 2015b).

The water table elevation in the Alluvial Aquifer is nearly flat. However, due to the variable topography, the depth to groundwater ranges from as shallow as 5 feet below ground surface (bgs) in the floodplain near the Colorado River to approximately 170 feet bgs in the upland alluvial terrace areas. The saturated thickness of the Alluvial Aquifer thins to the south, pinching out along the Miocene Conglomerate bedrock outcrops. In the western and northern portions of the site, where the depth to bedrock increases, the saturated Alluvial Aquifer is over 200 feet thick (CH2M Hill 2015b).

### 1.2.3 Cr(VI) Distribution and Trends

The Cr(VI) plume is defined as the part of the aquifer where Cr(VI) concentrations exceed natural background levels. Historical Cr(VI) analytical data from monitoring wells in and around the TCS is provided in Appendix A. In general, data presented in this report is based on results as of August 2020, with the exception of MW-68-180 and MW-98-055 and MW-98-077 where more recent data has been incorporated. The calculated statistical upper tolerance limit of natural background levels for Cr(VI) in alluvial groundwater is 32 micrograms per liter ( $\mu\text{g/L}$ ) (CH2M Hill 2009, 2015b). Figure 6 shows a plan view map of the Cr(VI) in the TCS area. Figures 7 through 9 show cross-sectional views of the Cr(VI) plume oriented north to south (F-F' – Figure 7), northwest to southeast (I-I' – Figure 8) through the TCS, and northeast to southwest (J-J' – Figure 9) from the TCS towards the Colorado River Floodplain. The majority of the Cr(VI) plume is located in the Alluvial Aquifer, with the highest Cr(VI) concentrations detected beneath the TCS. The highest Cr(VI) concentrations are detected at PT-9D (9,300 to 17,400  $\mu\text{g/L}$ ), screened approximately 350 to 370 feet amsl on the north end of the station and MW-68-180 (1,400 to 61,000  $\mu\text{g/L}$ ), screened approximately 442 to 457 feet amsl on the western side of the station near the bedrock interface. Cr(VI) concentrations above 10,000  $\mu\text{g/L}$  were also historically observed downgradient at National Trails Highway at the MW-20 well cluster in the 2004 to 2012 timeframe, with a maximum of 13,300  $\mu\text{g/L}$  at MW-20-130 in March 2008, and at MW-50-100, with a maximum of 10,900  $\mu\text{g/L}$  in March 2008. A small portion of the plume extends into the bedrock near the East Ravine; however, the bedrock beneath the central portion of the TCS does not contain Cr(VI) at MW-66-BR-270 and MW-68BR-280 (CH2M Hill 2014, 2015a, b).

The existing chromium contamination in groundwater has previously been largely attributable to historical wastewater discharge from TCS operations to Bat Cave Wash (designated as Solid Waste Management Unit [SWMU] 1/Area of Concern [AOC] 1 [CH2M Hill 2015b]). More recent examination of the groundwater monitoring data, particularly the elevated concentrations at monitoring well MW-68-180, has suggested the potential for an additional source of elevated Cr(VI) in groundwater at the TCS. Known sources of Cr(VI) in shallow soil (less than 10 feet bgs) in the vicinity of monitoring well MW-68-180 include historical releases from the former water treatment chemical mixing area (AOC 19) and auxiliary jacket water cooling pumps (AOC 15) (Figure 1).

Due to the restricted access to the subsurface on TCS, current knowledge of chromium mass in soil below 10 feet bgs on the station is limited to MW-66, MW-67 and MW-68 borings. Due to the limited access, these three deeper borings could not be placed at locations where the greatest likelihood of a Cr(VI) release would have occurred such as directly underneath the former auxiliary jacket water cooling pumps or underneath cooling tower basins. At these three locations, soil samples were collected at 5- to 10-foot intervals from the ground surface down to approximately 10 feet above the water table and submitted for Cr(VI) analysis. No Cr(VI) was detected in any of these soil samples. Nonetheless, releases from AOC 5, AOC 19 and/or AOC 15 may have also contributed to the elevated Cr(VI)

concentrations observed in groundwater at MW-68-180. Additional AOCs associated with historical Cr(VI) includes cooling tower B (AOC 6), but are less likely sources of Cr(VI) at MW-68 given its location. Cr(VI) in bedrock in the East Ravine may have entered to bedrock outside of the TCS. Runoff from TCS, the access road to TCS, historical incidental overflows of chromium-containing wastewater via the former trench drain at the top of the TCS access road, as well as discharge from stormwater drain pipes were documented for AOC 10 (East Ravine). These discharges would have pooled in the drainage depressions identified as AOC Subareas 10b, 10c, and 10d. In these subareas, contaminants could potentially be driven deeper and could potentially reach groundwater as run off from TCS, the access road to TCE and AOC9, historical incidental overflows (Jacobs 2019). Historical chromium-containing discharges to the East Ravine would have come into direct contact with the bedrock formations. Refer to the Soil RCRA Facility Investigation (RFI)/ Remedial Investigation (RI) Volume 3 for detailed information on the vadose-zone CSM (Jacobs 2019).

Additional characterization of the aquifer properties and transport behavior of Cr(VI) and other constituents through well testing at TW-01 is proposed to inform groundwater remedy implementation in the source area at the compressor station. The proposed testing will provide hydraulic data to update the conceptual site model, groundwater model, and for possible design improvements for efficiencies, cost savings, and site disturbance reduction.

### 1.2.4 Total Dissolved Solids

Total dissolved solids (TDS) distribution in groundwater is an additional component of the CSM for the site. The following is an excerpt from the BOD that summarizes TDS at the site, “A historical source of high TDS water was from the Topock Compressor Station blowdown water discharge to Bat Cave Wash. Though sparsely documented, the TDS of this water is assumed to be very high during early years of operation, with progressively lower values over time, by the late 1960s reaching values observed in non-plume wells (CH2M Hill 2009). As described in the RFI Volume 2 report, an apparent higher TDS in the plume well data set is related to the proximity of their screened intervals to the bedrock surface. This higher TDS is likely associated with older water in the bedrock and deeper alluvium in this part of the basin. Wells screened closer to the bedrock surface tend to have higher TDS, regardless of whether the well is associated with the plume or not.” (CH2M Hill 2015b).

On the compressor station in the area of interest, specific conductance in the shallow intervals is several times lower than the deeper alluvial intervals. For example, specific conductance from 2014 to 2019 ranged from 3,500 to 5,395 microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) at MW-68-180 and from 15,799 to 19,640  $\mu\text{S}/\text{cm}$  at the deeper well MW-68-240.

## 2 TEST OBJECTIVES AND OVERVIEW

The goal of the TW-01 well testing is to further characterize the groundwater flow, aquifer properties, and solute transport pathways in the vicinity of the TCS. Specific objectives of the testing are to:

- **Determine effective aquifer properties (permeability, transmissivity, specific yield, mobile/immobile porosity, anisotropy, and storativity) and update the fate and transport model for this area.**
- **Evaluate the influence of boundary conditions, with a primary focus on the bedrock interface and a secondary objective of evaluating recharge at Bat Cave Wash during a significant precipitation event.** Note that data collection to assess the effects of a significant precipitation event may extend beyond the duration of the TW-01 aquifer test (see Section 4.2.4).
- **Evaluate the hydraulic influence of extraction and effect on Cr(VI) concentrations in groundwater.** Data collected on the hydraulic influence of pumping at TW-01 will be used to estimate the capture zone from pumping well TW-01 specifically. The data collected during and aquifer properties derived from the testing may also be used to estimate capture zone of other potential pumping locations in the source area. Time scales for pore flushing to achieve concentration reductions will be evaluated from concentration trends over time.
- **Evaluate aquifer equilibrium during periods without episodic recharge under pumping conditions at TW-01.**
- **Evaluate and inform an update the CSM for the potential historical source of Cr(VI) on the compressor station** through collection and analysis of water levels and other parameters via dataloggers and additional Cr(VI) and other constituents by groundwater sampling. An additional objective of this work is to understand the flowpaths from the compressor station, particularly from area near well MW-68. However, data collection to fulfill that objective will extend beyond the timeframe of the TW-01 pumping test itself, as reflected in the Exhibit 2.1.

Exhibit 2.1 summarizes the types of data that will be collected to meet test objectives and determine aquifer parameters and the anticipated duration for each objective.

Exhibit 2.1 Testing Overview

Test Objective	Data Collection	Timeframe
Determine aquifer parameters and update flow model	Water Levels (Manual Measurements and Datalogger)	Days to week
Evaluate the influence of boundary conditions (to be used in flow model update)	Water Levels (Manual Measurements and Datalogger)	Weeks
Determine mobile/immobile Porosity and update fate and transport model	Tracer Study	Months (approximately 3 to 6 months)



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Test Objective	Data Collection	Timeframe
Evaluate the ability to affect hydraulics and Cr(VI) concentrations with distance	Water Levels (Manual Measurements and Datalogger) Cr(VI) Analysis Tracer Study	Months (greater than 3 to 6 months)
Evaluate and inform update of compressor station CSM	Datalogger dataset Broader constituent list analysis (See Section 4.4) MW-68-180 tracer study data collection	Will incorporate historical data and data collected during and after the test  MW-68-180 tracer data collection and potentially additional analytes will extend beyond the time of the TW-01 pump test

The pumping test portion of this study will include a constant-rate aquifer test and a tracer study. The constant-rate aquifer test will have two components: the 7-day duration test (7-day test) and the extended duration test (extended test). The 7-day test will include a higher frequency data collection for the first 7 days of the start of pumping and the extended test will include lower frequency data collection starting at the end of the 7-day test to the remainder of the test. The extended test is anticipated to last until steady-state conditions are achieved and the extraction from TW-01 is in equilibrium with aquifer recharge, estimated to occur within 2-8 weeks.

The 7-day test data will be used to estimate aquifer parameters including but not limited to permeability and transmissivity. Water level data collected during the extended test will be used to evaluate the potential influence of the boundary conditions within the TCS area including Bat Cave Wash, bedrock, and the Colorado river boundaries and to assess aquifer equilibrium.

The tracer test will be conducted concurrently with the constant-rate aquifer test and potentially extend beyond the constant-rate aquifer test with the exception of the tracer study at MW-68-180 which will be conducted after the completion of the TW-01 aquifer test. Tracer data will be collected periodically from the pumping well to determine tracer arrival and the mobile and immobile porosity of the saturated zone beneath the compressor station. The duration of the tracer study is anticipated to be approximately 3 to 6 months. Tracer data will also be collected from the injection wells and used in conjunction with Cr(VI) concentration data collected from monitoring wells during the extended test to evaluate the hydraulic effects of pumping on the aquifer and variations in Cr(VI) concentrations with distance and time.

The duration of the TW-01 aquifer test will be based upon meeting the objectives described above including objectives that take longer periods of time to meet, such as well-defined trends in tracer arrival and consistent trends in Cr(VI) observed, as described in more detail section 4.5.5. If trends indicate the objectives have been fulfilled, the pumping can be stopped within an approximate 3-6 month timeframe or earlier should objectives be met earlier than the projected 3-6 month timeframe. If trends indicate the objectives of the test require additional pumping, the test may be extended beyond 6 months, with approval from the agencies and only if options for managing the extracted water are available. The

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extended data, beyond 6 months, would be used to further understand the response of the aquifer and site-specific transport of Cr(VI).

The activities in this workplan will contribute to updating the CSM for the compressor station. As the pumping test results become available, the information will be incorporated into the CSM and a future model update. The duration of the additional source area datalogger and groundwater sampling data collection and the implementation of a tracer test at MW-68-180 for flowpath analysis will extend beyond the end of the TW-01 aquifer test. It is anticipated that detection of the tracer from the MW-68-180 test will take years to arrive at monitoring wells, if the monitoring wells are located on the flowpath from MW-68-180, which is uncertain. As such, the data may be very useful for understanding the CSM as the remedy is implemented but will not likely be available to inform Phase II design.

### 3 TEST PREPARATION

This section describes the TW-01 well preparations, monitoring network preparations, datalogger deployments, tracer test preparation, and temporary infrastructure planned to support the completion of the tracer and constant-rate pumping tests.

#### 3.1 TW-01 Well Preparation

TW-01 was selected for the proposed well testing because this well is of suitable construction and capacity to induce hydraulic influence from pumping that can be measured at the distance of available monitoring wells at the TCS.

TW-01 is a test well that was installed and developed in November 2003 to characterize the hydrogeology and aquifer capacity in the saturated alluvial aquifer beneath the TCS (Department of Toxic Substances Control [DTSC] 2003). TW-01 was constructed as an extraction well with 5-inch diameter polyvinyl chloride (PVC) and is screened from 168 to 268 feet bgs. The boring log is provided in Appendix B. After installation of TW-01, a step test was conducted for a total duration of 2 hours, pumping at four different rates for 30-minute each. Exhibit 3.1 summarizes the step test results.

**Exhibit 3.1. Summary of TW-01 Step 2003 Test**

Step	Time-weighted Average Pumping Rate (gpm)	Maximum Drawdown (cumulative feet)	Specific Capacity (gpm/foot)
1	22.1	1.35	16.4
2	35.2	2.40	14.6
3	61.7	4.88	12.6
4	88.3 <sup>1</sup>	8.20	10.8

Notes:

1. Drawdown had not stabilized at the end of this final pumping step.

gpm = gallons per minute

Once characterization and testing of the aquifer was completed, TW-01 became a part of the groundwater monitoring program and has been sampled semiannually since installation. However, due to construction activity blocking the well in June 2020, TW-01 was last purged and sampled in December 2019 with a depth to water (DTW) of 168.10 feet below top of casing (btoc) and a Cr(VI) concentration of 2,200 µg/L. Selenium, which may potentially serve as a tracer for compressor station inputs to groundwater, was elevated at 155 µg/L in 2004 soon after installation. Selenium concentrations declined over time to 13 µg/L in December 2019. Nearby monitoring well MW-67-185 has yielded increasing concentrations over time since construction from 35 µg/L in October 2011 to 380 µg/L in April 2020.

To prepare for the well test, TW-01 was redeveloped on November 23, 2020, consistent with procedures that have been used for the Phase 1 remedy wells. Redevelopment was conducted to reestablish aquifer communication that may have deteriorated over time since installation. After redevelopment of TW-01, a step test was conducted for a total duration of 2 hours, pumping at three different rates. Pumping duration for the step test for the first two rates was 30 minutes each, and for the last step was 1 hour. Exhibit 3.2

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summarizes the step test results. Appendix C contains the Well Redevelopment and Specific Capacity Evaluation Procedure for TW-01.

### Exhibit 3.2. Summary of TW-01 Step 2020 Test

Step	Time-weighted Average Pumping Rate (gpm)	Maximum Drawdown (cumulative feet)	Specific Capacity (gpm/foot)
1	30.3	1.34	22.69
2	60.7	2.82	21.56
3	91.1	4.61	19.78

Notes:

1. Step 1 and Step 2 ran for 30 minutes. Step 3 ran for 1 hour.  
gpm = gallons per minute

The above results show that the well was successfully redeveloped, and that specific capacity was reestablished. Results exceeded the specific capacity measured during the earlier step test conducted just after well installation. The recent additional development improved the hydraulic communication between the well and the aquifer indicating that the earlier development conducted at the time of installation was potentially incomplete. The testing results also showed that well should be able to sustain a flow rate of 90 gpm for the duration of the TW-01 aquifer test.

At the completion of redevelopment and step test, a downhole video survey was conducted, and a static and dynamic spinner log was conducted to further examine well integrity and flow within TW-01. Summaries of the video log and the passive and active spinner logs are provided in Appendix D. The results of the downhole video survey show that the well screen is in good condition and that the overall well construction is in accordance with the well construction log. The passive spinner log showed that there was very little vertical gradient measured across the screen. The results of the active spinner log showed that more than 50 percent of the flow was produced from the middle portion of the screen, suggesting a potential higher permeability zone on this portion of the aquifer. The TW-01 boring log reported a relatively coarse zone consisting of well graded sands with some gravels present from approximately 205 to 240 feet below ground surface (ft bgs). The log indicated more silt content above 205 ft bgs and significantly more fines (silt and clay) below 240 ft bgs. Therefore, the dynamic spinner log results appear consistent with the geologic description in the TW-01 boring log.

At the completion of redevelopment, a pump sized to deliver approximately 90 gpm continuous flow from TW-01 to the onsite Interim Measure 3 (IM-3) treatment system was installed and used to complete step testing at TW-01. This pump will be used to conduct the TW-01 aquifer test transmitting water through the temporary infrastructure described in Section 5 (Temporary Conveyance Piping and Water Management).

Temporary conveyance will be constructed to connect TW-01 to the existing remedy pipeline in advance of the test as detailed in Section 5.

## 3.2 MW-38D Review and Recommendations

MW-38D is planned to be used as a tracer dye injection well due to its proximity to TW-01. Groundwater samples were not collected from monitoring well MW-38D from 2010 to 2014 due to damage caused by

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two separate flooding events in January 2010 and in October 2012. After additional investigations and reconnaissance work in April 2013, the well was repaired in May 2013 and has been sampled as a part of the Topock groundwater monitoring program since that time.

Hexavalent chromium, specific conductance, dissolved oxygen, oxidation reduction potential (ORP), and water levels over time before and after the repair are shown in Exhibit 3.2 below. Evaluation of the MW-38D data shows that, since the repair, water levels have been consistent with historical ranges but that Cr(VI) concentrations have been consistently lower than before the repair. Prior to well damage, Cr(VI) had decreased from a maximum of 328 ppb in March 2004 to 47.5 ppb in January 2010. After repair, the Cr(VI) concentration stabilized to between 15 and 21 ppb, less than half of the concentration prior to the damage. Specific conductivity did not change before and after the repair. Dissolved oxygen and ORP indicate somewhat more reducing conditions after the repair. ORP was between -100 and 200 mV prior to the repair, dipped in several samples after the repair to below -250 millivolts, and then returned to between -100 and -50 mV. Dissolved oxygen was relatively low, around 0.5 mg/L prior to the repair and decreased to less than 0.5 mg/L following the repair.

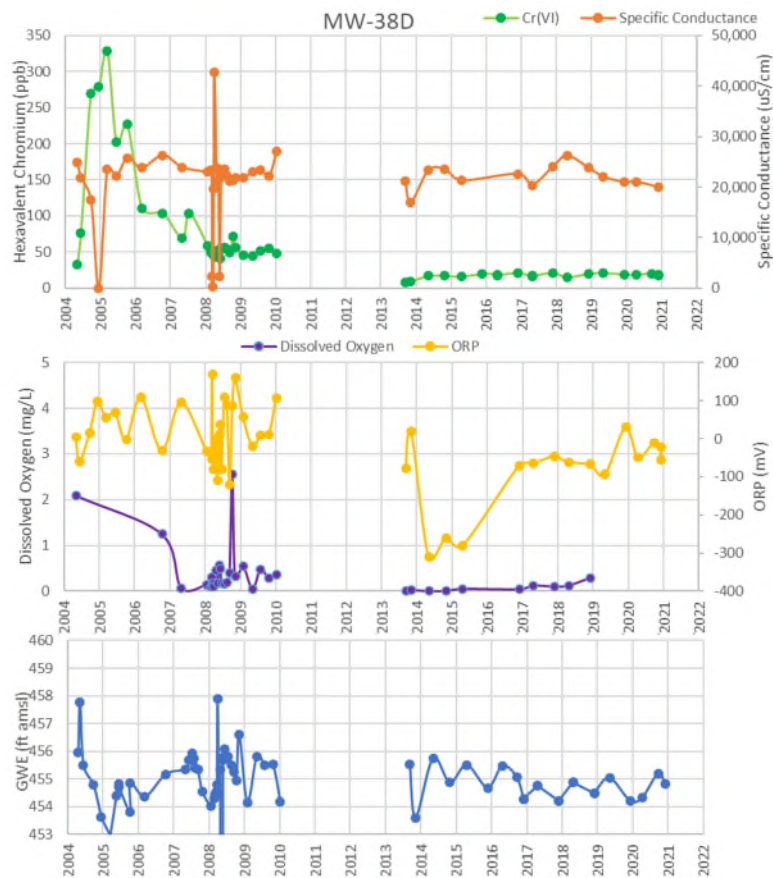


Exhibit 3.2 MW-38D Trends

Based on comments received from DTSC regarding well MW-38D at recent TWG meetings, Arcadis conducted a historical review of data from this well to assess if any preparations (redevelopment, testing, or other assessments) were necessary before using MW-38D for data collection during the TW-01 aquifer test.

To better assess the well condition and casing integrity at MW-38D, redevelopment was completed during the week of November 23, 2020 using procedures consistent with the Phase 1 remedy monitoring wells. Following redevelopment, a downhole video log survey was conducted; and an injectivity evaluation was performed to evaluate specific injectivity for MW-38D before the start of tracer injections.

During downhole video logging of MW-38D, the field geologist noted a slight bend or bulge in the blank casing above the screen at approximately 79 feet btoc and a minor crack in the casing at the top of the screen between the joint of the blank and screened PVC. These observations do not appear to pose significant issues to well integrity and were not included in the video survey log attached in Appendix E. After completion of the assessment and redevelopment at MW-38D, it appears that the well is in good condition and MW-38D can be used for tracer injections during the TW-01 aquifer test. It does not appear that the well was damaged such that the historical sampling results were affected.

### 3.3 Datalogger Deployment for Background Data Collection

Before starting the constant-rate aquifer test and tracer study, dataloggers will be deployed in select on-site well locations as shown in Table 1 and on Figure 10. Dataloggers have been installed as of February 3, 2021 in all wells listed in Table 1 with the exception of MW-09, MW-11, the MW-24 cluster, the MW-40 cluster, MW-70BR-289, the MW-75 cluster, the MW-84 cluster, the MW-85 cluster, and the MW-98 cluster which will be equipped with a datalogger prior to the start of the TW-01 aquifer test. In-Situ Aqua TROLL 600's, which collect water level, temperature, pH, conductivity, dissolved oxygen (DO), and oxidation-reduction potential (ORP), have been deployed within monitoring wells MW-66-165, MW-67-185, MW-68-180, and MW-68-240. All other locations received either Solinst Levellogger 5 LTC dataloggers that will collect water level, specific conductivity, and temperature data or Solinst Levellogger 5/Edge dataloggers that will collect water level and temperature, as summarized in Table 1. Data collection started immediately after deployment, collecting data readings every 30 minutes, and will continue until the start of the constant-rate aquifer test.

### 3.4 Tracer Test Equipment and Work Zone Setup

Before starting the tracer injections, testing equipment and work zones will be established at each injection location. Figure 11 shows the planned equipment configuration during tracer injections. Fluorescent tracer dyes will be injected into monitoring wells MW-67-185 and MW-38D. Each site will be equipped with the following mixing and storage tank setup:

- MW-67-185 is located within the northern perimeter of the TCS. Injections at this location will use a 20,000-gallon frac tank or 6,000-gallon polypropylene tanks (with secondary containment) for mixing and storing tracer dye.
- MW-38D is located in Bat Cave Wash. Two 6,000-gallon polypropylene tanks with secondary containment will be used to mix and store tracer dye. Batches of dye solution will be mixed in each 6,000-gallon polypropylene tank on a rotating basis until the required injection volume is achieved.
- MW-68-180 is located centrally within the TCS. Injections in this location will use a 20,000-gallon frac tank or 6,000-gallon polypropylene tanks (with secondary containment) for mixing and storing tracer dye. Tracer injections at MW-68-180 are anticipated to start in 2022.

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Tanks will be filled using a water truck and fresh water provided from the on-site TCS raw water tanks. The TCS water tanks are filled with water from wells Topock-2 and Topock-3. Each injection well will have equipment needed to perform injections including pumps, conveyance hosing, generators, and electric flowmeter/totalizers. Tracer dye will be procured from Ozark Underground Laboratories (OUL). Tracer dye will be stored and handled according to the manufacturer's recommendations.



## 4 TEST EXECUTION

This section describes the TW-01 test execution including the tracer injections, the constant-rate aquifer test, the groundwater sampling and analysis plan, and data analysis to be conducted during and at the conclusion of the test.

### 4.1 Tracer Injections

Tracer injections are planned to fulfill several of the pilot test objectives: to determine mobile/immobile porosity (solute transport model parameters), to evaluate the hydraulic influence of extraction at the compressor station, and to evaluate flowpaths from the MW-68 area.

To evaluate the objectives of determining mobile/immobile porosity and hydraulic influence of extraction, tracer injections will be conducted at monitoring wells MW-38D and MW-67-185 before the constant-rate aquifer test at TW-01. Tracer concentration data will be collected periodically at TW-01 to estimate tracer arrival, and mobile and immobile porosity. Tracer concentrations data will also be collected from monitoring wells MW-38D and MW-67-185 periodically to evaluate the influence of TW-01 pumping on solute transport. Locations MW-38 and MW-67 were selected for this purpose, because they are close to TW-01 to allow for arrival of tracer at TW-01 during the test (see particle track modeling estimates below in Section 4.3.1). The depth intervals were selected to represent depth and hydrogeologic intervals of interest. The MW-67-185 interval was selected to represent the shallow hydrogeologic layer in which the Cr(VI) mass at MW-68-180 is situated (note, MW-68-180 is too far away to see tracer migration and arrival at available monitoring locations within the duration of this test, see Section 4.3.1 for particle tracking estimates of travel times during pumping). The MW-38D interval was selected to represent the hydrogeologic layer in which the deeper plume that contains the Cr(VI) plume western extent represented by MW-40D. Injection of tracer into MW-38D will aid in the evaluation of the hydraulic influence of TW-01 pumping on this western extent of the plume.

To evaluate flowpath from MW-68-180, tracer will be injected into MW-68-180 and monitored in potential downgradient monitoring wells. This tracer test will be conducted after the analysis of datalogger and groundwater analytical data from compressor station monitoring wells to allow for that dataset to be collected without interruption. As such, this injection is not likely to occur until 2022, after the TW-01 pump test is completed. Once the tracer injection into MW-68-180 has been completed, the MW-20 cluster, MW-26, MW-59-100, MW-66 cluster, MW-67 cluster, MW-78 cluster, MW-79 cluster, MW-80 cluster, and the MW-98 cluster will be monitored on a quarterly basis for the selected tracer in order to evaluate the flowpath. The monitoring frequency can be adjusted based on actual data obtained, with concurrence from the Agencies.

Fluorescent dyes are conservative applied tracers that are readily available, relatively easy to use, practical, and convenient. They are particularly appropriate for this testing because they allow for several orders of magnitude between injected concentrations and detection limits, which will be needed for monitoring at pumping well TW-01 given the anticipated dilution. Commonly used dye tracers include fluorescein, Rhodamine WT (RWT), eosine, and sulforhodamine B (SRB). For this specific tracer test, fluorescein, eosine and RWT have been selected. There is extensive technical literature (Field et al., 1995) demonstrating that these dyes present no health or environmental problems at concentrations five orders of magnitude or more above the method detection limits (Aley 2019). Fluorescein dye will be used



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at monitoring well MW-38D, and RWT dye will be used at monitoring well MW-67-185. These dyes were previously deployed during the Uplands pilot test (see next paragraph for an evaluation of residual concentrations in that area). A distinct tracer, eosine, will be used for the future injection at MW-68-180 for flowpath evaluation. In each instance, injections will target a radius of influence (ROI) of approximately 25 feet (assuming a mobile porosity of 12 percent). Exhibit 4.1 summarizes the target injection volumes at each well, the dyes to be used at each location, and the expected injection flow rates at each well. Once the tracer solution is injected at each location, the aquifer test will begin at TW-01. Safety Data Sheets for eosine, fluorescein and RWT are provide in Appendix F.

**Exhibit 4.1 Tracer Injection Location Summary**

Injection Location	Screen Interval (feet bgs)	Target Injection ROI (feet)	Target Volume of Dye Mixture (gallons)	Tracer to be Used	Target Tracer Concentration (ppm)	Expected Injection Flow Rate (gpm)	Expected Duration of Injection (hours)
MW-38D	163.3-183.3	25	35,000	Fluorescein dye	Approximately 70 ppm	20	29
MW-67-185	177.0-187.0	25	18,000	Rhodamine WT dye	Approximately 50 ppm	10	30
MW-68-180	165.0-180.0	25	25,000	Eosine dye	Approximately 50 ppm	10	42

Note:

ppm = parts per million

Tracer monitoring was performed in October 2020 to establish baseline concentrations. RWT and fluorescein were used during the 2009 pilot tests at nearby well locations (Arcadis 2009); therefore, baseline sampling was necessary to determine if any residual tracer remains in the pilot test area. Baseline sampling was conducted at the wells identified in Section 4.4 – Groundwater Sampling and Analysis Plan. The baseline tracer results (Appendix G) indicate that residual tracer remains in the pilot test area but is limited. RWT was detected at two of the 13 wells sampled at concentrations of 43.1 parts per billion (ppb) at MW-24A and 3.31 ppb at PT9M. Fluorescein was detected at nine of the 13 wells at concentrations ranging from 0.023 ppb to 414 ppb at PT-7M. Particle track predictions indicate some water from the PT-7 area may arrive at TW-01 within the timeframe of the test (See Section 4.1.3 and Figure 12. However, given the dilution that is anticipated, the residual tracer from the pilot area is not expected to be detected at TW-01, whereas the two orders of magnitude higher injection concentrations of the tracers injected at MW-38D and MW-67-185 should provide a signal at TW-01. Based on these results, RWT and fluorescein are still recommended for the test.

Monitoring of tracer from the injections prior to the TW-01 pump test at MW-38D and MW-67-185 will be conducted periodically during the long-term aquifer test to determine tracer breakthrough at TW-01. Tracer monitoring will be conducted according to Section 4.4 and will include both groundwater sample collection and deployment of activated carbon samplers. Groundwater samples will provide data on dye concentrations in the water at a known point in time. Carbon samplers will be deployed during the period between groundwater sampling events to determine if dye has reached the pumping well at any time

during deployment. Carbon samplers will continuously adsorb and accumulate the dyes during the deployment timeframe.

## 4.2 Constant-Rate Aquifer Test

This section provides the activities to complete the constant-rate aquifer test, including pumping start-up, 7-day test, and extended test.

### 4.2.1 Background Data Collection

For a period of two weeks prior to conducting the continuous rate aquifer test, water level data will be collected using transducers and by manual methods to establish background conditions. Most of the pre-pumping data collection will be by instrumentation (transducers with datalogging capability). These data will include barometric pressure, river stage, and water levels for each well in the study area and will be used to evaluate pre-pumping aquifer trends and any data corrections that will be necessary based on barometric or river influences on water levels. At the end of the two-week background monitoring period, the dataloggers will be downloaded and reset to prepare for conducting the continuous rate aquifer test. In addition, during the test water level data will be collected via transducers from wells MW-75, 84, and 85 to continue to assess background changes in aquifer water level. These wells are located outside the anticipated of hydraulic effect from test wells TW-01 and TW-03D.

### 4.2.2 TW-01 Pumping

Dataloggers for select monitoring points will be downloaded after collecting background data and reprogrammed for linear 5-minute data collection intervals. Baseline depth to water manual measurements will be collected in each well located in Monitoring Well Areas 1 and 2 (shown on Figure 10). A well list for Monitoring Well Areas 1 and 2 is also provided in Table 1.

At the conclusion of redevelopment and step testing performed at TW-01, a sustainable flow rate of 90 gpm was achieved and this flowrate will be targeted as the constant flow rate used to conduct both the 7-day constant-rate aquifer test and the extended constant-rate aquifer test.

At the start of the test, groundwater pumping rates in existing IM-3 extraction wells will be reduced so that the IM-3 system has capacity to treat the combined flow from TW-01 pumping and the IM-3 extraction wells at the target flowrate of 135 gpm. Assuming a flow rate of 90 gpm in TW-01 during the aquifer test, the total flow rate from the IM-3 extraction wells will be adjusted to approximately 45 gpm so that the IM-3 discharge capacity is not exceeded. Section 4.3 provides more detail of the safeguards associated with pumping at TW-01 and adjusting IM-3 extraction wells to the appropriate discharge capacity for IM-3.

### 4.2.3 Data Collection During 7-Day Constant-Rate Aquifer Test

During the 7-day test, manual depth to water readings in the pumping well and select surrounding monitoring points within Monitoring Well Area 1 will be collected more frequently, and manual depth to water readings at Monitoring Well Area 2 will be collected less frequently. Dataloggers will collect data at the 5-minute intervals as described in Section 4.2.1 at select well locations (Table 1). Groundwater parameters (temperature, pH, specific conductivity, DO, ORP, turbidity) will be collected from TW-01 at the start of the test and every 12 hours during the 7-day test. Groundwater sampling will be conducted

periodically during the entire duration of the constant-rate aquifer test and tracer test within TW-01 and tracer injection well locations (monitoring wells MW-38D and MW-67-185). Sampling details are discussed in Section 4.4.

### 4.2.4 Data Collection During Extended Constant-Rate Aquifer Test

After the completion of the 7-day test, datalogger measurements within select monitoring well locations (Table 1) will be downloaded and reprogrammed to collect measurements every 30 minutes; these measurements will be downloaded approximately monthly for the remainder of the test. Manual water level readings within TW-01 and monitoring points located within Monitoring Well Areas 1 and 2 (Table 1) will be collected every 2 weeks, and groundwater parameters (temperature, pH, specific conductivity, DO, ORP, turbidity) will be collected concurrent with groundwater sampling described in Section 4.4.

To assess the potential impacts to hydraulic gradients from a large storm event, the sampling frequency of select transducers located in wells near Bat Cave Wash will be programmed at the start of the test to measure water levels at 5-minute intervals. Specifically, transducers in wells MW-9, MW-10S, MW-10D, MW-11S, MW-11D, MW-38S, MW-38D, MW-84 (four screens) and MW-85 (control well located outside wash – three screens) will be programmed to collect water level data at a 5-minute frequency. This instrument data collection frequency will continue at least three months past the occurrence of a large precipitation event (i.e. greater than 0.35 inches in a 24-hour period) even if it occurs past the end point of the TW-01 aquifer test. This will provide increased data resolution so that more detailed evaluations of the effects of flood conditions in the wash can be evaluated. These data will be analyzed, and the findings will be presented to the agencies and TWG during a forthcoming meeting. The instrument data collection frequency will not be changed in the above-listed wells until the agencies provide concurrence that the goals of the infiltration study have been met.”

## 4.3 Modeling of IM-3 Hydraulic Performance and Proposed Monitoring Plan for Floodplain Wells During TW-01 Aquifer Test

This section provides:

- An assessment of predicted changes to the average monthly hydraulic gradients at interim measure (IM3) performance monitoring well pairs resulting from redistributing some of the flow used for gradient control to the TW-01 aquifer test
- A summary of the data that will be collected to evaluate hydraulic gradients at IM3 performance monitoring pairs and Cr(VI) concentrations from floodplain wells during the TW-01 aquifer test.

### 4.3.1 Groundwater Modeling During TW-01 Test

To show the potential drawdown from pumping TW-01, a steady state modeling simulation was conducted for aquifer test conditions, i.e. 90 gpm pumping at TW-01 and 45 gpm at IM3 pumping well TW-03D). The drawdown at steady state in comparison to the base case of IM-3 operation is shown on Figure 12. Reverse particle tracks to TW-01 posted on the figure provide information on predicted groundwater flow with time.

In order to evaluate the average hydraulic gradient at key well pairs used for performance monitoring of IM3 under the proposed TW-01 pumping test conditions (i.e., 90 gpm for conducting TW-01 aquifer test

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and 45 gpm at well TW-03D for floodplain gradient control), the groundwater flow model was run transiently to account for the variations in the Colorado River stage elevation. For this transient modeling analysis, the groundwater flow model was run for a full year to account for the potential impacts of the variations in river stage over time. The pumping rates at TW-01 and TW-03D were held constant at 90 gpm and 45 gpm, respectively, for the full duration of the modeling. The average river stage was varied monthly, and the modeled variation was based on the long-term monthly average river data observed at I-3 between 2001 and August 2020. Observation nodes were placed in the three monitoring well pair locations currently used for performance monitoring of the interim remedy to evaluate the hydraulic gradient near TW-03D (MW-31-135 and MW-33-150; MW-20-130 and MW-34-100; and MW-20-130 and MW-27-85). These well locations are shown on Figure 13, which is an excerpted figure from the Fourth Quarter 2020 and Annual Interim Measures Performance Monitoring and Site-wide Groundwater and Surface Water Monitoring Report (Arcadis 2021).

The transient modeling indicates that the simulated hydraulic gradient at the three well pairs remains inward, i.e. a westerly gradient toward the site rather than east toward the Colorado River, for most months. During the winter months of January and December, when the average monthly river stage is lowest, the magnitude of the inward gradient is the lowest and approaches a more neutral or static gradient. The simulated hydraulic gradient at one well pair (MW-20-130 and MW-27-85) shifts very slightly outward (simulated at -0.00004 ft/ft) during January, indicating the potential for reversal in flow; however, as the average river stage rises in the next month, the simulated hydraulic gradients quickly revert back to inward for the remainder of the year.

Based on the transient groundwater flow modeling, the proposed pumping conditions of the TW-01 hydraulic testing indicate that the groundwater gradient in the floodplain area is inward or neutral for all months except for January. In the two months during which average river stages are the lowest (January and December), the inward gradient shifts to a more neutral or static gradient with only a single well pair exhibiting a very slight outward gradient. These simulated neutral and slightly outward hydraulic gradients are relatively brief, as the average river stage rises during February and subsequent months. The planned aquifer test is anticipated to take place starting in March or April 2021 and is estimated to conclude in September-October 2021 depending on the results observed, so the December-January period of lowest river levels will be avoided. This analysis indicates that there is a minimal risk for transport of contaminants migrating towards the Colorado River in the vicinity of the river's edge during the TW-01 aquifer test.

### 4.3.2 Proposed Monitoring Plan

During the TW-01 aquifer test, groundwater will be pumped from TW-01 at an approximate constant rate of 90 gpm and transferred to the IM-3 treatment plant for processing. Pumping rates from the existing IM-3 extraction wells will be adjusted to accommodate for the total discharge capacity of 135 gpm at IM-3. To evaluate potential changes to hydraulic gradient and Cr(VI) concentrations under the TW-01 pumping that might be affected by this adjusted rate within the floodplain area, contingency monitoring will be conducted to monitor for Cr(VI) concentrations and hydraulic gradient. During the TW-01 aquifer test, in addition to gradient monitoring at the IM3 performance monitoring well pairs, the following well locations will be monitored biweekly for Cr(VI), and transducer data will be collected monthly:

- MW-34-055
- MW-34-080

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- MW-34-100
- MW-36-020
- MW-36-040
- MW-36-050
- MW-36-070
- MW-36-090
- MW-36-100
- MW-44-070
- MW-44-115
- MW-44-125
- MW-46-175

The Cr(VI) concentrations and gradient trend graphs will be integrated into the current monthly IM-3 gradient snapshots or trend graphs provided by Jacobs. If monitoring indicates significant concentrations of contaminants are occurring in monitoring wells listed above, then the TW-01 aquifer test will either be terminated, or flow rates will be adjusted at TW-01 and the IM-3 extraction wells to accommodate for contaminate migration. The monitoring data will be evaluated biweekly and agencies will be notified if concentrations exceed twice the concentrations observed at each well before the start of the TW-01 aquifer test or greater than or equal to a Cr(VI) concentration of 100 ug/L (whichever is less). In addition to the biweekly monitoring, other monitoring wells in the floodplain that are part of the IM-3 Performance Monitoring Program will continue to be sampled and results communicated under the existing threshold within that program.

### 4.4 Groundwater Sampling and Analysis Plan

Exhibit 4.4, below, details the sampling and analysis plan for the constant-rate aquifer test and tracer study.

Exhibit 4.4 Groundwater Sampling Plan Summary

Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
Baseline sampling – groundwater	Once	Evaluate baseline conditions before starting the constant-rate aquifer test and tracer study. Determine if any residual tracer remains from the 2009 pilot test. Monitor Cr(VI)	Modified low-flow (sampled within one to two day time period)	<ul style="list-style-type: none"><li>• Cr (VI)</li><li>• Cr (T) for dissolved metals</li><li>• Fluorescent tracers</li><li>• Cations (calcium, magnesium, potassium and sodium) and the anions (chloride, sulfate, and nitrate)</li></ul>	MW-10 MW-66-165/230/270 MW-67-185/225/260 MW-38S/D TW-01* MW-24A/B PT7S/M/D

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Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
		concentrations before test start.		<ul style="list-style-type: none"> <li>• Additional metals (arsenic, selenium, and molybdenum)</li> <li>• Specific Conductivity</li> <li>• TDS</li> <li>• Caprolactam</li> </ul>	PT8S/M/D PT9S/M/D MW-68-180/240/BR-280 MW-10D
TW-01 Cr(VI) concentration monitoring	Every 24 hours during 7-day constant rate test; biweekly during extended constant-rate test	Monitor Cr(VI) concentrations.	Grab	<ul style="list-style-type: none"> <li>• Cr (VI)</li> <li>• Cr (T) for dissolved metals</li> <li>• Specific Conductivity</li> <li>• TDS</li> </ul>	TW-01
IM-3 Water Quality Evaluation for Water Treatment	Monthly	Assess water quality for suitability of treatment by IM-3 system	Grab	<ul style="list-style-type: none"> <li>• Cr (VI)</li> <li>• Cr (T) for dissolved metals</li> <li>• Cations (calcium, magnesium, potassium, and sodium) and the anions (chloride, sulfate, and nitrate)</li> <li>• Additional metals (arsenic, selenium, and molybdenum)</li> <li>• pH</li> <li>• Specific Conductance</li> <li>• Oil and Grease</li> <li>• Total dissolved solids (TDS)</li> <li>• Total suspended solids (TSS)</li> <li>• Total organic carbon (TOC)</li> <li>• Title 22 metals</li> <li>• Ammonia</li> <li>• Fluoride</li> <li>• Nitrate/nitrite</li> <li>• Sulfate</li> </ul>	TW-01
Tracer monitoring – extracted water	Weekly (possibly twice per week once breakthrough is observed or suspected)	Monitor for tracer breakthrough.	Grab	<ul style="list-style-type: none"> <li>• Fluorescent tracers</li> <li>• Cations (calcium, magnesium, potassium, and sodium) and the anions (chloride and sulfate and nitrate)</li> <li>• Additional metals (arsenic, selenium, and molybdenum)</li> </ul>	TW-01

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Sample Event	Frequency	Purpose	Sample Method	Analysis	Sample Locations
	Weekly	Monitor for tracer breakthrough between groundwater samples. Ensure that breakthrough is not missed between sample events.	Carbon sampler	<ul style="list-style-type: none"> <li>Fluorescent tracers</li> </ul>	TW-01
Additional tracer sampling	Approximately months 2, 4, and 6	Evaluate if residual tracer concentrations (if any remain) are changing over time due to long-term pumping at TW-01.	Modified low-flow (sampled within one to two day time period)	<ul style="list-style-type: none"> <li>Fluorescent tracers</li> </ul>	MW-24A/B PT7S/M/D PT8S/M/D PT9S/M/D MW-38D/S MW-67-185/225
Solute transport monitoring-groundwater	Approximately months 3 and 6	Evaluate influence of pumping on Cr(VI) concentrations	Modified low-flow (sampled within one to two day time period)	<ul style="list-style-type: none"> <li>Cr (VI)</li> <li>Cr (T) for dissolved metals</li> <li>Cations (calcium, magnesium, potassium, and sodium) and the anions (chloride, sulfate, and nitrate)</li> <li>Additional metals (arsenic, selenium, molybdenum)</li> <li>Fluorescent tracers</li> <li>Specific Conductivity</li> <li>TDS</li> </ul>	MW-10 MW-66-165/230/270 MW-67-185/225/260 MW-38S/D MW-68-180/240/BR-280 MW-10D
	Monthly	Evaluate concentration trends at MW-68-180 in conjunction with datalogger collection	Modified low-flow	<ul style="list-style-type: none"> <li>Cr(VI)</li> </ul>	MW-68-180

Notes:

Cr(T) = total chromium

\* In addition to Cr(T), Cr(VI), and tracers, to evaluate water quality for treatment at IM-3, TW-01 was sampled and analyzed for pH, specific conductance, oil and grease, TDS, TSS, TOC, Title 22 metals, ammonia, fluoride, nitrate/nitrite, and sulfate. Analytical data collected from TW-01 on November 4, 2020 is attached in Table 2.

All groundwater samples collected for fluorescence tracers will be collected in 50 mL plastic vials provided by OUL and kept in total darkness to prevent sample degradation. Carbon samplers will be placed in sample bags and labeled. All samples will be refrigerated prior to sample shipment. For sample shipment to OUL, wet ice will not be used during shipment. Blue ice is preferred, but no ice is acceptable if blue ice is unavailable. The samples will be shipped to OUL and placed on HOLD until PG&E determines which subset of samples will be analyzed.



Groundwater samples for additional laboratory analysis will be collected within appropriately preserved bottles as required for each method and submitted by courier to Asset Laboratories for analysis. Analytical methods, bottle type, preservatives and holding times are summarized in Table 3.

### 4.5 Data Analysis

#### 4.5.1 Background Data Analysis

At the end of the two-week background monitoring period, the dataloggers will be downloaded. Time series data plots of barometric pressure, river stage, and aquifer water levels will be prepared and evaluated.

These data will be used to evaluate pre-pumping aquifer trends and any data corrections that will be necessary based on barometric or river influences on water levels. Note that both barometric and river influence corrections to water level data were necessary for the previous TW-03 aquifer test and will likely be necessary for the TW-01 test also.

#### 4.5.2 Constant-rate Aquifer Test Data Analysis

At the conclusion of the 7-day test, manual water level data and downloaded digital data (dataloggers) will be compiled and digitally transcribed into time series plots used to interpret aquifer properties including hydraulic conductivity, specific yield, and transmissivity. The time series plots will undergo analytical corrections to account for barometric compensation, river response, reduction in saturated thickness, and partial penetration of wells. The corrected data plots will be analyzed using applicable standard published methods.

At the conclusion of each month during the extended constant-rate aquifer test, manual water level data and downloaded digital data (from dataloggers) will be compiled and digitally transcribed into time series plots used to evaluate and determine stabilization/equilibrium and the presence of boundary conditions. Data analyzed each month will undergo corrections similar to those conducted for the previous TW-03 7-day test, and the corrected plots will be evaluated to determine stabilization/equilibrium and the presence of boundary conditions.

The water level data collected during the TW-01 aquifer test will be used to update the CSM and calibrate the existing flow and transport model as part of a model update. In addition, the transient drawdown data will be used as a model calibration target for the flow model update. This will consist of simulating the TW-01 aquifer test in the model and comparing how close the field data matches the model simulated drawdown data. During calibration, aquifer parameters may be adjusted to improve the closeness of fit between the model simulated and field observed drawdown values.

Groundwater analytical data captured during the constant-rate aquifer test will be used to analyze the ability to affect Cr(VI) concentrations with distance during pumping.

#### 4.5.3 Tracer Test Data Analysis

Tracer results will be utilized to refine the understanding of groundwater flow velocities in the vicinity of TW-01. The computed groundwater flow velocities from the tracer testing can be used to validate or refine the groundwater flow and solute transport parameters simulated in the groundwater flow and



solute transport model (i.e. mobile porosity and hydraulic conductivity) that control the simulated groundwater flow velocities. Details on the analysis are presented below.

The tracer breakthrough analysis can be used to compute the average groundwater flow velocity:

$$v_{avg} = \frac{x}{t_{com}}$$

where  $x$  is the distance between the tracer injection well and the observation well and  $t_{com}$  is time of the arrival of the center of mass.

The ratio of mobile porosity to total can then be estimated from:

$$v_{ave} = \frac{v_{mobile}}{1 + \frac{\theta_i}{\theta_m}}$$

where  $V_{mobile}$  is the mobile velocity estimated from the initial breakthrough portion of the curve,  $\theta_i$  is the immobile porosity and  $\theta_m$  is the mobile porosity.

The formation mobile porosity estimate derived from the tracer test will be used to validate or further calibrate the parameter values in the current groundwater flow and solute transport model. Currently, mobile porosity in the model is 12%, while hydraulic conductivity medians range from 35 to 78 feet per day in the alluvial layers. Pathline analyses and model simulations of tracer transport runs will be performed to further calibrate the groundwater flow model parameters and groundwater flow velocities in the vicinity of TW-01.

### 4.5.4 Cr(VI) and Tracer Analysis Related to TW-01 Pump Test

Cr(VI) concentration, specific conductivity, and water level trend plots will be prepared for the Cr(VI) monitoring wells listed in Exhibit 4.1. The plots will be evaluated for influence of pumping and boundary conditions on Cr(VI) concentrations. Additional boundary condition analyses of Bat Cave Wash may be conducted if a significant storm event were to occur during the TW-01 test. If a storm event were to occur, some additional evaluation of monitoring points near Bat Cave Wash would be conducted to assess the effects of a large recharge event on this area of the site.

Trends in Cr(VI) data and tracer concentration data will be used to determine when to end the pump test. One point of evaluation is the progress of tracer breakthrough curves at TW-01. If the tracer breakthrough curve at TW-01 is complete (i.e. breakthrough is observed and concentrations level off), that portion of the test will be complete. If tracer concentration are increasing at TW-01 and have not leveled off, it may warrant extending the test. Another point of evaluation are trends in Cr(VI) at the monitoring wells and tracer concentrations at the injection locations (MW-38D and MW-67-185). If concentrations trends are developing and appear informative, that may warrant extending the test, if the agencies approve and options for managing extracted water are available.

### 4.5.5 Datalogger, Cr(VI) and other Analytes Trend Analysis

Dataloggers were deployed to collect long term trend data for water levels, salinity, and redox parameters. This data will be analyzed over the course of the test, possibly including a period of time after completion of the test, to look at trends and potential relationships between groundwater flow and

concentrations in conjunction with yearly cycles in river stage and water levels. Hydrographs for individual wells and clusters of wells will be evaluated for potential changes in flow direction and groundwater elevation maps will be prepared for time snapshots of interest based on the hydrograph analysis. Concentration trends for Cr(VI) and other constituents (cations, anions, arsenic, molybdenum, selenium, dissolved oxygen, oxidation reduction potential, and specific conductance) will be evaluated in the context of changing water levels and flow directions. The analysis will be used to evaluate the source area CSM, looking at the potential explanations for fluctuating and elevated concentrations at MW-68-180. Visualizations of the data and dynamics will be prepared as warranted to illustrate any insights gleaned from the analysis.

### **4.5.6 Data Reporting**

Data transfers reports will be provided monthly during the pumping portion of the test. Data evaluations and interpretations will be reported through interim slide deck deliverables. A summary technical memorandum will be released approximately 3 months after completion of the aquifer test. The technical memorandum will include the aquifer test plots and analyses, tables summarizing the aquifer parameter and tracer testing results, and discussion of key observations during the test.

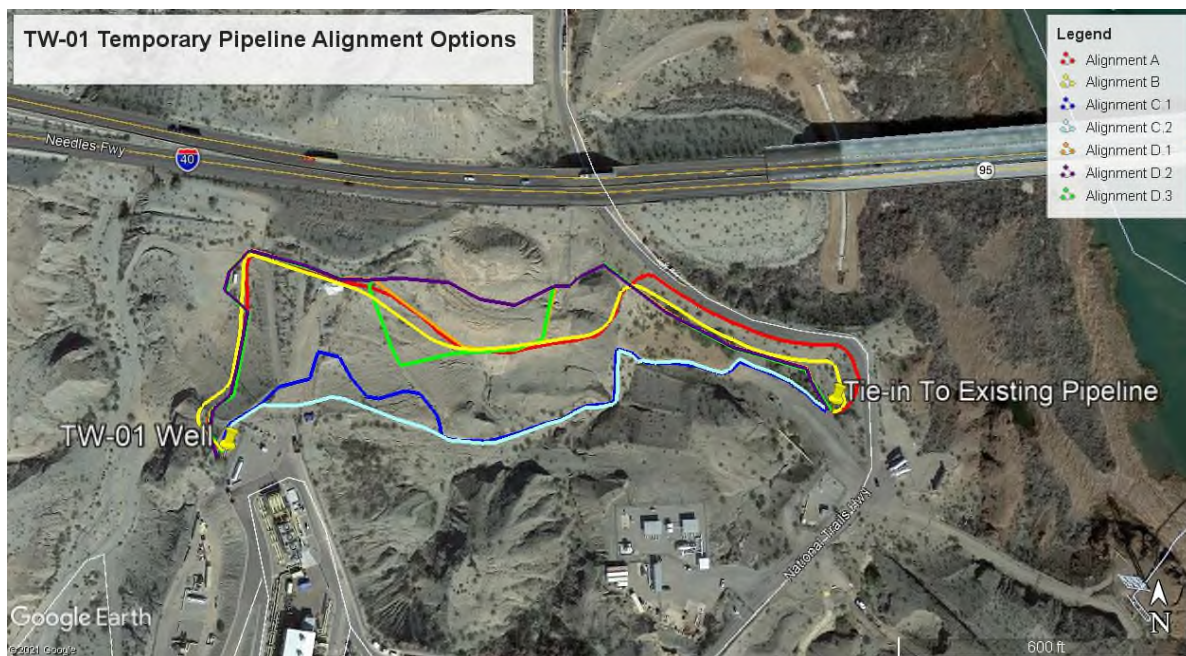
## 5 TEMPORARY CONVEYANCE PIPING AND WATER MANAGEMENT

This section describes the details considered during the planning of this temporary conveyance pipeline and connections at TW-01, final remedy pipelines, and MW-20 Bench IM-3 infrastructure.

### 5.1 Temporary Pipeline

PG&E evaluated several potential aboveground pipeline alignments from the TW-01 wellhead to the pipeline connection location near the southern end of the National Trails Highway jack and bore (see Exhibit 5.1).

Exhibit 5.1 TW-01 Temporary Alignment Options



Alignments A, B, D.1, D.2, and D.3 all proceed directly north from the wellhead, enter the MW-24 Bench, and then proceed along the I-40 fence line to the top of the hill (often call “the point”). From the point, each individual alignment takes its own pathway to the east going down the hill toward the pipeline connection location. In contrast to these alignments, Alignments C.1 and C.2 both proceed directly east from the wellhead and continue down the slope toward the pipeline connection location, taking divergent routes down the slope and through the bottom of the northeast ravine wash.

PG&E proposes Alignment A as the most suitable because it has the best constructability and maintainability; avoidance of conflicts with other underground utilities; and avoidance of biological and cultural resources. Alignments B, C.1, C.2, and D.1 are almost as good, but constructability and maintainability is not as favorable as Alignment A. Alignments D.2 and D.3 are not considered to be

## TW-01 AQUIFER TEST PLAN

acceptable because constructability and maintainability are poor; conflicts with other underground utilities may be irresolvable; and they pose a significant increase of potential conflicts with biological and cultural resources.

Details of Alignment A are shown in Drawing C-1. Piping will be secured to bin blocks at the top and toe of the slopes to ensure the pipeline will not shift during use (Drawing C2, detail 2). Soil anchors may be used approximately every 100 linear feet to anchor the pipeline along the slope in its intended alignment (Drawing C2, detail 1) if deemed necessary during installation of the pipeline. Piping will be secured to the National Trails Highway guardrail every third post or approximately 25 linear feet (Drawing C3, detail 8) when the pipeline alignment parallels the National Trails Highway.

The temporary pipeline will be constructed of 3-inch by 6-inch double-walled high-density polyethylene (HDPE) pipe. Access ports will be installed at designed low points along the temporary pipeline allowing inspection for leaks within the containment space of the double contained line. Access ports will be inspected weekly or more frequently if needed to ensure leak-free operation. A minimum of two air/vacuum relief assemblies will be installed at the high point of the pipeline to ensure proper pipeline operations and will be contained within an above grade concrete vault to collect any potential spillage.

The conveyance pipeline will connect to the existing 6-inch by 10-inch double-walled (HDPE) pipeline installed as part of the Phase 1 Final Groundwater Remedy construction at pipeline segment C10 near the south end of the jack and bore under National Trails Highway through a previously installed flanged cleanout port. A concrete vault will be installed over this port to provide containment during connection, operation, and disassembly of the temporary conveyance pipeline (Drawing C2, detail 3).

Extracted groundwater will be conveyed from the temporary connection at pipeline segment C10 to the MW-20 Bench through the existing 6-inch by 10-inch double-walled HDPE remedy piping. At the MW-20 Bench a temporary connection will be installed between the remedy piping and the existing IM-3 infrastructure to allow the extracted groundwater to be conveyed to the IM-3 facility for treatment. An inline booster pump (5Hp, 3500 RPM for 76 dBA at 1 meter), compatible with the TW-3D well pump and piping system, may be installed between the remedy piping and IM-3 piping to ensure the transferred groundwater can reach the treatment facility with sufficient flow to maintain the extraction target flowrate during the test. The three storage tanks located at the MW-20 Bench (IM-3 Brine Tanks), may be used for temporary storage and/or used as surge tanks in the process of transferring extracted TW-01 water to IM-3.

## 5.2 Mechanical

A new submersible pump capable of achieving the intended flowrate target for this test was installed in TW-01 as described in Section 3.1 – TW-01 Well Preparation. Double-walled piping does not enable the use of valving/mechanical equipment in line; therefore, an isolation valve and flow meter will be installed at the surface of the well head before transitioning to double-walled pipe. An additional isolation valve will be installed at the connection to pipeline segment C10 during the transition to the existing remedy piping to isolate the temporary pipeline when removed from service at a later date.

A new in-line booster may be installed at the 20 Bench to provide additional energy for the extracted TW-01 groundwater, ensuring that operating conditions are met while fluid is pumped to IM-3 for treatment. A flow meter, check valve, and an isolation valve will be installed in conjunction with the booster pump to provide flow information to the operators for proper booster pump operation and periodic maintenance.

### 5.3 Electrical

Electrical systems and equipment will be designed to meet PG&E standards and the California Electrical Code unless specifically noted. The primary power supply source for the aquifer test will be provided by Needles Electric. A new pole and pole-mounted transformer will be installed near the electrical infrastructure that was used for the uplands pilot study. The TW-01 pump will be powered and controlled by a variable frequency drive and mounted in an enclosure rated for the outdoor environment. Remote system access will be evaluated to potentially allow for observation and control of the flow rate at TW-01 as well as energize or de-energize the system pumps in the case of IM-3 system stoppage.

## 6 SCHEDULE

Exhibit 6.1 depicts an estimated schedule for the next steps to prepare and execute the constant-rate aquifer and tracer study.

**Exhibit 6.1 Estimated Schedule**

Task	Timeframe
Redevelop and perform specific capacity evaluation of TW-01	Week of October 5, 2020
Deploy dataloggers	Weeks of October 26 and November 2, 2020
Submit draft of TW-01 Work Plan	December 2020; revised draft submitted February 2021
Receive approval of work plan (anticipated)	March 2021 (to be determined)
Receive substantive requirements from the RWQCB for tracer injection	February 2021 (to be determined)
Issue ERTC (anticipated)	March 2021 (to be determined, pending work plan approval)
Design and construction of tie-in	February-April 2021
Perform tracer injections	March-April 2021
Start-up constant-rate aquifer test and tracer study	March-April 2021
Run 7-day test	April 2021 (anticipated)
Run extended test (proposed)	April 2021 – end date to be determined pending results during extended aquifer testing and the availability of options to manage extracted water
Incorporate data into groundwater model and design	At the completion of the 7-day constant-rate aquifer testing and extended constant-rate aquifer testing periods
Prepare report (summary tech memo)	Approximately 3 months after completion of the aquifer test

Shutdown of the IM-3 extraction system is currently forecasted to occur around late-2021. At that time, options for management of TW-01 aquifer testing water could include continuing operation of IM-3 treatment plant and the injection systems for the purposes of TW-01 waste water disposal, disposal in TCS evaporation ponds, injection into select IRZ injection wells, or off-site disposal.

The schedule will be revised based on the approval date of this work plan.

## 7 REFERENCES

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# TABLES





**Table 1**  
**TW-01 Aquifer Test Program Summary**  
PG&E Topock Compressor Station, Needles, California

Location ID	Site Area	Transducer Equipment		Manual Water Level Monitoring Point Locations		Monitoring Well Construction Details				
		Datalogger Currently Installed	Proposed Datalogger Installation/Not Installed	Monitoring Well Area 1	Monitoring Well Area 2	Measuring Point Elevation (ft amsl)	Well Screen Interval (ft bgs)	Well Screen Lithology	Well Casing Diameter (inches)	Well Depth (ft bgs)
EXISTING GMP MONITORING WELLS										
MW-09	Bat Cave Wash	--	Levellogger 5 LTC		X	536.56	77 - 87	Alluvial	4 in PVC	89.4
MW-10	Bat Cave Wash	Levellogger 5 LTC	--	X		530.65	74 - 94	Alluvial	4 in PVC	96.9
MW-11	Bat Cave Wash	Levellogger Edge	Levellogger 5 LTC		X	522.54	62.5 - 82.5	Alluvial	4 in PVC	86.1
MW-12	East of Station	Levellogger 5 LTC	--		X	484.01	27.5 - 47.5	Alluvial	4 in PVC	50.4
MW-21	Route 66	--	--		X	505.55	39 - 59	Alluvial	4 in PVC	58.5
MW-23-060	East Ravine	--	--	X		504.08	50 - 60	Bedrock	2 in Sch 40 PVC	60.2
MW-23-080	East Ravine	--	--	X		504.13	75 - 80	Bedrock	2 in Sch 40 PVC	80.8
MW-24A	MW-24 Bench	--	Levellogger 5 LTC	X		567.16	104 - 124	Alluvial	4 in PVC	127.5
MW-24B	MW-24 Bench	--	Levellogger 5 LTC	X		564.76	193 - 213	Alluvial	4 in PVC	214.8
MW-24BR	MW-24 Bench	--	--	X		563.95	378 - 437	Bedrock	4 in PVC	441.0
MW-26	Route 66	Levellogger Edge	--		X	502.22	51.5 - 71.5	Alluvial	2 in PVC	70.1
MW-38D	Bat Cave Wash	Levellogger 5 LTC	--	X		525.31	163 - 183	Alluvial	2 in PVC	190.9
MW-38S	Bat Cave Wash	Levellogger 5 LTC	--	X		526.59	75 - 95	Alluvial	2 in PVC	98.1
MW-40D*	I-40 Median	--	Levellogger 5			566.08	240 - 260	Alluvial	2 in PVC	266.0
MW-40S*	I-40 Median	--	Levellogger 5			566.04	115 - 135	Alluvial	2 in PVC	134.0
MW-48	East of Station	--	--		X	486.22	124 - 134	Bedrock	2 in PVC	138.0
MW-51	Route 66	Levellogger Edge	--		X	501.56	97 - 112	Alluvial	4 in PVC	113.3
MW-57-050	East Ravine	--	--		X	508.76	40 - 50	Bedrock	2 in Sch 40 PVC	50.0
MW-57-070	East Ravine	--	--		X	509.37	55 - 70	Bedrock	2 in Sch 40 PVC	70.0
MW-57-185	East Ravine	--	--		X	508.97	70 - 184	Bedrock	4 in Sch 40 PVC	184.7
MW-58-065	East Ravine	--	--		X	523.26	54 - 64	Bedrock	2 in Sch 40 PVC	66.0
MW-58BR	East Ravine	--	--		X	521.78	95 - 115 and 160 - 206	Bedrock	4 in Sch 40 PVC	206.0
MW-59-100	East Ravine	Levellogger 5 LTC	--		X	541.61	86 - 101	Alluvial	2 in Sch 40 PVC	101.0
MW-60-125	East Ravine	--	--		X	555.47	103 - 123	Bedrock	2 in Sch 40 PVC	122.5
MW-60BR-245	East Ravine	--	--		X	554.95	136 - 245	Bedrock	5 in	244.1
MW-61-110	East Ravine	--	--		X	544.03	92 - 112	Bedrock	2 in Sch 40 PVC	112.5
MW-62-065	East Ravine	--	--		X	503.56	44.5 - 64.5	Bedrock	2 in Sch 40 PVC	67.4
MW-62-110	East Ravine	--	--		X	504.05	85 - 110	Bedrock	--	110.0
MW-62-190	East Ravine	--	--		X	504.05	155 - 192	Bedrock	--	190.0
MW-65-160	Topock Compressor Station	Levellogger 5 LTC	--		X	596.59	150 - 160	Alluvial	2 in PVC	160.1
MW-65-225	Topock Compressor Station	Levellogger 5 LTC	--		X	596.58	215 - 225	Alluvial	2 in PVC	225.1
MW-66-165	Topock Compressor Station	Aqua TROLL 600	--	X		586.16	142 - 162	Alluvial	2 in PVC	162.1
MW-66-230	Topock Compressor Station	Levellogger 5 LTC	--	X		586.22	218 - 228	Alluvial	2 in PVC	228.1
MW-66BR-270	Topock Compressor Station	Levellogger 5 LTC	--	X		586.15	248 - 271	Bedrock	5 in	270.6

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Location ID	Site Area	Transducer Equipment		Manual Water Level Monitoring Point Locations		Monitoring Well Construction Details				
		Datalogger Currently Installed	Proposed Datalogger Installation/Not Installed	Monitoring Well Area 1	Monitoring Well Area 2	Measuring Point Elevation (ft amsl)	Well Screen Interval (ft bgs)	Well Screen Lithology	Well Casing Diameter (inches)	Well Depth (ft bgs)
MW-67-185	Topock Compressor Station	Aqua TROLL 600	--	X		625.91	177 - 187	Alluvial	2 in	186.7
MW-67-225	Topock Compressor Station	Levellogger 5 LTC	--	X		625.83	210 - 225	Alluvial	2 in PVC	225.0
MW-67-260	Topock Compressor Station	Levellogger 5 LTC	--	X		625.81	250 - 260	Alluvial	2 in PVC	260.0
MW-68-180	Topock Compressor Station	Aqua TROLL 600	--		X	621.17	165 - 180	Alluvial	2 in PVC	180.1
MW-68-240	Topock Compressor Station	Aqua TROLL 600	--		X	621.17	220 - 240	Alluvial	2 in PVC	240.1
MW-68BR-280	Topock Compressor Station	Aqua TROLL 600	--		X	620.64	257 - 279	Bedrock	5 in	278.2
MW-69-195	Topock Compressor Station	Levellogger 5 LTC	--		X	631.36	176 - 196	Bedrock	2 in	195.5
MW-70-105	East Ravine	Levellogger 5 LTC	--		X	541.47	85 - 105	Bedrock	2 in PVC	107.8
MW-70BR-225	East Ravine	Levellogger 5 LTC	--		X	537.60	130.0 - 229.0	Bedrock	5 in PVC/ 3.8 in open	229.0
MW-71-035	East Ravine	--	--		X	483.69	26 - 36	Alluvial	2 in	36.2
MW-74-240	East Ravine	--	--		X	672.34	220 - 240	Bedrock	2 in	239.7
PGE-07BR	MW-24 Bench	--	--	X		--	249 - 300	Bedrock	7 in	300.0
PGE-8	Station	--	--		X	596.01	405-554	Bedrock	6.75 in Steel	564.0
<b>TEST AND EXTRACTION WELLS</b>										
TW-01	MW-24 Bench	Levellogger 5 LTC	--	X		620.55	169 - 269	Alluvial	5 in PVC	271.0
<b>OTHER EXISTING MONITORING WELLS</b>										
PT-7S	MW-24 Bench	--	--	X		560.54	130 - 150	Alluvial	2 in PVC	152.0
PT-7M	MW-24 Bench	--	--	X		560.66	165 - 185	Alluvial	2 in PVC	187.0
PT-7D	MW-24 Bench	--	--	X		560.42	197 - 217	Alluvial	2 in PVC	219.0
PT-8S	MW-24 Bench	--	--	X		562.22	127 - 147	Alluvial	2 in PVC	152.0
PT-8M	MW-24 Bench	--	--	X		562.1	162 - 182	Alluvial	2 in PVC	184.5
PT-8D	MW-24 Bench	--	--	X		562.03	190 - 210	Alluvial	2 in PVC	212.5
PT-9D	MW-24 Bench	--	--		X	559.11	128 - 148	Alluvial	2 in PVC	153.0
PT-9M	MW-24 Bench	--	--		X	559.14	162 - 182	Alluvial	2 in PVC	187.0
PT-9S	MW-24 Bench	--	--		X	559.27	190 - 210	Alluvial	2 in PVC	212.5
<b>NEWLY INSTALLED MONITORING WELLS</b>										
MW-10D	Bat Cave Wash	Levellogger 5 LTC	--	X		531.537	108.1 - 123.1	Alluvial	2 in PVC	125.5
MW-11D	Bat Cave Wash	--	Levellogger 5 LTC		X	522.59	110 - 130	Alluvial	2 in PVC	132.4
MW-70BR-287	East Ravine	--	Levellogger 5 LTC		X	538.282	258.0 - 288.9	Bedrock	5 in PVC/ 3.8 in open	288.9
MW-75-033	Floodplain	--	Levellogger 5			473.31	18 - 33	Alluvial	2 in PVC	35.4
MW-75-117	Floodplain	--	Levellogger 5			473.37	97 - 117	Alluvial	2 in PVC	119.3
MW-75-202	Floodplain	--	Levellogger 5			472.08	183 - 202	Alluvial	2 in PVC	204
MW-75-267	Floodplain	--	Levellogger 5			473.01	247 - 267	Alluvial	2 in PVC	269.3
MW-75-337	Floodplain	--	Levellogger 5			473.79	317 - 337	Alluvial	2 in PVC	357
MW-79-058	Route 66	--	--		X	--	48 - 58	Alluvial	2 in PVC	60.5
MW-79-102	Route 66	--	--		X	--	92 - 102	Alluvial	2 in PVC	104.8
MW-80-057	Route 66	--	--		X	--	47.4 - 57.4	Alluvial	2 in PVC	59.9
MW-80-082	Route 66	--	--		X	--	67.0 - 82.0	Alluvial	2 in PVC	84.5
MW-84-057	Bat Cave Wash	--	Levellogger 5			--	42 - 57	Alluvial	2 in PVC	59.4
MW-84-095	Bat Cave Wash	--	Levellogger 5			--	75 - 95	Alluvial	2 in PVC	97.4
MW-84-132	Bat Cave Wash	--	Levellogger 5			--	112 - 132	Alluvial	2 in PVC	134.4
MW-84-193	Bat Cave Wash	--	Levellogger 5			--	173 - 193	Alluvial	2 in PVC	195.5

**Table 1**  
**TW-01 Aquifer Test Program Summary**  
PG&E Topock Compressor Station, Needles, California

Location ID	Site Area	Transducer Equipment		Manual Water Level Monitoring Point Locations		Monitoring Well Construction Details				
		Datalogger Currently Installed	Proposed Datalogger Installation/Not Installed	Monitoring Well Area 1	Monitoring Well Area 2	Measuring Point Elevation (ft amsl)	Well Screen Interval (ft bgs)	Well Screen Lithology	Well Casing Diameter (inches)	Well Depth (ft bgs)
MW-85-129	Upland	--	Levellogger 5			569.125	114 - 129	Alluvial	2 in PVC	131.3
MW-85-217	Upland	--	Levellogger 5			569.361	197 - 217	Alluvial	2 in PVC	219
MW-85-237	Upland	--	Levellogger 5			569.501	227 - 237	Alluvial	2 in PVC	239
MW-88-107	Bat Cave Wash	Levellogger 5 LTC	--		X	546.77	87 - 111	Alluvial	2 in PVC	109.3
MW-95-113	Bat Cave Wash	Levellogger 5 LTC	--		X	553.638	93 - 113	Alluvial	2 in PVC	115.3
MW-95-157	Bat Cave Wash	Levellogger 5 LTC	--		X	553.602	137 - 157	Alluvial	2 in PVC	159.3
MW-98-055 (MW-K)	East of Station	--	Levellogger 5 LTC		X	502.124	40-55	Alluvial	2 in PVC	57.3
MW-98-077 (MW-K)	East of Station	--	Levellogger 5 LTC		X	502.016	67-77	Alluvial	2 in PVC	79.3
<b>NEWLY INSTALLED IRZ WELLS</b>										
IRZ-29	Route 66	--	--		X	--	48.2 - 77.0 and 92.1 - 120.9	Alluvial	10 in SS	126.3
IRZ-31	Route 66	--	--		X	--	48.2 - 77.1 and 92.1 - 121.0	Alluvial	10 in SS	126.8
IRZ-33	Route 66	--	--		X	--	87.2 - 111.0	Alluvial	10 in SS	116.4
IRZ-35	Route 66	--	--		X	--	53.1 - 88.0	Alluvial	10 in SS	93.8
IRZ-37	Route 66	--	--		X	--	49.0 - 74.0	Alluvial	8 in SS	79.8
IRZ-39	East of Station	--	--		X	--	28.0 - 39.0	Alluvial	8 in SS	44.7
<b>Totals</b>		<b>27</b>	<b>22</b>	<b>23</b>	<b>50</b>					

-- = not applicable

\* = The MW-40 cluster will be monitored using pressure transducers only and is not included in Monitoring Well Area 1 or 2. Manual data will be collected periodically during the TW-01 aquifer test.

Levellogger 5 Parameters = Water Level and Temperature

Levellogger 5 LTC Parameters = Water level, Temperature, and Conductivity

Aqua TROLL 600 Parameters = Water Level, pH, Conductivity, Dissolved Oxygen, and Oxidation-Reduction Potential

ft = feet

amsl = above mean sea level

bgs = below ground surface

ID = identification

IM = interim measure

IRZ = in situ reactive zone

LTC = Level, Temperature, and Conductivity

PVC = polyvinyl chloride (pipe)

Middle = mid-depth interval of Alluvial Aquifer

Shallow = shallow interval of Alluvial Aquifer

Deep = deep interval of Alluvial Aquifer

**Table 2****Analytical Results from TW-01****TW-01 Aquifer Test Program Summary***PG&E Topock Compressor Station, Needles, California*

TW-01-268-110420 11/4/2020			
Analyte	Analysis Location	Unit	
Groundwater Elevation	FI	feet	452.45
Aluminum	LB	ug/L	ND (50)
Aluminum, dissolved	LB	ug/L	ND (50)
Ammonia as nitrogen	LB	mg/L	ND (0.2)
Antimony	LB	ug/L	ND (0.5)
Antimony, dissolved	LB	ug/L	ND (0.5)
Arsenic	LB	ug/L	0.41
Arsenic, dissolved	LB	ug/L	0.71
Barium	LB	ug/L	29
Barium, dissolved	LB	ug/L	26
Beryllium	LB	ug/L	ND (0.5 J)
Beryllium, dissolved	LB	ug/L	ND (0.5)
Boron	LB	ug/L	1,500
Boron, dissolved	LB	mg/L	1.6
Cadmium	LB	ug/L	ND (0.5)
Cadmium, dissolved	LB	ug/L	ND (0.5)
Calcium	LB	ug/L	170,000 J
Calcium, dissolved	LB	mg/L	170
Chromium, Hexavalent	LB	ug/L	1,400
Chromium, total	LB	ug/L	1,400
Chromium, total dissolved	LB	ug/L	1,400
Cobalt	LB	ug/L	ND (0.5)
Cobalt, dissolved	LB	ug/L	ND (0.5)
Copper	LB	ug/L	22
Copper, dissolved	LB	ug/L	ND (1.0)
Fluoride	LB	mg/L	2.9
Iron	LB	ug/L	65 J
Iron, dissolved	LB	ug/L	ND (20)
Lead	LB	ug/L	ND (1.0)
Lead, dissolved	LB	ug/L	ND (1.0)
Magnesium	LB	ug/L	21,000 J
Magnesium, dissolved	LB	mg/L	21
Manganese	LB	ug/L	0.96
Manganese, dissolved	LB	ug/L	ND (0.5)
Mercury	LB	ug/L	ND (0.2)
Mercury, dissolved	LB	ug/L	ND (0.2)
Molybdenum	LB	ug/L	26
Molybdenum, dissolved	LB	ug/L	26
Nickel, dissolved	LB	ug/L	ND (1.0)
Nitrate/Nitrite as Nitrogen	LB	mg/L	13
pH	LB	PHUNITS	7.4
Potassium, dissolved	LB	mg/L	17 J

**Table 2****Analytical Results from TW-01****TW-01 Aquifer Test Program Summary***PG&E Topock Compressor Station, Needles, California*

			TW-01-268-110420 11/4/2020
Analyte	Analysis Location	Unit	
Selenium	LB	ug/L	11
Selenium, dissolved	LB	ug/L	10
Silver	LB	ug/L	ND (0.5)
Silver, dissolved	LB	ug/L	ND (0.5)
Sodium, dissolved	LB	mg/L	1,000
Specific conductance	FI	uS/cm	--
Specific conductance	LB	uS/cm	--
Sulfate	LB	mg/L	520
Thallium	LB	ug/L	ND (0.5)
Thallium, dissolved	LB	ug/L	ND (0.5)
Total dissolved solids	LB	mg/L	3,500
Total organic carbon	LB	mg/L	ND (1.0)
Total Suspended Solids	LB	mg/L	ND (5.0)
TPH as diesel	LB	ug/L	ND (50)
TPH as motor oil	LB	ug/L	ND (50 J)
Vanadium	LB	ug/L	9.7
Vanadium, dissolved	LB	ug/L	9.4
Zinc	LB	ug/L	35 J
Zinc, dissolved	LB	ug/L	16 J

-- = not applicable

mg/L = milligrams per liter

ug/L = micrograms per liter

uS/cm = microsiemens per centimeter

LB = lab

FI = field

ND = non-detect

J = result is an estimated value

**Table 3**  
**Analytical Methods, Preservation, and Holding Times**  
**TW-01 Aquifer Test Program Summary**  
*PG&E Topock Compressor Station, Needles, California*

Parameter	Preparation Method	Analytical Method	Container	Handling and Preservation	Holding Time (days)
pH	--	SM4500-HB	150 ml Poly	4°C	As soon as possible
Specific Conductance	--	EPA 120.1	150 ml Poly	4°C	28
Chloride	--	EPA 300.0	500 ml Poly	4°C	2
Fluoride	--	EPA 300.0	500 ml Poly	4°C	2
Nitrate/Nitrite as Nitrogen	--	SM 4500-NO3 F	500 ml Poly	H2SO4, 4°C	14
Dissolved Sodium	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Sulfate	--	EPA 300.0	500 ml Poly	4°C	2
Total Dissolved Solids	--	SM 2540 C	1 L Poly	4°C	7
Total Suspended Solids	--	SM 2540 D	1 L Poly	4°C	7
Total Organic Carbon	--	SM5310C	3 X 40 mL VOA	H2SO4, 4°C	28
Alkalinity, Carbonate as CaCO3	--	SM 2320B	250 ml Poly	4°C	30
Dissolved Arsenic	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Dissolved Calcium	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Dissolved Total Chromium	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Hexavalent Chromium	3060A	EPA 218.6	250 ml Poly	Field Filtered; (NH4)2SO4, NH4OH, 4°C	28
Dissolved Magnesium	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Dissolved Molybdenum	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Dissolved Selenium	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Oil and Grease	1664B	EPA 1664B	1 L Amber glass	HCl, 4°C	30
Dissolved Potassium	3005A	EPA 6020	250 ml Poly	Field Filtered; HNO3, 4°C	180
Dissolved Title 22 Metals	3050B	EPA 6010B	250 ml Poly	Field Filtered; HNO3, 4°C	180
Ammonia as nitrogen	--	SM4500-NH3D	1 L Amber glass	H2SO4, 4°C	28
Fluorescent tracers	9012B	OUL in-house method	50 mL plastic vial	4°C	30
Fluorescent tracers	9012B	OUL in-house method	carbon sampler	4°C	30

-- = not applicable

L - Liter

mL - Milliliter

Na2S2O3 - Sodium thiosulfate

NaOH - Sodium hydroxide

(NH4)2SO4 - Ammonium sulfate

NH4OH - Ammonium hydroxide

Poly - Polyethylene bottle

SM - Standard method

SW - Solid Waste Method

VOA - Volatile organic analysis

ZnAc - Zinc acetate

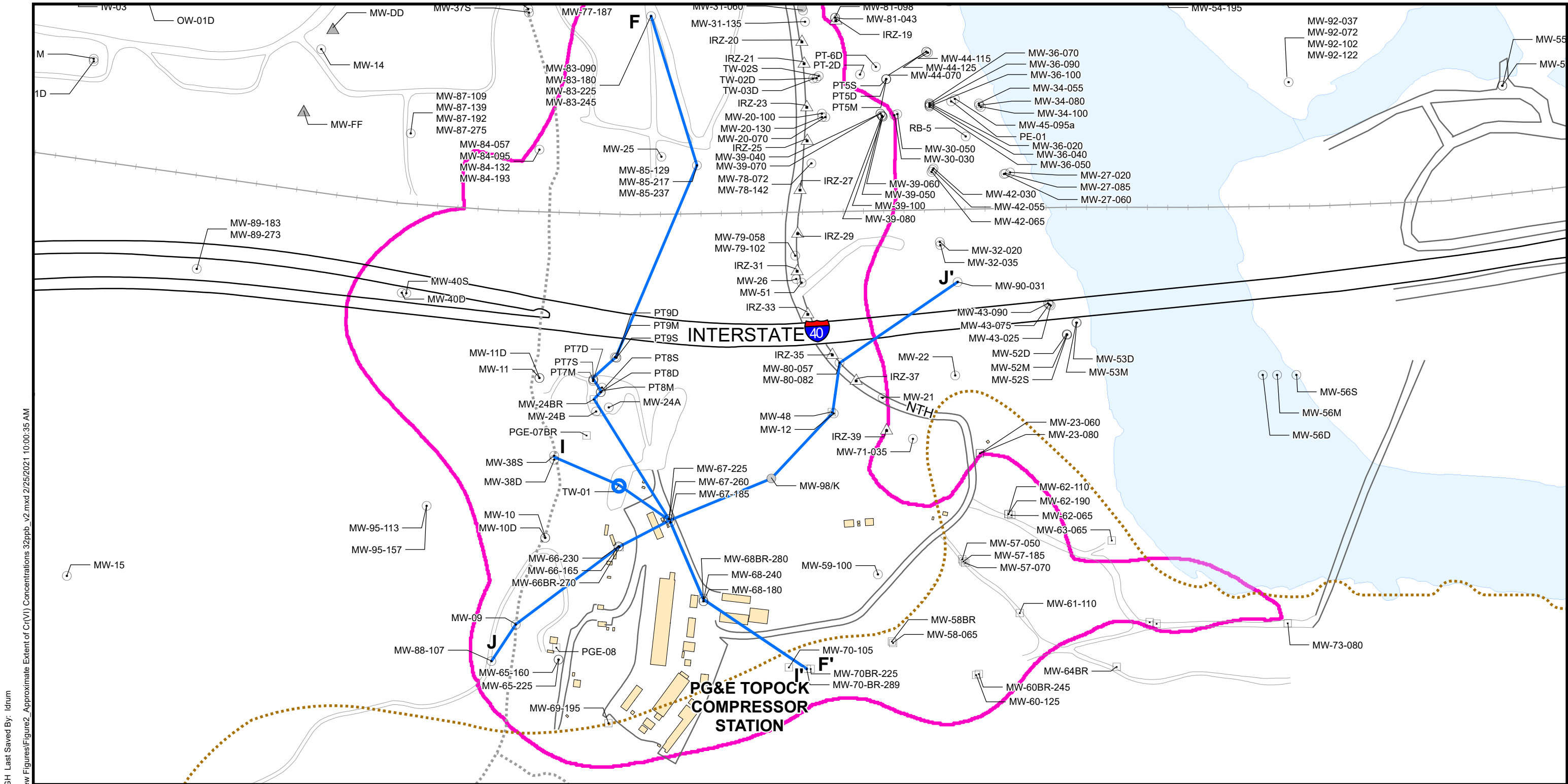
FIGURES









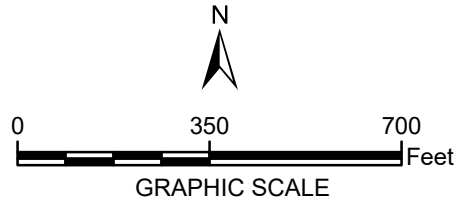


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Topock (RC000753.802D.04182)  
T:\ENVPGE\_Topock\GEC\MD\GMP\2Q20\Final\New Figures\Figure2\_Approximate Extent of Cr(VI) Concentrations 32ppb\_v2.mxd 2/25/2021 10:00:35 AM

#### LEGEND

- Groundwater Monitoring Well
- Groundwater Well Completed in Bedrock
- Remediation Well
- Test Well
- Bat Cave Wash
- Approximate bedrock contact at 455 feet above mean sea level.

Approximate Extent of Cr(VI) Concentrations Exceeding 32 ppb based on most recent Sampling Data



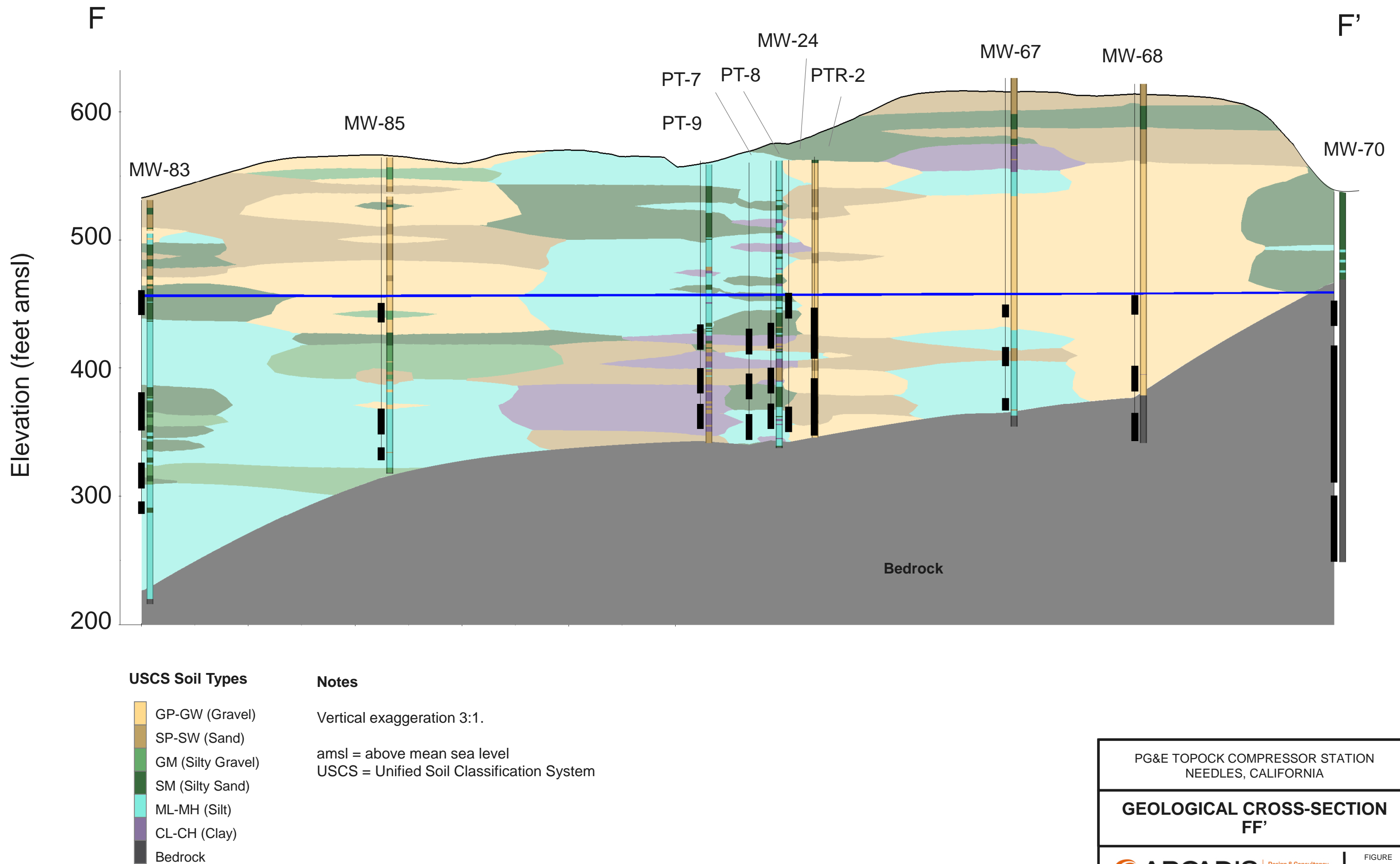
#### Notes:

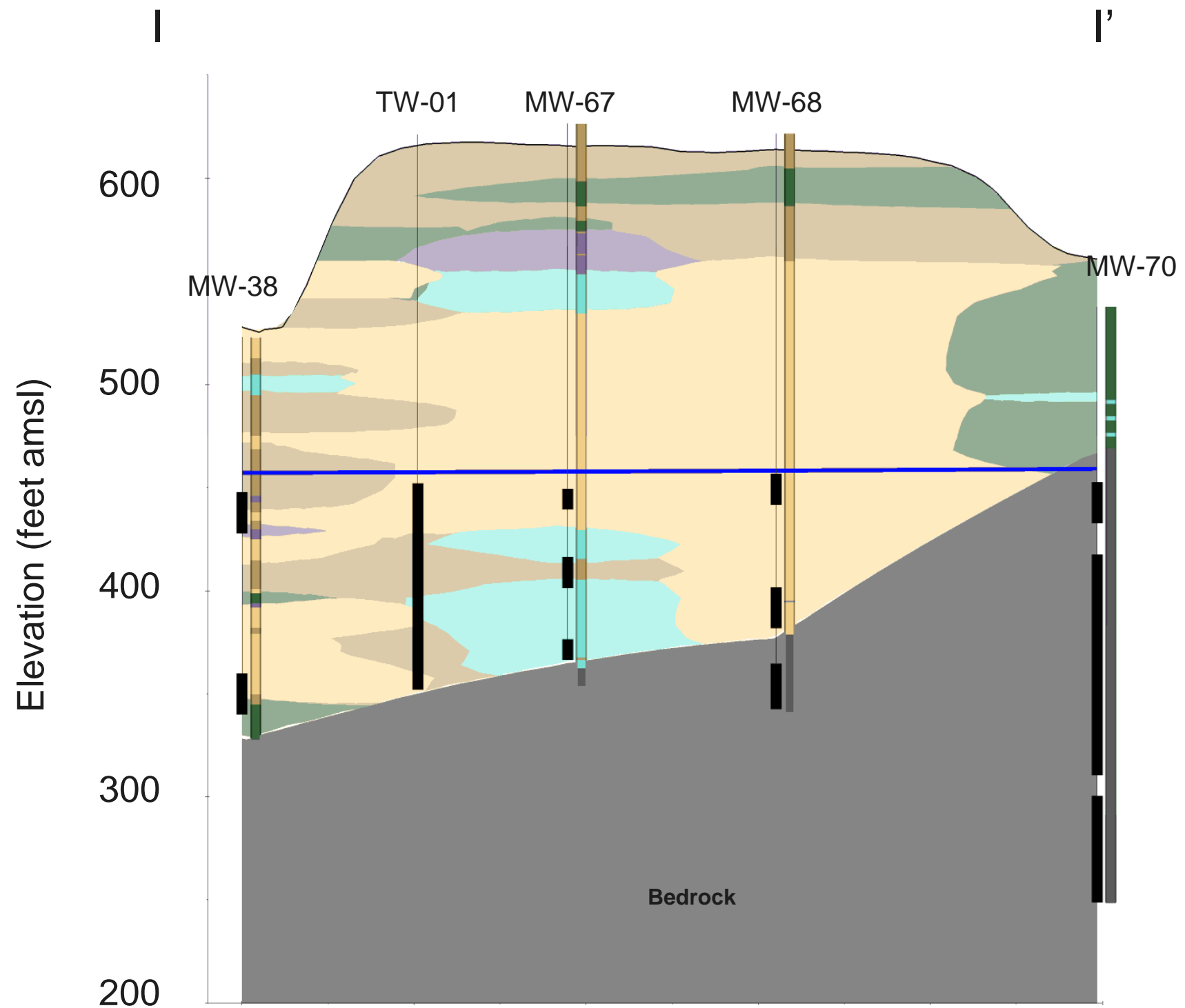
Cr(VI) = Hexavalent Chromium  
ppb = Parts Per Billion  
NTH = National Trails Highway

#### PG&E TOPOCK COMPRESSOR STATION NEEDLES, CALIFORNIA

**APPROXIMATE EXTENT OF CR(VI)  
CONCENTRATIONS EXCEEDING 32 PPB  
BASED ON MOST RECENT SAMPLING DATA**

2/26/2021 8:40:23 AM





#### USCS Soil Types

<span style="display:inline-block; width:10px; height:10px; background-color:yellow; border:1px solid black;"></span>	GP-GW (Gravel)
<span style="display:inline-block; width:10px; height:10px; background-color:tan; border:1px solid black;"></span>	SP-SW (Sand)
<span style="display:inline-block; width:10px; height:10px; background-color:lightgreen; border:1px solid black;"></span>	GM (Silty Gravel)
<span style="display:inline-block; width:10px; height:10px; background-color:darkgreen; border:1px solid black;"></span>	SM (Silty Sand)
<span style="display:inline-block; width:10px; height:10px; background-color:cyan; border:1px solid black;"></span>	ML-MH (Silt)
<span style="display:inline-block; width:10px; height:10px; background-color:purple; border:1px solid black;"></span>	CL-CH (Clay)
<span style="display:inline-block; width:10px; height:10px; background-color:grey; border:1px solid black;"></span>	Bedrock

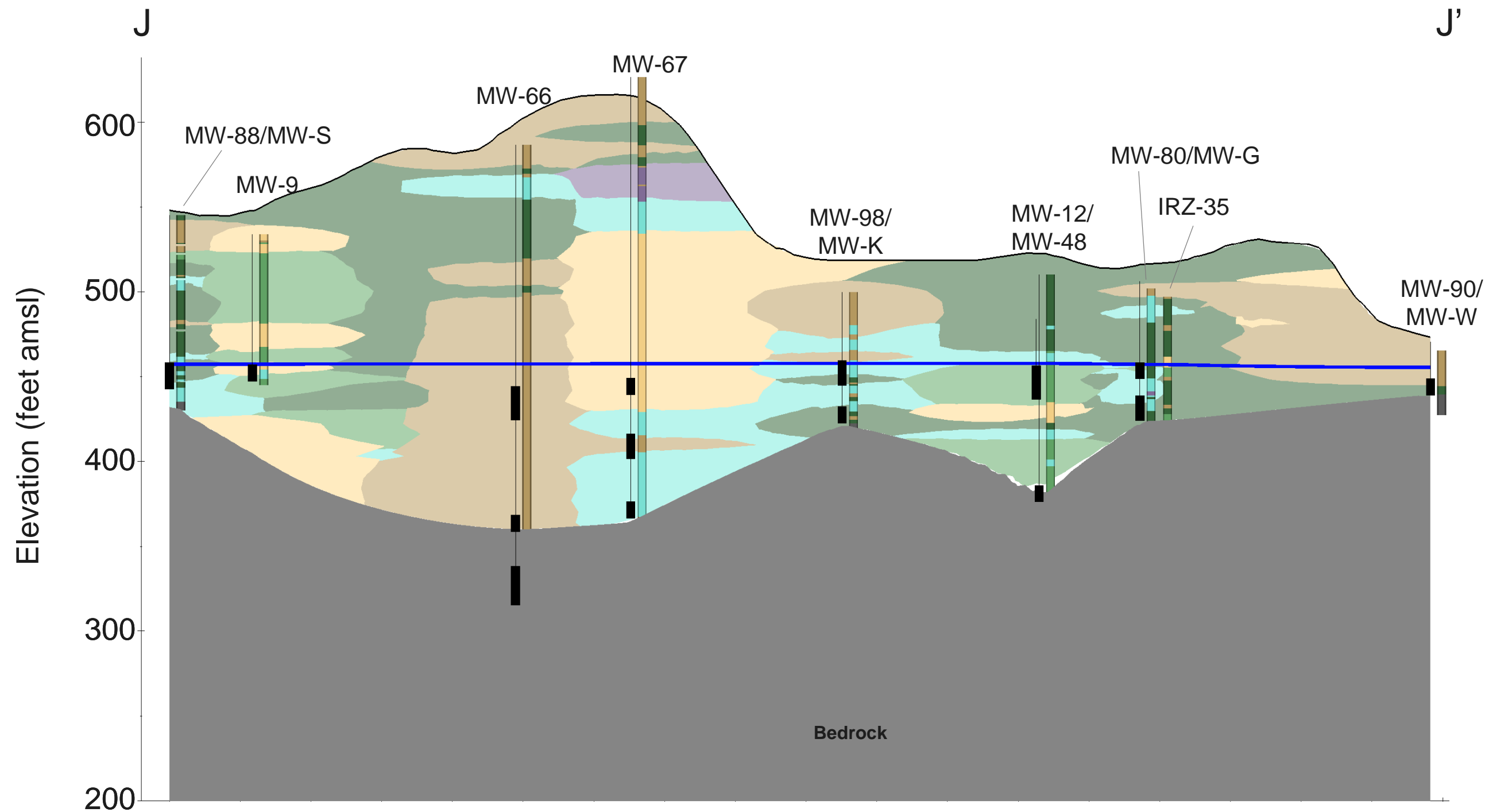
#### Notes

Vertical exaggeration 3:1.  
 amsl = above mean sea level  
 USCS = Unified Soil Classification System

PG&E TOPOCK COMPRESSOR STATION  
 NEEDLES, CALIFORNIA

### GEOLOGICAL CROSS-SECTION II'

2/26/2021 8:40:23 AM



PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

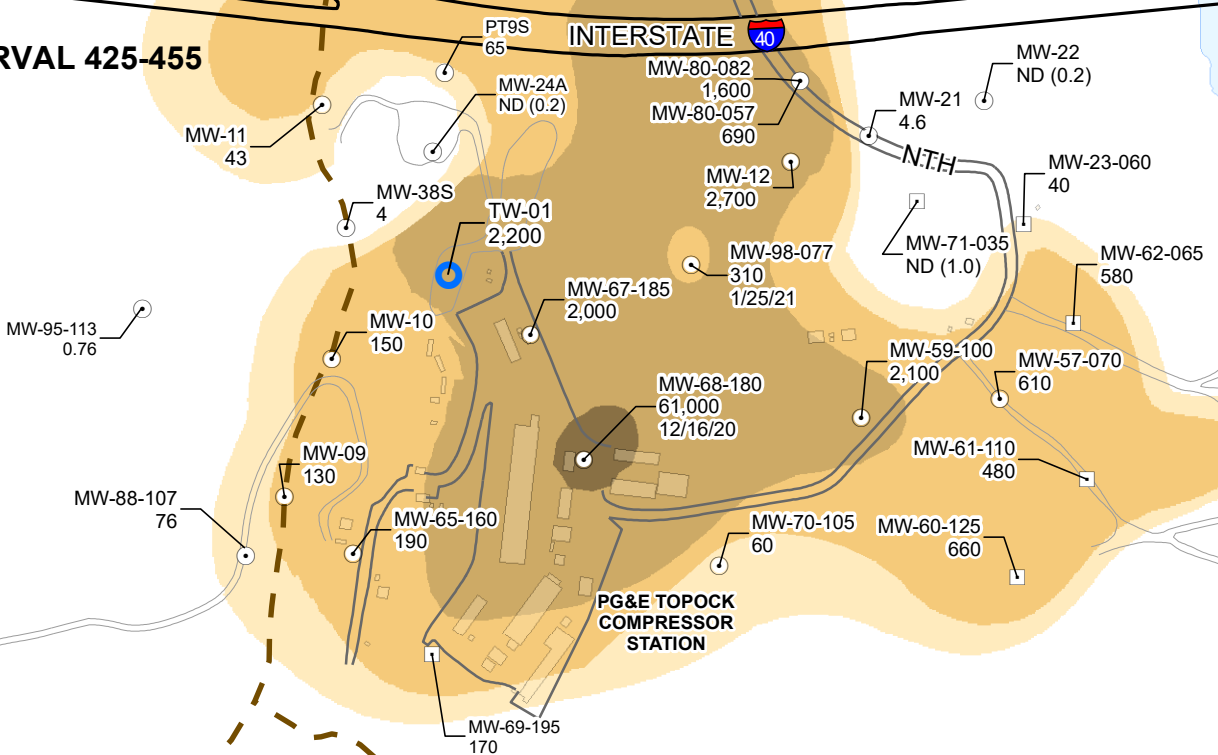
## GEOLOGICAL CROSS-SECTION JJ'

**ARCADIS** Design & Consultancy  
for natural and  
built assets

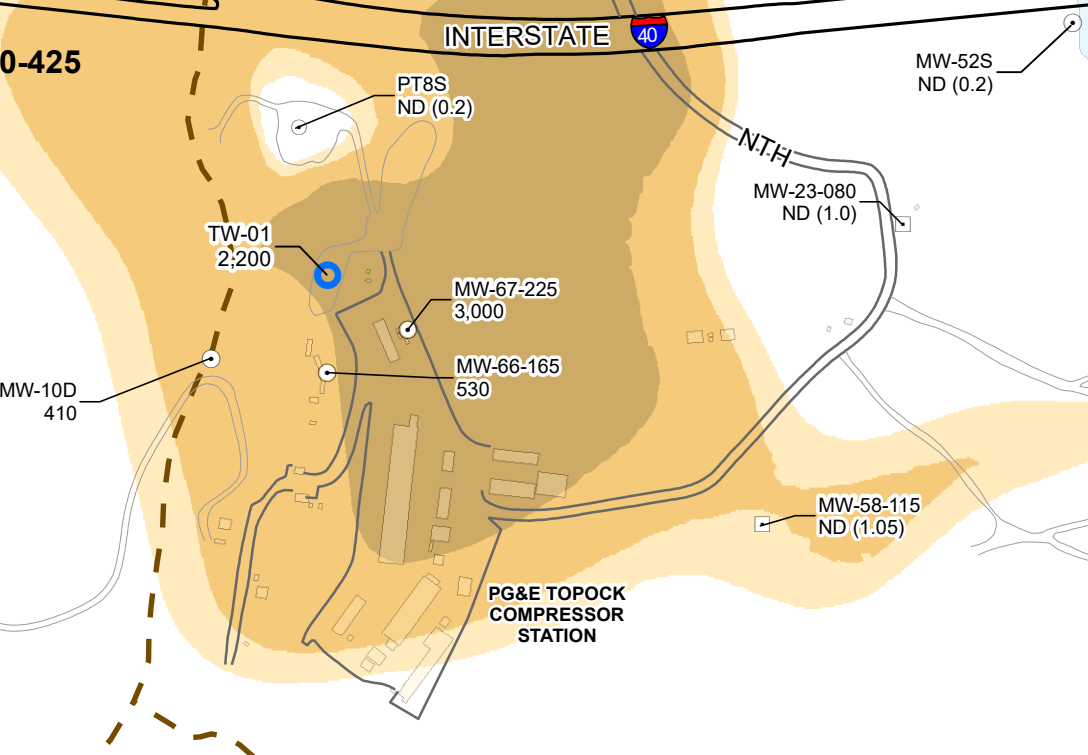
FIGURE  
**5**

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Topock (RC000753.802D.04182)  
T:\ENV\PG&E\_Topock\GEC\MD\GMP\2020\Final\New Figures\Figure6\_Cr(VI) Concentrations in Groundwater by Elevation Interval.mxd 2/25/2021 1:45:55 PM

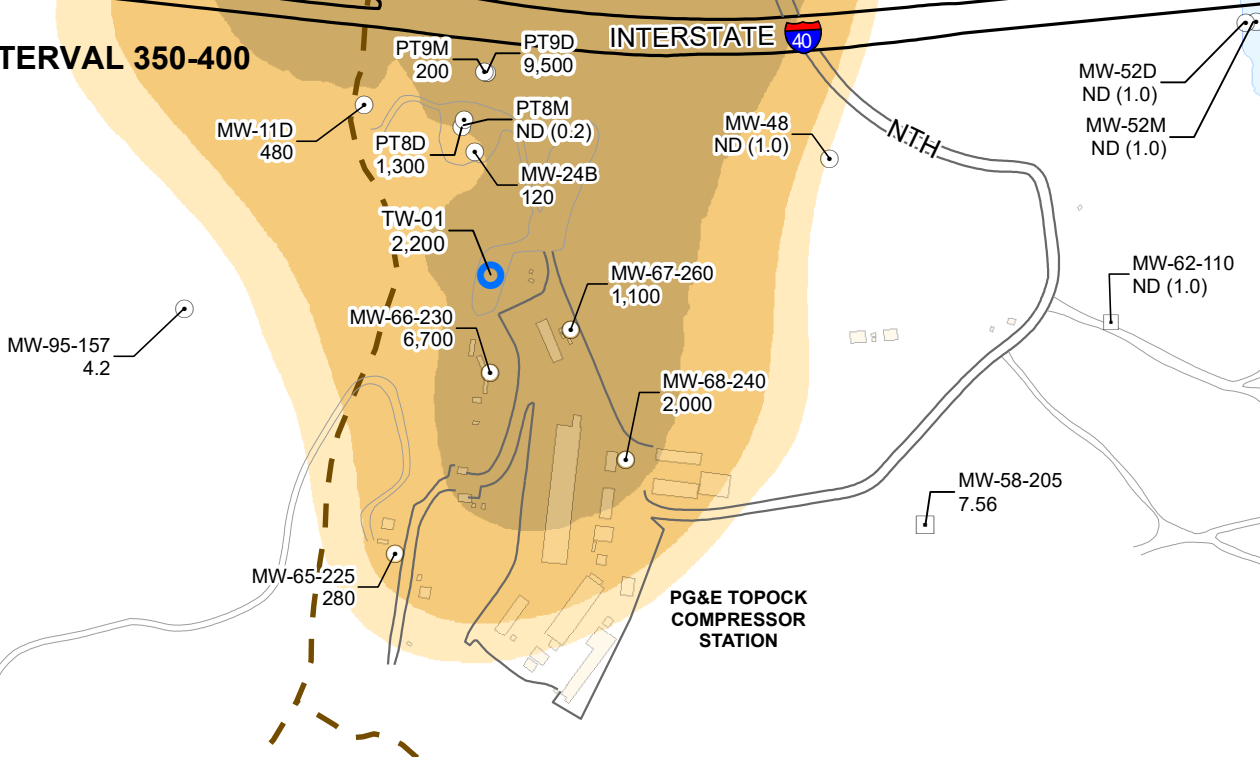
**LAYER 1**  
**ELEVATION INTERVAL 425-455**



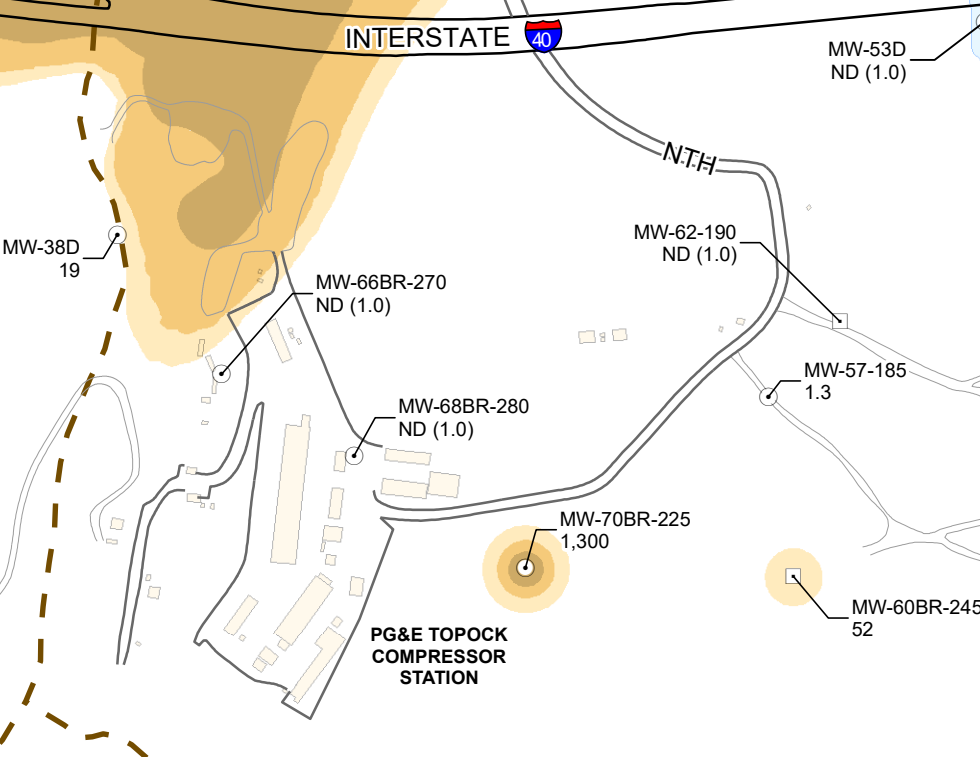
**LAYER 2**  
**ELEVATION INTERVAL 400-425**



**LAYER 3**  
**ELEVATION INTERVAL 350-400**



**LAYER 4**  
**ELEVATION INTERVAL 350-300**



**LEGEND**

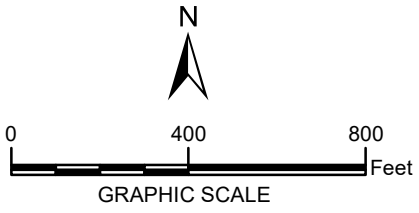
- Groundwater Monitoring Well
- Groundwater Well Completed in Bedrock
- Test Well
- Bat Cave Wash

**Cr(VI) contours**

- 32 ppb
- 100 ppb
- 1000 ppb
- 10000 ppb

- Notes:**
- Cr(VI) = Hexavalent Chromium
  - ppb = Parts Per Billion
  - NTH = National Trails Highway
  - Data posted for MW-98-077 is from January 2021
  - Data posted for MW-68-180 is from December 2020

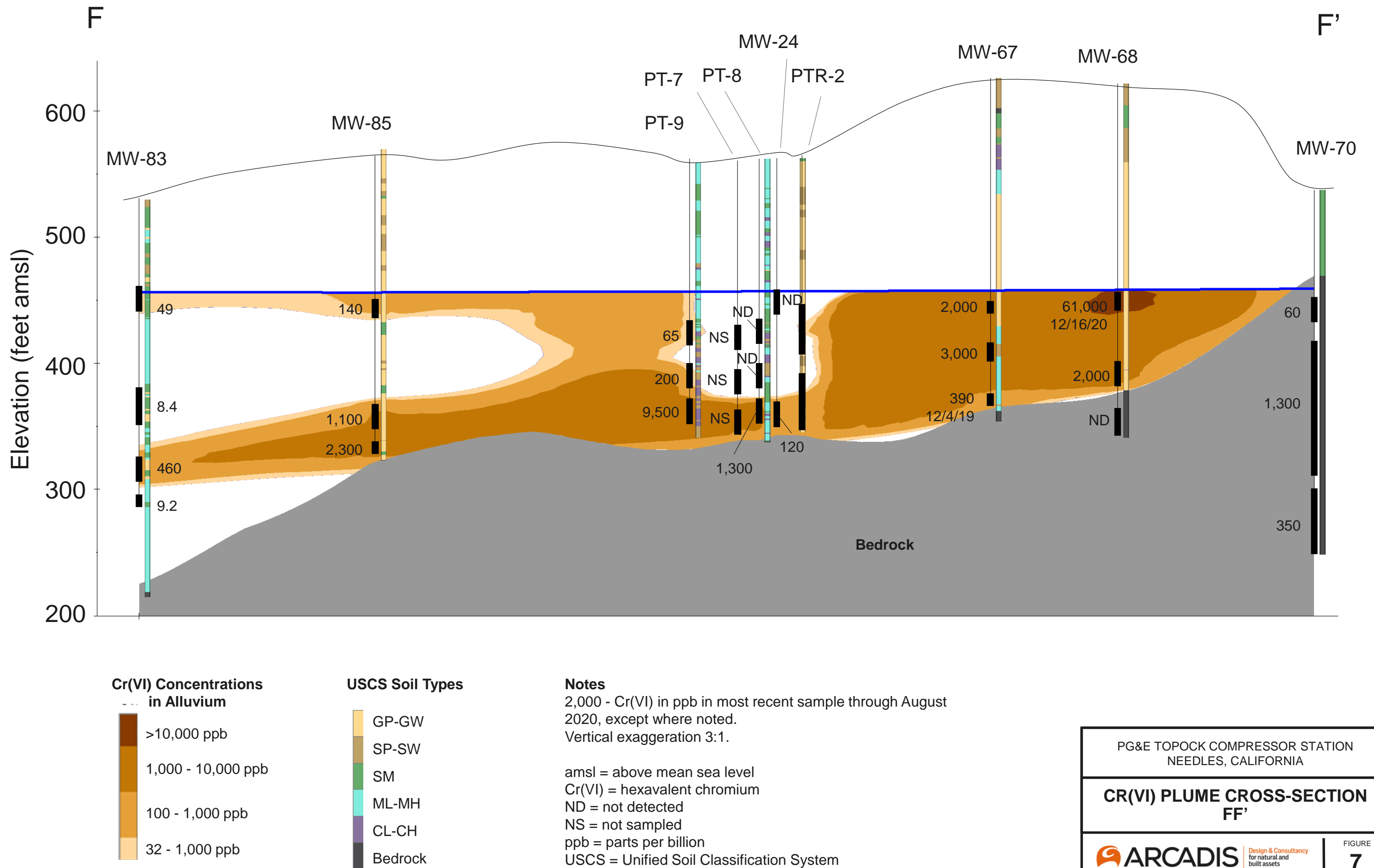
MW-58-205 7.56 — Well ID  
— Most recent concentration through August 2020, except where noted



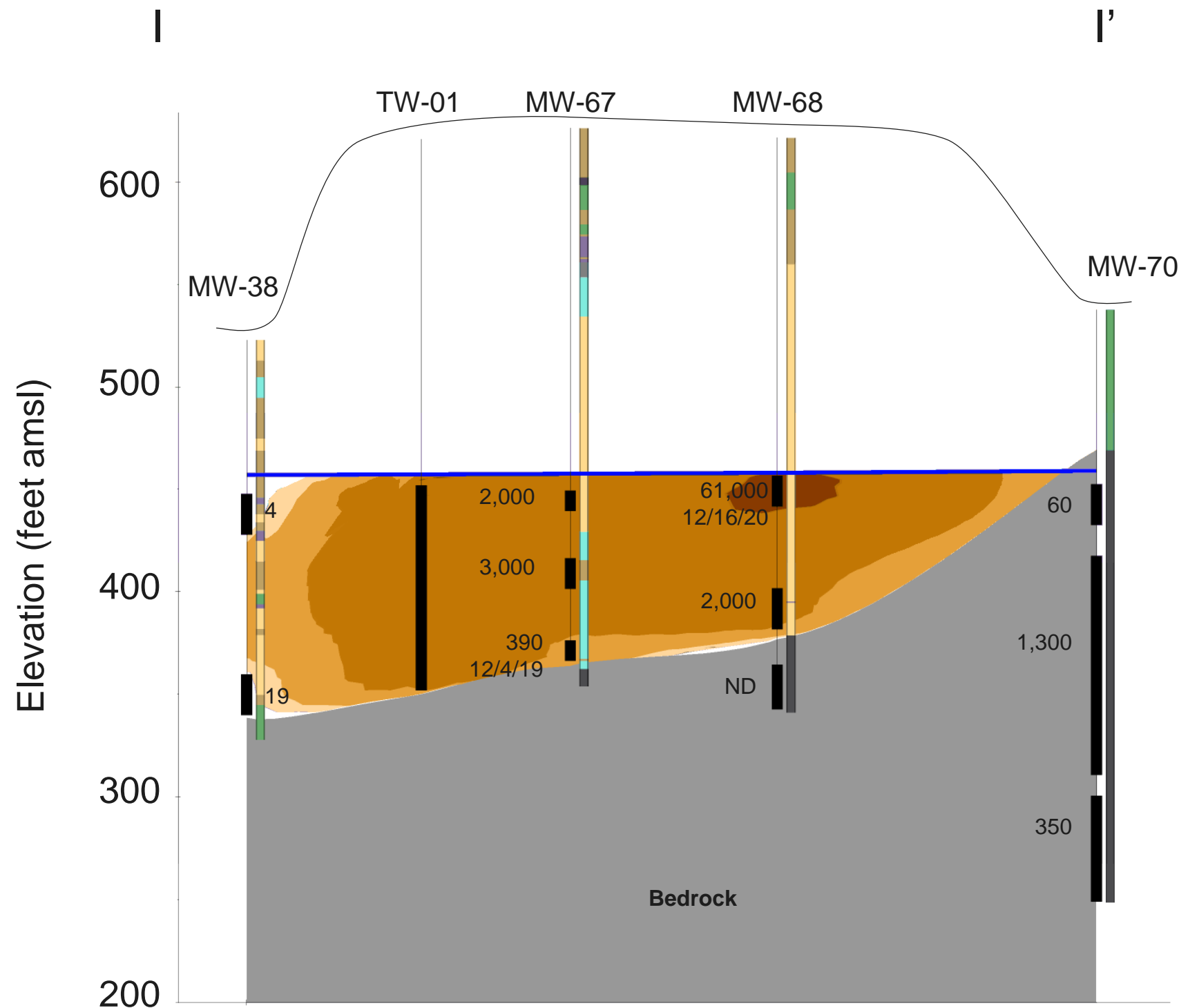
**PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA**

**CR(VI) CONCENTRATIONS IN  
GROUNDWATER BY  
ELEVATION INTERVAL**

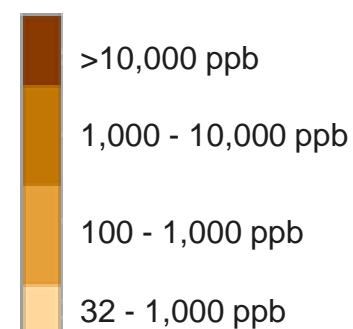
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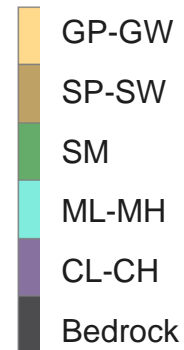




#### Cr(VI) Concentrations in Alluvium



#### USCS Soil Types



#### Notes

2,000 - Cr(VI) in ppb in most recent sample through August 2020, except where noted.  
Vertical exaggeration 3:1.

amsl = above mean sea level  
Cr(VI) = hexavalent chromium  
ND = not detected  
NS = not sampled  
ppb = parts per billion  
USCS = Unified Soil Classification System

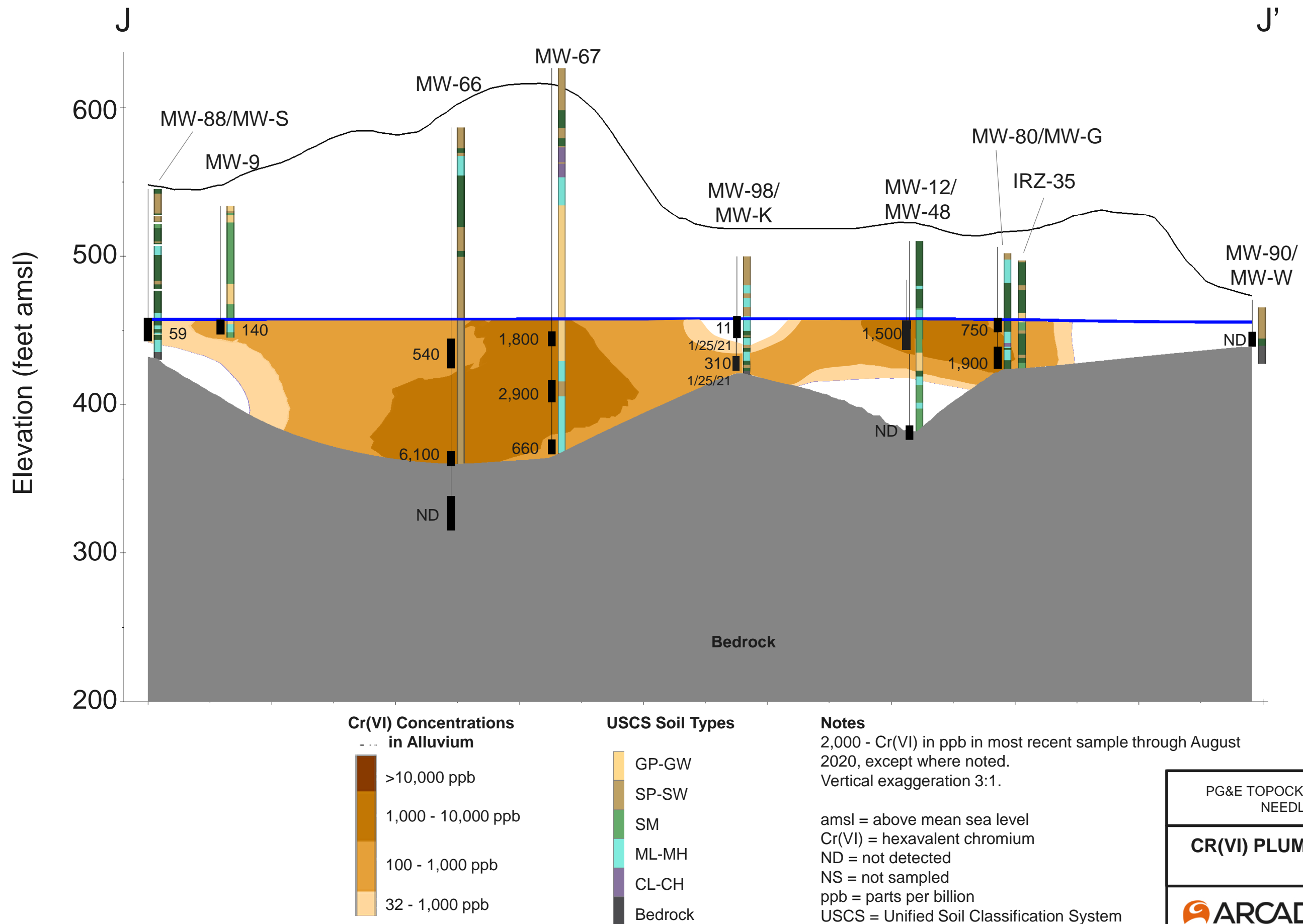
PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

#### CR(VI) PLUME CROSS-SECTION II'



FIGURE  
8

2/26/2021 8:40:23 AM



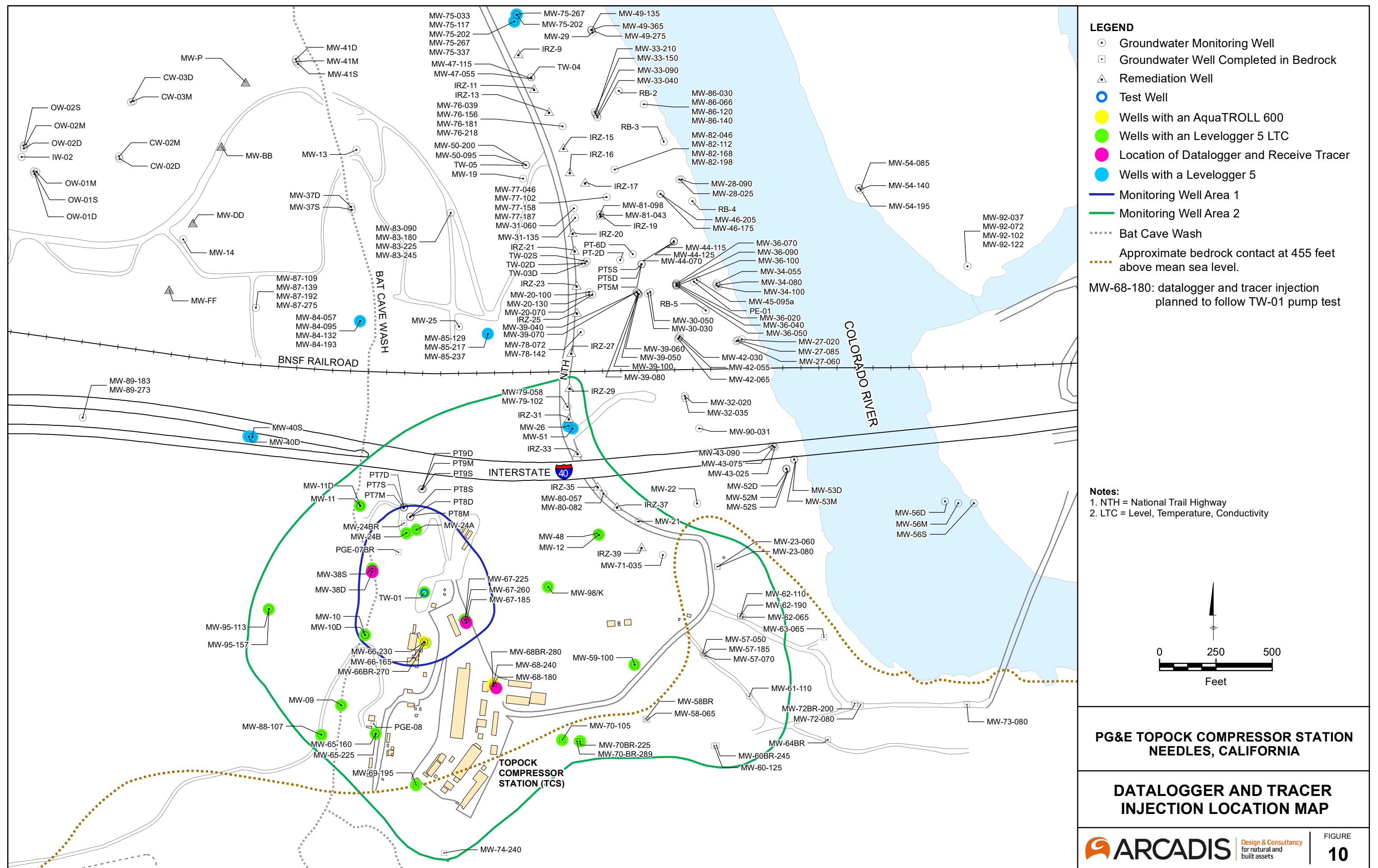
PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

## CR(VI) PLUME CROSS-SECTION JJ'

**ARCADIS** Design & Consultancy  
for natural and  
built assets

FIGURE  
**9**



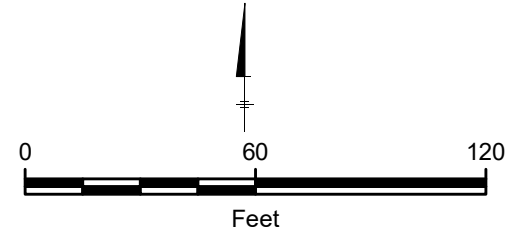






**LEGEND**

- GROUNDWATER MONITORING WELL
- TEST WELL
- GRAVEL ROAD / AREA
- PAVED ROAD
- ..... BAT CAVE WASH
- DELINEATED EXCLUSION ZONE
- 20,000 GALLON FRAC TANK WITH SECONDARY CONTAINMENT
- 6,000 GALLON TANK WITH SECONDARY CONTAINMENT



PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

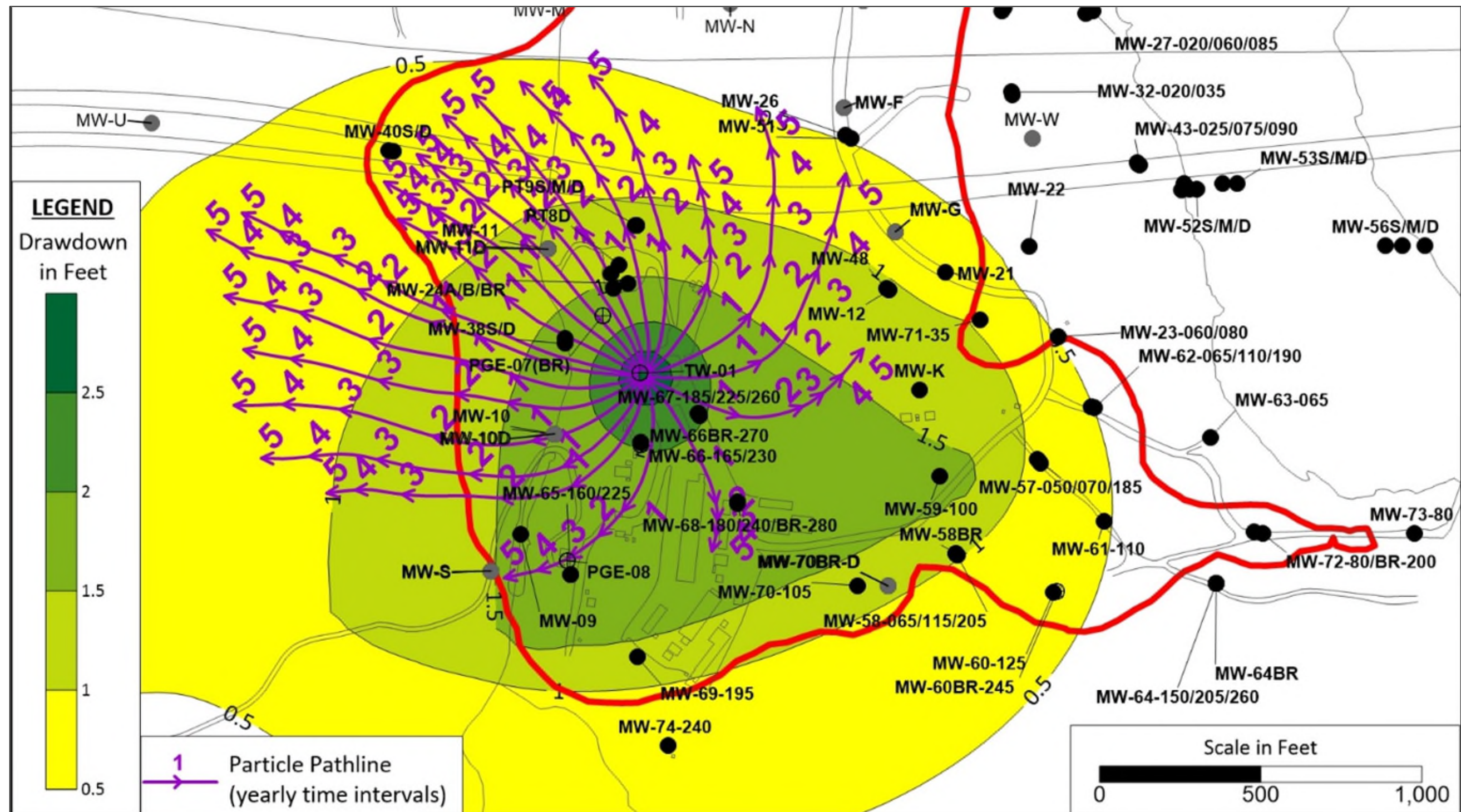
TRACER INJECTION  
EQUIPMENT LAYOUT



Design & Consultancy  
for natural and  
built assets

FIGURE  
%%

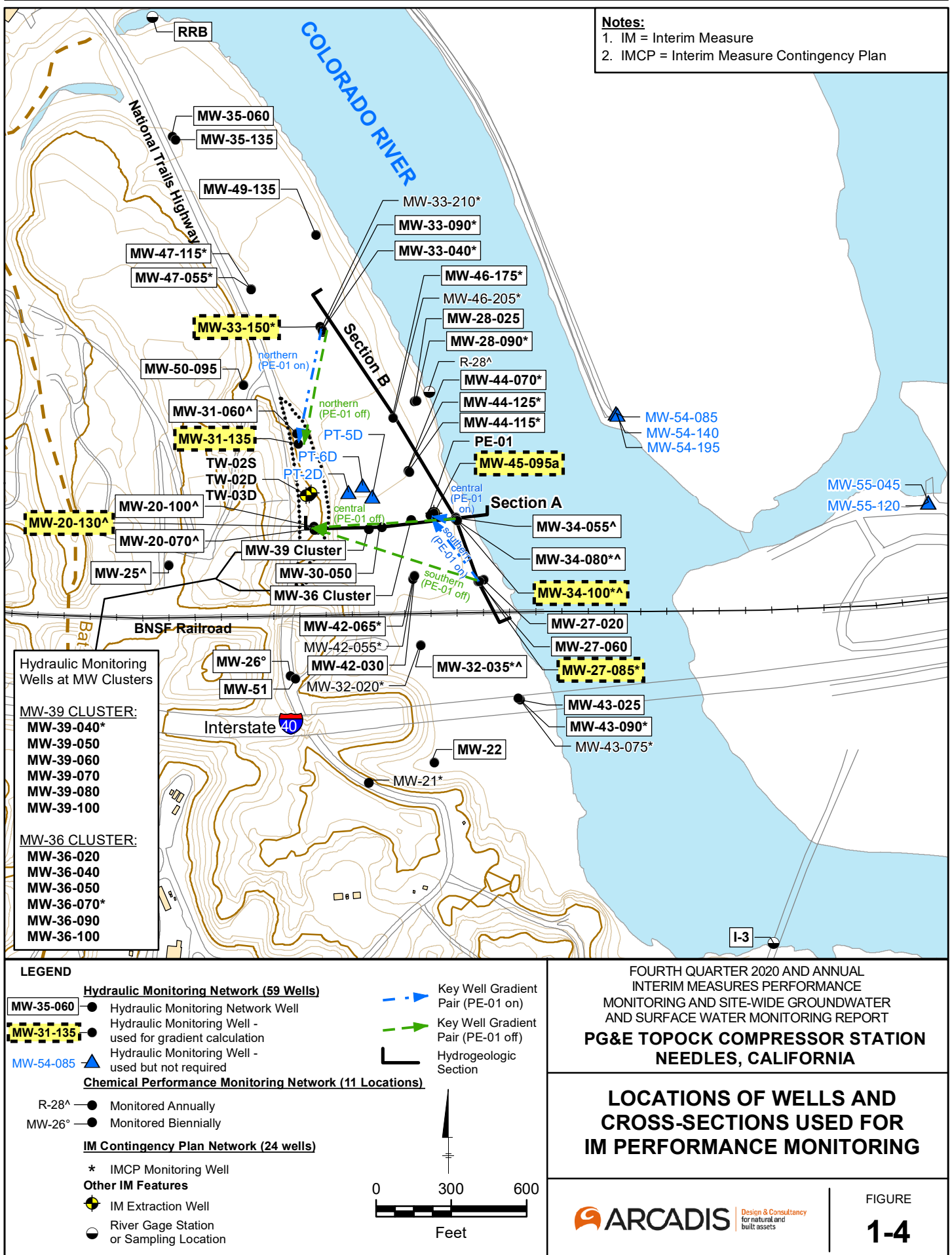




- Approximate Extent of Hexavalent Chromium Concentrations Exceeding 32 micrograms per liter
- Groundwater Monitoring Well Historical
- Groundwater Monitoring Well (New)
- Remediation Well

PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

## TW-01 DRAWDOWN MODELING



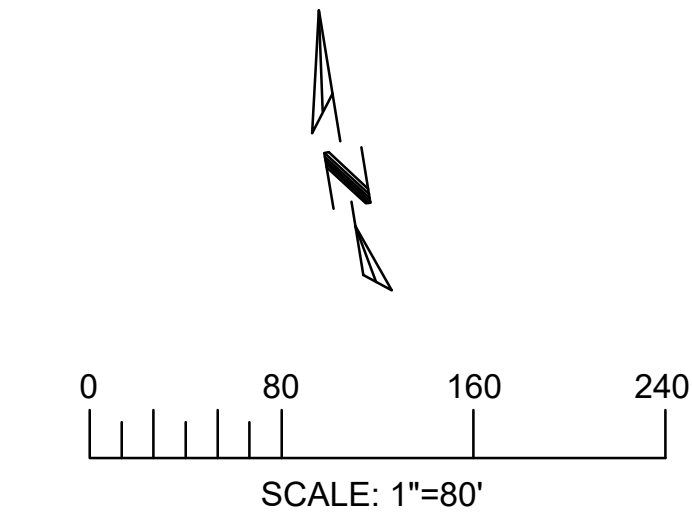
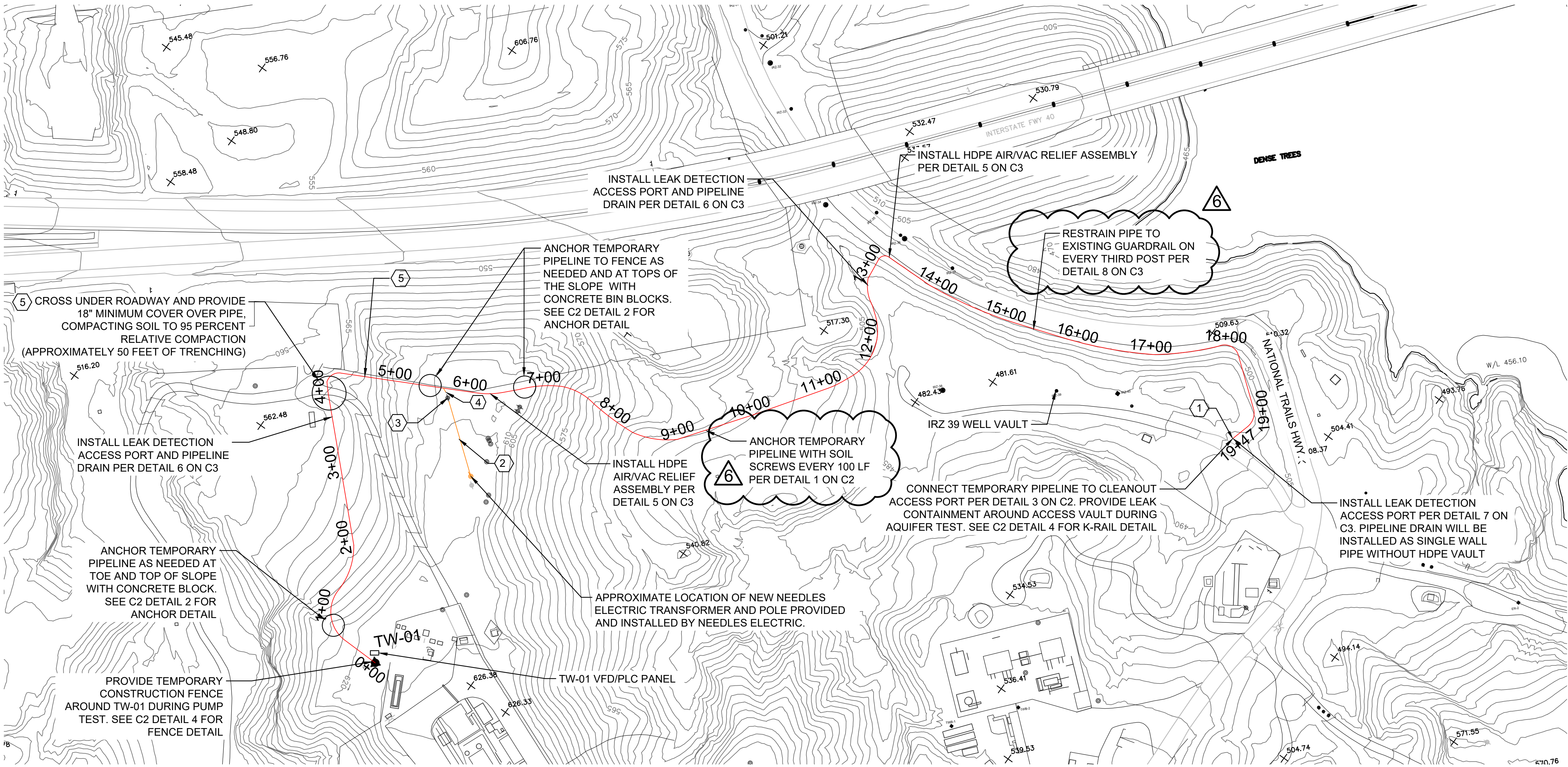








E  
D  
C  
B  
A



- LEGEND**
- AQUIFER TEST WATERLINE
  - AERIAL POWER CABLE INSTALLED BY NEEDLES ELECTRIC

**KEY NOTES:**

- ① INSTALL DUAL CONTAINMENT 6"x10" REDUCED TO 3"x6" WITH BLIND FLANGE TERMINATION AND ACCESS VAULT FOR TEMPORARY PUMP TEST WATERLINE CONNECTION.
- ② AERIAL POWER CABLE, PROVIDED AND INSTALLED BY NEEDLES ELECTRIC.
- ③ EXISTING CONDUIT RISER POLE. NEEDLES ELECTRIC SHALL PROVIDE AND INSTALL METER AND POWER DROP WITH WEATHERHEAD ON POLE. CONTRACTOR SHALL INSTALL 60A SERVICE ENTRANCE RATED DISCONNECT BELOW METER.
- ④ (2) #4, (1) #8 G., 1" C. FROM EXISTING CONDUIT RISER POLE TO TEMPORARY PIPELINE.
- ⑤ (2) #4, (1) #8 G. PVC-COATED RIGID MC CABLE, ATTACHED TO TEMPORARY PIPELINE. SUPPORT MC CABLE AS REQUIRED BY NEC, AT 6' MAXIMUM SPACING. RUN IN 1" CONDUIT AT ROADWAY CROSSING.

**NOTES:**

- 1. CONSTRUCT TEMPORARY WATER LINE TO BE ABOVE GRADE. LOCATION SHOWN IS APPROXIMATE. CONTRACTOR TO FIELD LOCATE, ADJUST ALIGNMENT AS NEEDED AND AS APPROVED BY ENGINEER.
- 2. CONSTRUCTION WATER LINE TO BE SECURED USING TEMPORARY SOIL ANCHORS AND PIPE STRAPS OR APPROVED EQUIVALENT. SEE C2 DETAIL 1 FOR SOIL ANCHOR DETAIL.



NO.	DATE	DESCRIPTION	GM/SPEC	DWN	CHKD	SUPV	APVD BY
6	03/18/21	RTC REVISION #1					

REVISIONS

5	02/22/21	ISSUED FOR CONSTRUCTION						LTH	VJM	BLP	RAO		
4	12/28/20	AGENCY REVIEW - RTC REVISION						LTH	VJM	BLP	RAO		
3	11/20/20	REVISED ALIGNMENT 90% PLAN (2.0)						MJS	VJM	BLP	RAO		
2	11/03/20	REVISED ALIGNMENT 90% PLAN						MJS	VJM	BLP	RAO		
1	10/16/20	REVISED ALIGNMENT 60% PLAN						MJS	VJM	BLP	RAO		
0	09/21/20	PRELIMINARY (30%) PLAN						MJS	VJM	BLP	RAO		

REVISIONS

APPROVED BY	RAO	SO
		SUPV
DATE	SCALES	DSGN
		DWN
DATE	SCALES	CHKD
		OK

TOPOCK GROUNDWATER REMEDIATION PROJECT  
**TEMPORARY CONSTRUCTION  
AQUIFER TEST WATERLINE**  
GAS TRANSMISSION & DISTRIBUTION  
PACIFIC GAS AND ELECTRIC COMPANY  
SAN FRANCISCO, CALIFORNIA

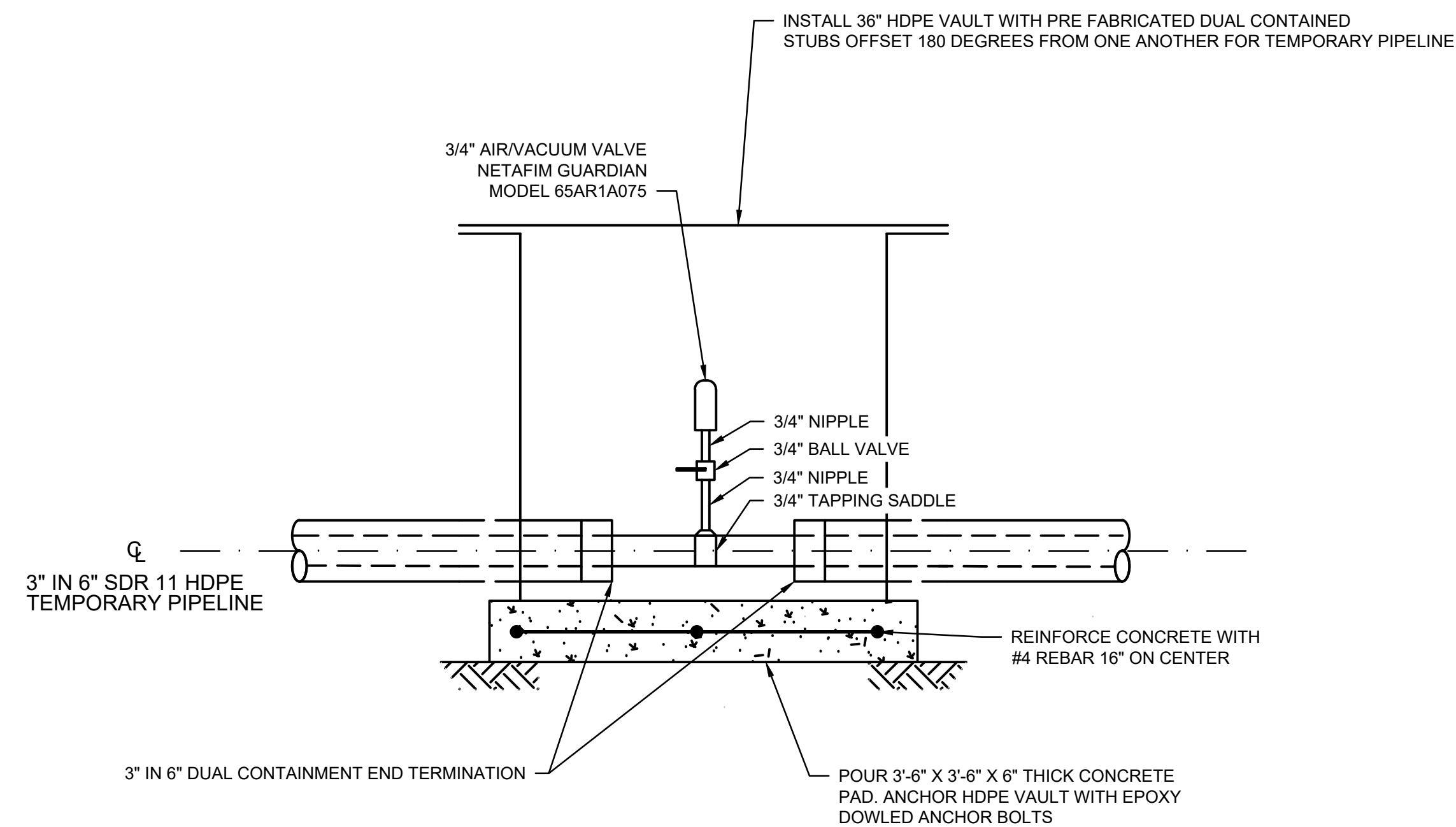
MICROFILM	
BILL OF MATL	
DWG LIST	
SUPSDS	
SUPSD BY	
SHEET NO.	of SHEETS
C1	REV 6

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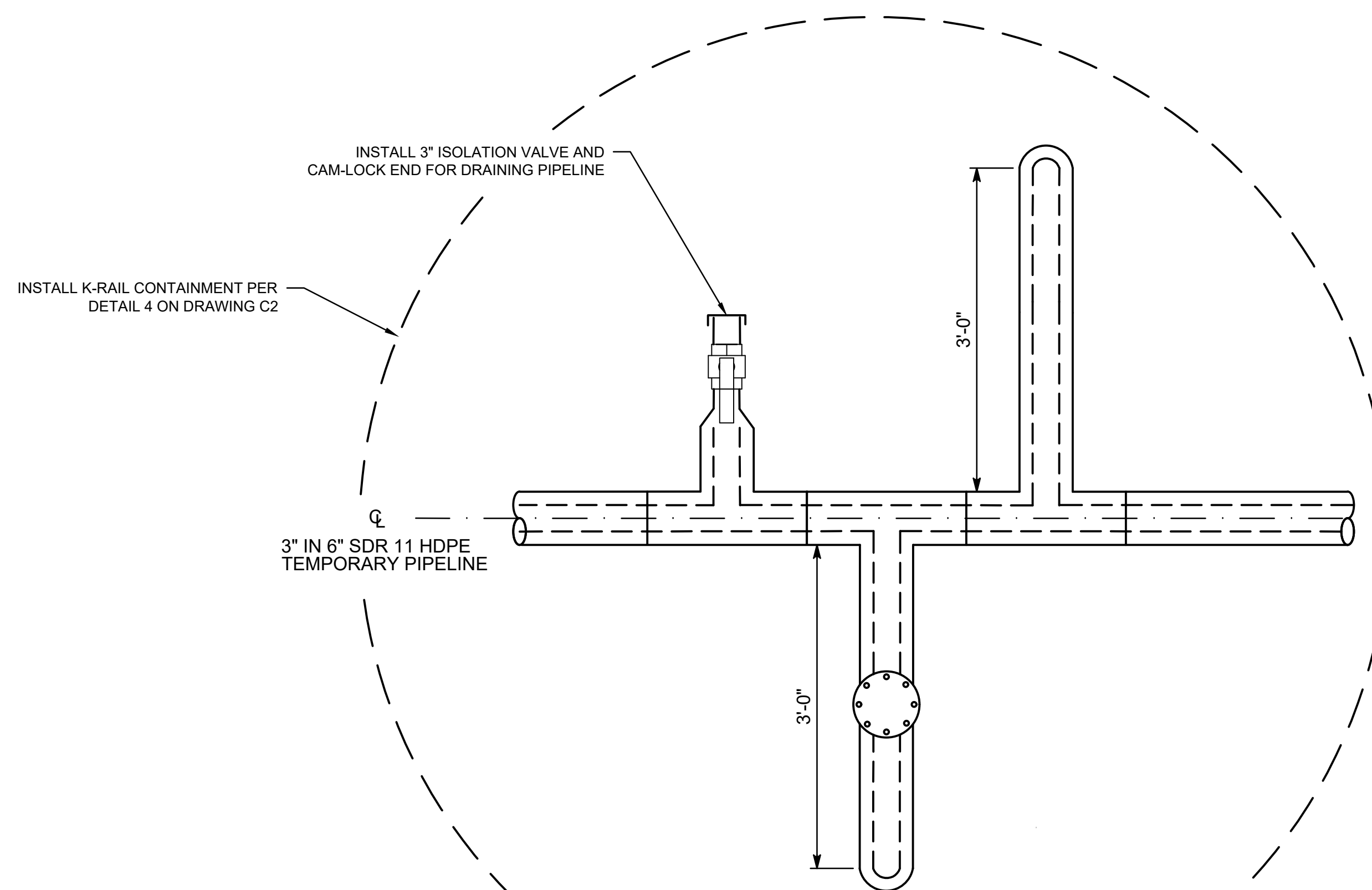




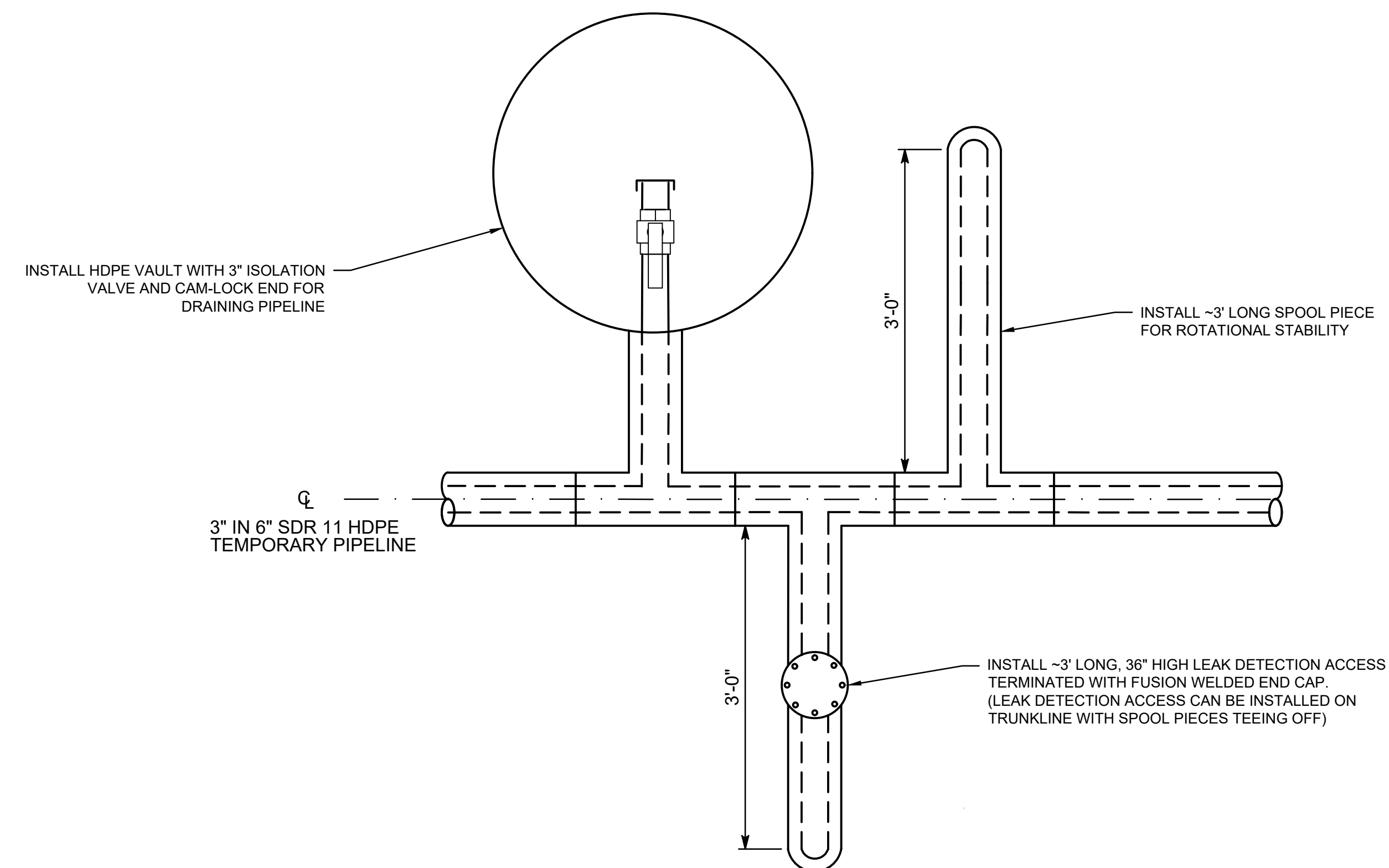




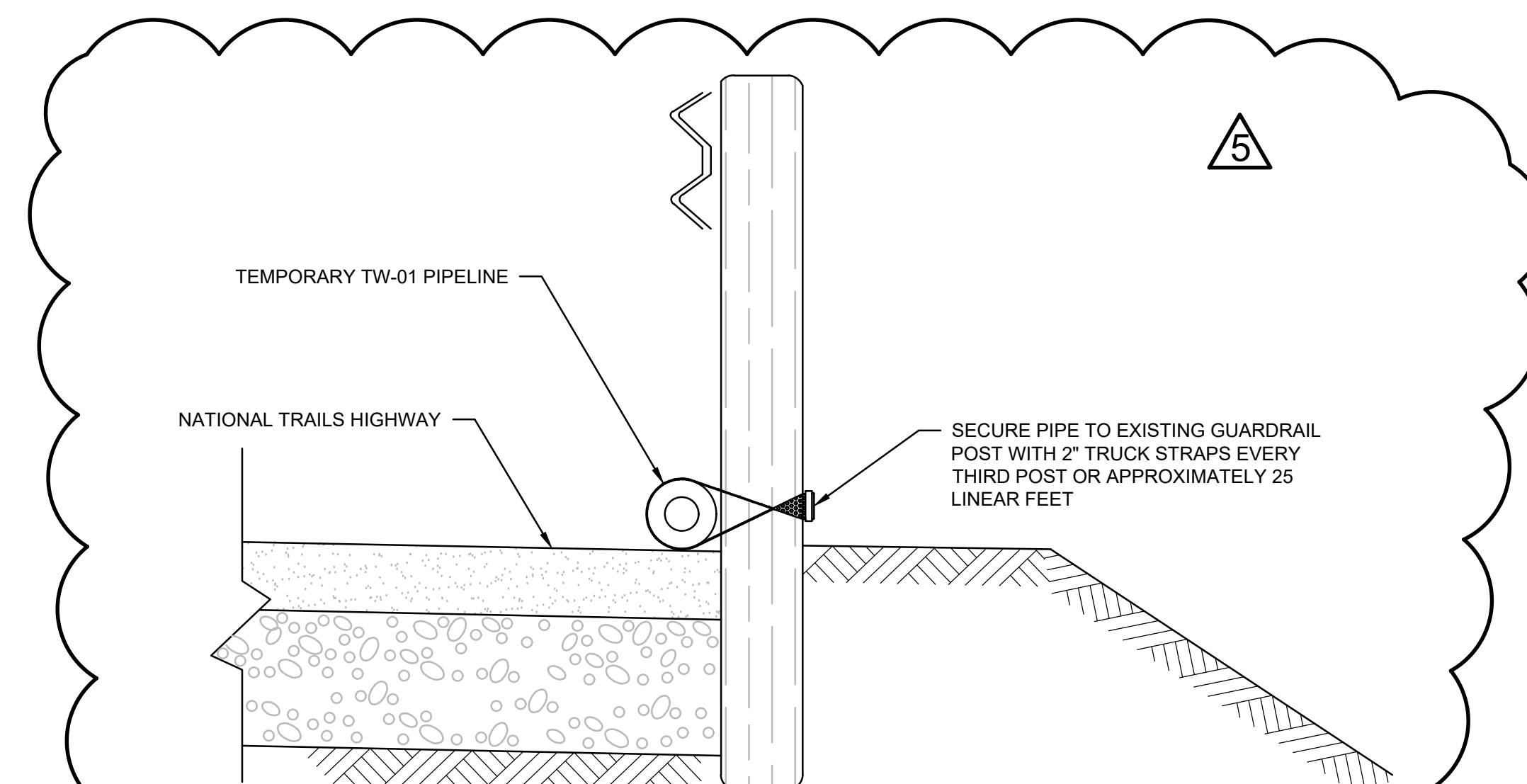
5 AIR/VACUUM VALVE DETAIL  
1"=1'-0"



7 LEAK DETECTION AND DRAIN DETAIL  
1"=1'-0"



6 LEAK DETECTION AND HDPE VAULT DRAIN DETAIL  
1"=1'-0"



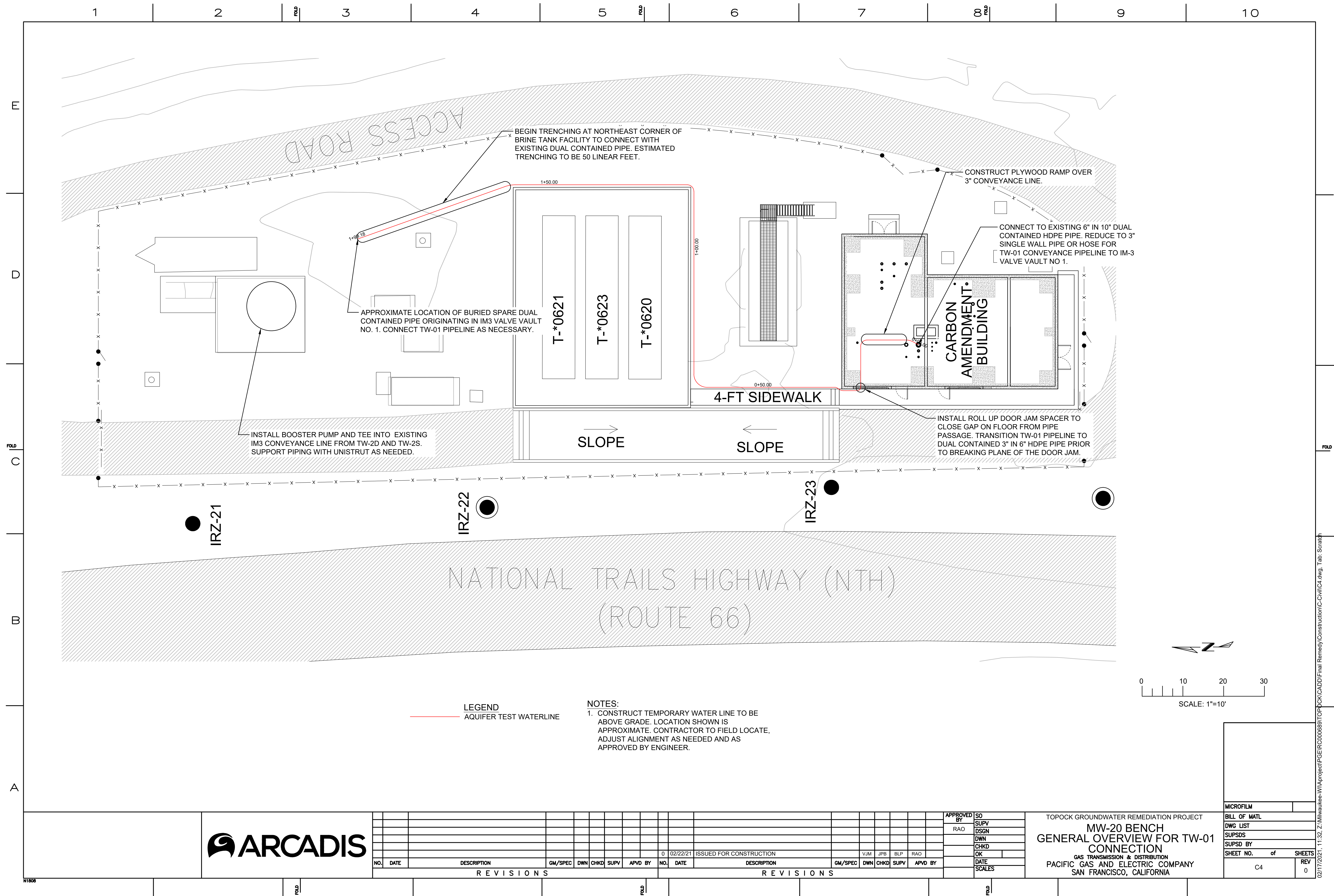
8 GUARDRAIL ATTACHMENT DETAIL  
1"=1'-0"

[illegible]

APPROVED BY	SO
RAO	SUPV
	DSGN
	DWN
	CHKD
	OK
	DATE
	SCALES

TOPOCK GROUNDWATER REMEDIATION PROJECT  
TEMPORARY CONSTRUCTION  
AQUIFER TEST WATERLINE  
DETAILS (SHEET 2 OF 2)  
GAS TRANSMISSION & DISTRIBUTION  
PACIFIC GAS AND ELECTRIC COMPANY  
SAN FRANCISCO, CALIFORNIA

MICROFILM	
BILL OF MATL	
DWG LIST	
SUPSDS	
SUPSD BY	
SHEET NO.	of SHEETS
C3	REV 5



# APPENDIX A

Analytical Data Summary



## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-09	10/06/2008	3V	N	282
MW-09	09/24/2009	3V	N	311
MW-09	12/15/2010	3V	N	312
MW-09	12/09/2011	3V	N	299
MW-09	12/05/2012	3V	N	259
MW-09	12/09/2013	3V	N	240
MW-09	12/02/2014	LF	N	210
MW-09	05/12/2015	LF	N	230
MW-09	10/07/2015	LF	N	200
MW-09	12/01/2015	LF	N	190
MW-09	05/03/2016	LF	N	190
MW-09	12/07/2016	LF	N	160
MW-09	02/09/2017	LF	N	160
MW-09	05/03/2017	LF	N	160
MW-09	12/07/2017	LF	N	150
MW-09	02/23/2018	LF	N	150
MW-09	05/02/2018	LF	N	150
MW-09	12/12/2018	LF	N	140
MW-09	03/18/2019	LF	N	140
MW-09	05/17/2019	LF	N	150
MW-09	09/30/2019	LF	N	130
MW-09	12/18/2019	LF	N	120
MW-09	04/24/2020	LF	N	130
MW-10	03/11/2008	3V	N	478
MW-10	10/06/2008	3V	N	462
MW-10	03/12/2009	3V	N	265
MW-10	09/22/2009	3V	N	341
MW-10	03/11/2010	3V	N	2,880
MW-10	12/07/2010	3V	N	912
MW-10	12/07/2010	3V	FD	900
MW-10	05/05/2011	3V	N	411
MW-10	05/05/2011	3V	FD	391
MW-10	12/09/2011	3V	N	621
MW-10	05/15/2012	3V	N	269
MW-10	12/10/2012	3V	N	484
MW-10	05/14/2013	3V	N	267
MW-10	12/12/2013	3V	N	380
MW-10	05/14/2014	3V	N	260
MW-10	05/14/2014	3V	FD	260
MW-10	12/02/2014	LF	N	200

## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-10	05/12/2015	LF	N	280
MW-10	10/07/2015	LF	N	190
MW-10	12/01/2015	LF	N	150
MW-10	05/03/2016	LF	N	220
MW-10	12/07/2016	LF	N	180
MW-10	02/09/2017	LF	N	160
MW-10	05/03/2017	LF	N	190
MW-10	12/07/2017	LF	N	130
MW-10	12/07/2017	LF	FD	130
MW-10	02/23/2018	LF	N	160
MW-10	05/02/2018	LF	N	170
MW-10	12/12/2018	LF	N	110
MW-10	03/18/2019		FD	150
MW-10	03/18/2019	LF	N	150
MW-10	05/17/2019	LF	N	180
MW-10	05/17/2019	LF	FD	180
MW-10	09/30/2019	LF	N	110
MW-10	12/18/2019	LF	N	220
MW-10	04/23/2020		N	150
MW-10D	04/11/2019	PD	N	160
MW-10D	05/17/2019	LF	N	130
MW-10D	06/26/2019	LF	N	230
MW-10D	07/24/2019	LF	N	31
MW-10D	09/25/2019	LF	N	1,300
MW-10D	12/18/2019	LF	N	390
MW-10D	02/24/2020	LF	N	370
MW-10D	05/28/2020	LF	N	380
MW-10D	08/19/2020	LF	N	410
MW-11	01/24/2008	3V	N	342
MW-11	03/04/2008	3V	N	350
MW-11	03/11/2008	3V	N	319
MW-11	03/19/2008	3V	N	340
MW-11	03/27/2008	3V	N	360
MW-11	04/01/2008	3V	N	334
MW-11	04/15/2008	3V	N	326
MW-11	04/28/2008	3V	N	322
MW-11	05/13/2008	3V	N	420
MW-11	05/27/2008	3V	N	380
MW-11	06/10/2008	3V	N	302
MW-11	06/24/2008	3V	N	252

## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-11	07/22/2008	3V	N	299
MW-11	08/21/2008	3V	N	285
MW-11	09/16/2008	3V	N	269
MW-11	10/14/2008	3V	N	337
MW-11	11/11/2008	3V	N	343
MW-11	07/08/2013	3V	N	128
MW-11	07/08/2013	3V	FD	131
MW-11	12/02/2014	LF	N	130
MW-11	12/02/2014	LF	FD	130
MW-11	05/12/2015	LF	N	130
MW-11	10/07/2015	LF	N	130
MW-11	12/02/2015	LF	N	120
MW-11	12/02/2015	LF	FD	120
MW-11	05/03/2016	LF	N	110
MW-11	05/03/2016	LF	FD	110
MW-11	12/07/2016	LF	N	79
MW-11	12/07/2016	LF	FD	80
MW-11	02/09/2017	LF	N	60
MW-11	05/03/2017	LF	N	67
MW-11	12/07/2017	LF	N	64
MW-11	02/23/2018	LF	N	57
MW-11	05/02/2018	LF	N	57
MW-11	05/02/2018	LF	FD	58
MW-11	12/12/2018	LF	N	47
MW-11	12/12/2018	LF	FD	47
MW-11	03/18/2019	LF	N	42
MW-11	05/17/2019	LF	N	51
MW-11	09/30/2019	LF	N	44
MW-11	12/18/2019	LF	N	37
MW-11	04/23/2020	LF	N	43
MW-11D	11/02/2019	PD	N	17
MW-11D	12/18/2019	LF	N	270
MW-11D	01/29/2020	LF	N	390
MW-11D	02/24/2020	LF	N	390
MW-11D	05/28/2020	LF	N	340
MW-11D	08/26/2020	LF	N	480
MW-12	03/10/2008	3V	N	2,760
MW-12	05/05/2008	3V	N	2,580
MW-12	10/07/2008	3V	N	2,680
MW-12	10/07/2008	3V	FD	2,580

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-12	12/11/2008	3V	N	2,460
MW-12	03/12/2009	3V	N	2,490
MW-12	05/05/2009	3V	N	2,550
MW-12	09/24/2009	3V	N	2,490
MW-12	09/24/2009	3V	FD	2,700
MW-12	12/11/2009	3V	N	2,750
MW-12	04/06/2010	3V	N	1,960
MW-12	04/06/2010	3V	FD	1,960
MW-12	05/06/2010	3V	N	2,650
MW-12	05/06/2010	3V	FD	2,650
MW-12	09/30/2010	3V	N	2,930
MW-12	09/30/2010	3V	FD	3,110
MW-12	12/16/2010	3V	N	2,770
MW-12	02/10/2011	3V	N	2,950
MW-12	05/06/2011	3V	N	2,910
MW-12	10/06/2011	3V	N	2,840
MW-12	12/09/2011	3V	N	2,240
MW-12	02/09/2012	3V	N	2,730
MW-12	05/07/2012	3V	N	3,330
MW-12	10/02/2012	3V	N	2,740
MW-12	10/02/2012	H	N	2,770
MW-12	10/02/2012	LF	N	2,500
MW-12	11/27/2012	3V	N	2,310
MW-12	11/27/2012	H	N	2,470
MW-12	11/27/2012	LF	N	2,170
MW-12	02/26/2013	3V	N	2,580
MW-12	02/26/2013	3V	FD	2,570
MW-12	02/26/2013	H	N	2,560
MW-12	02/26/2013	H	FD	2,560
MW-12	02/26/2013	MPP	N	2,650
MW-12	02/26/2013	MPP	FD	2,660
MW-12	05/09/2013	3V	N	2,440
MW-12	09/25/2013	3V	N	2,260
MW-12	12/10/2013	3V	N	2,440
MW-12	02/25/2014	3V	N	2,560
MW-12	05/01/2014	3V	N	2,400
MW-12	12/15/2014	LF	N	2,300
MW-12	05/19/2015	LF	N	1,900
MW-12	12/02/2015	LF	N	2,300
MW-12	05/02/2016	LF	N	1,900

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-12	12/07/2016	3V	N	1,900
MW-12	05/01/2017	LF	N	1,900
MW-12	12/11/2017	LF	N	1,800
MW-12	05/01/2018	LF	N	1,500
MW-12	12/11/2018	LF	N	1,500
MW-12	05/22/2019	LF	N	1,600
MW-12	12/17/2019	LF	N	1,600
MW-12	04/28/2020	LF	N	2,700
MW-21	03/11/2008	3V	N	ND (1.05)
MW-21	05/06/2008	3V	N	ND (1.05)
MW-21	10/02/2008	3V	N	ND (1.0)
MW-21	12/11/2008	3V	N	1.86
MW-21	03/11/2009	3V	N	1.9
MW-21	05/06/2009	3V	N	1.6
MW-21	09/23/2009	3V	N	ND (1.05)
MW-21	12/09/2009	3V	N	ND (1.05)
MW-21	03/10/2010	3V	N	1.4
MW-21	05/04/2010	3V	N	2
MW-21	09/28/2010	3V	N	ND (1.0)
MW-21	12/07/2010	3V	N	ND (1.0)
MW-21	02/08/2011	3V	N	3.3
MW-21	05/03/2011	3V	N	2
MW-21	09/29/2011	3V	N	ND (1.0)
MW-21	12/06/2011	3V	N	2.1
MW-21	02/07/2012	3V	N	2.1
MW-21	04/26/2012	3V	N	0.56
MW-21	09/12/2012	3V	N	ND (1.0)
MW-21	11/13/2012	3V	N	2.3
MW-21	02/07/2013	3V	N	2.6
MW-21	04/24/2013	3V	N	1.5
MW-21	09/10/2013	3V	N	ND (1.0)
MW-21	11/05/2013	3V	N	1.5
MW-21	02/19/2014	3V	N	2.6
MW-21	04/22/2014	3V	N	1.9
MW-21	11/11/2014	LF	N	2.4
MW-21	05/06/2015	LF	N	1.5
MW-21	12/09/2015	LF	N	1.5
MW-21	05/02/2016	G	N	ND (1.0)
MW-21	12/14/2016	LF	N	1.3
MW-21	05/03/2017	3V	N	2.1



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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-21	12/12/2017	LF	N	2.3
MW-21	05/02/2018	LF	N	ND (1.0)
MW-21	05/02/2018	LF	FD	ND (1.0)
MW-21	12/12/2018	LF	N	1.1
MW-21	05/23/2019	LF	N	6.5
MW-21	12/13/2019	LF	N	ND (1.0)
MW-21	04/30/2020	LF	N	4.6
MW-23	01/21/2008	3V	N	ND (1.0)
MW-23	01/22/2008	3V	N	16.3
MW-23	01/22/2008	3V	N	2.1
MW-23	01/23/2008	3V	N	34.3
MW-23	03/10/2008	3V	N	ND (20)
MW-23	03/11/2008	3V	N	43.7
MW-23	05/06/2008	3V	N	22.2
MW-23	05/06/2008	3V	FD	23.2
MW-23	10/01/2008	3V	N	8.03
MW-23	12/11/2008	3V	N	5.21 J
MW-23	12/12/2008	3V	FD	2.53 J
MW-23	03/12/2009	3V	N	32.6
MW-23-060	07/21/2009	3V	N	26
MW-23-060	09/24/2009	3V	N	30.5
MW-23-060	12/10/2009	3V	N	25.8
MW-23-060	03/08/2010	3V	N	19.7
MW-23-060	05/03/2010	3V	N	24.7
MW-23-060	09/29/2010	3V	N	29.6
MW-23-060	12/14/2010	3V	N	30.4
MW-23-060	02/09/2011	3V	N	31.5
MW-23-060	05/04/2011	3V	N	30.2
MW-23-060	09/29/2011	3V	N	26.8
MW-23-060	12/13/2011	3V	N	29.9
MW-23-060	02/14/2012	3V	N	30.2
MW-23-060	04/30/2012	3V	N	29.7
MW-23-060	04/30/2012	3V	FD	29.9
MW-23-060	09/12/2012	3V	N	32.8
MW-23-060	11/08/2012	3V	N	31.6
MW-23-060	02/18/2013	3V	N	33.7
MW-23-060	04/23/2013	3V	N	34.3
MW-23-060	09/17/2013	3V	N	36.9
MW-23-060	11/11/2013	3V	N	35.9
MW-23-060	02/13/2014	3V	N	34.9

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-23-060	04/22/2014	3V	N	39
MW-23-060	11/10/2014	3V	N	38
MW-23-060	04/30/2015	3V	N	38
MW-23-060	12/03/2015	3V	N	36
MW-23-060	05/02/2016	3V	N	37
MW-23-060	12/14/2016	LF	N	39
MW-23-060	04/28/2017	LF	N	38
MW-23-060	12/08/2017	LF	N	40
MW-23-060	04/26/2018	LF	N	39
MW-23-060	12/11/2018	LF	N	39
MW-23-060	05/21/2019	LF	N	40
MW-23-060	12/09/2019	LF	N	41
MW-23-060	06/18/2020	LF	N	40
MW-23-080	07/21/2009	3V	N	34
MW-23-080	09/23/2009	3V	N	29.7
MW-23-080	12/10/2009	3V	N	21.8
MW-23-080	03/08/2010	3V	N	11.3
MW-23-080	05/04/2010	3V	N	21.8
MW-23-080	09/29/2010	3V	N	6
MW-23-080	12/14/2010	3V	N	12.2
MW-23-080	02/09/2011	3V	N	19.8
MW-23-080	05/04/2011	3V	N	14.1
MW-23-080	05/04/2011	3V	FD	14.4
MW-23-080	09/29/2011	3V	N	5.6
MW-23-080	12/12/2011	3V	N	8.7
MW-23-080	12/12/2011	3V	FD	8.2
MW-23-080	02/14/2012	3V	N	9.5
MW-23-080	04/30/2012	3V	N	6
MW-23-080	09/12/2012	3V	N	12.8
MW-23-080	09/12/2012	3V	FD	14.2
MW-23-080	11/08/2012	3V	N	19.2
MW-23-080	02/18/2013	3V	N	11.2
MW-23-080	04/23/2013	3V	N	14
MW-23-080	09/17/2013	3V	N	13.7
MW-23-080	11/11/2013	3V	N	11
MW-23-080	02/13/2014	3V	N	8.4
MW-23-080	04/22/2014	3V	N	15
MW-23-080	11/10/2014	3V	N	5.3
MW-23-080	04/30/2015	3V	N	3
MW-23-080	12/03/2015	3V	N	1.8

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-23-080	05/02/2016	3V	N	2.7
MW-23-080	12/14/2016	LF	N	2.2
MW-23-080	12/14/2016	LF	FD	2
MW-23-080	04/28/2017	LF	N	1.2
MW-23-080	12/08/2017	LF	N	1.5
MW-23-080	04/26/2018	LF	N	ND (1.0)
MW-23-080	12/11/2018	LF	N	ND (1.0)
MW-23-080	05/21/2019	LF	N	ND (1.0)
MW-23-080	12/09/2019	LF	N	ND (1.0)
MW-23-080	06/18/2020	LF	N	ND (1.0)
MW-24A	01/24/2008	3V	N	2,980
MW-24A	03/06/2008	3V	N	325
MW-24A	03/12/2008	3V	N	14,060
MW-24A	03/19/2008	3V	N	111
MW-24A	03/26/2008	3V	N	173
MW-24A	04/01/2008	3V	N	440
MW-24A	04/17/2008	3V	N	160
MW-24A	04/30/2008	3V	FD	220
MW-24A	05/15/2008	3V	N	120
MW-24A	05/27/2008	3V	N	10
MW-24A	06/12/2008	3V	N	10
MW-24A	06/26/2008	3V	N	18
MW-24A	07/24/2008	3V	N	180
MW-24A	08/19/2008	3V	N	17
MW-24A	09/16/2008	3V	N	50
MW-24A	10/16/2008	3V	N	123
MW-24A	11/13/2008	3V	N	10
MW-24A	07/08/2013	3V	N	ND (0.2)
MW-24A	11/04/2014	LF	N	ND (0.2)
MW-24A	04/29/2015	LF	N	0.28
MW-24A	04/29/2015	LF	FD	0.3
MW-24A	12/01/2015	LF	N	ND (0.2)
MW-24A	05/03/2016	LF	N	0.47
MW-24A	12/06/2016	LF	N	ND (0.2)
MW-24A	05/03/2017	LF	N	ND (0.2)
MW-24A	12/07/2017	LF	N	ND (0.2)
MW-24A	12/07/2017	LF	FD	ND (0.2)
MW-24A	05/02/2018	LF	N	ND (0.2)
MW-24A	12/12/2018	LF	N	ND (0.2)
MW-24A	05/17/2019	LF	N	ND (0.2)

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-24A	12/03/2019	LF	N	ND (0.2)
MW-24A	05/01/2020	LF	N	ND (0.2)
MW-24B	01/24/2008	3V	N	5,400
MW-24B	03/06/2008	3V	N	4,400
MW-24B	03/12/2008	3V	N	4,800
MW-24B	03/19/2008	3V	N	4,460
MW-24B	03/26/2008	3V	N	4,700
MW-24B	04/03/2008	3V	N	4,420
MW-24B	04/17/2008	3V	N	4,640
MW-24B	04/30/2008	3V	N	3,800
MW-24B	05/15/2008	3V	N	3,860
MW-24B	05/28/2008	3V	N	3,940
MW-24B	06/12/2008	3V	N	3,980
MW-24B	06/26/2008	3V	N	3,400
MW-24B	07/24/2008	3V	N	3,240
MW-24B	08/19/2008	3V	N	3,400
MW-24B	09/17/2008	3V	N	3,360
MW-24B	10/16/2008	3V	N	3,380
MW-24B	11/13/2008	3V	N	3,000
MW-24B	07/08/2013	3V	N	1,140
MW-24B	12/18/2014	LF	N	ND (1.0)
MW-24B	04/29/2015	LF	N	ND (1.0)
MW-24B	12/01/2015	LF	N	32
MW-24B	05/03/2016	LF	N	11
MW-24B	05/03/2016	LF	FD	12
MW-24B	12/06/2016	LF	N	ND (1.0)
MW-24B	05/03/2017	LF	N	230
MW-24B	05/03/2017	LF	FD	230
MW-24B	12/07/2017	LF	N	250
MW-24B	05/02/2018	LF	N	200
MW-24B	12/12/2018	LF	N	160
MW-24B	05/17/2019	LF	N	86
MW-24B	05/17/2019	LF	FD	84
MW-24B	12/03/2019		FD	230
MW-24B	12/03/2019	LF	N	230
MW-24B	05/01/2020	LF	N	120
MW-24BR	03/11/2008	3V	N	7.1
MW-24BR	05/08/2008	3V	N	ND (1.0)
MW-24BR	10/02/2008	3V	N	ND (0.2)
MW-24BR	12/10/2008	3V	N	ND (1.05)

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-24BR	03/11/2009	3V	N	ND (0.2)
MW-24BR	05/07/2009	3V	N	ND (0.2)
MW-24BR	09/28/2009	3V	N	ND (2.1)
MW-24BR	12/08/2009	3V	N	ND (1.05)
MW-24BR	03/12/2010	3V	N	ND (1.05)
MW-24BR	05/05/2010	3V	N	ND (1.0)
MW-24BR	09/30/2010	3V	N	ND (1.0)
MW-24BR	12/08/2010	3V	N	ND (1.0)
MW-24BR	02/08/2011	3V	N	ND (1.0)
MW-24BR	05/05/2011	3V	N	ND (1.0)
MW-24BR	09/30/2011	3V	N	ND (1.0)
MW-24BR	12/09/2011	3V	N	ND (1.0)
MW-24BR	12/09/2011	3V	FD	ND (1.0)
MW-24BR	02/10/2012	3V	N	ND (1.0)
MW-24BR	05/16/2012	3V	N	ND (1.0)
MW-24BR	09/26/2012	3V	N	ND (1.0)
MW-24BR	11/13/2012	3V	N	ND (1.0)
MW-24BR	03/14/2013	3V	N	ND (1.0)
MW-24BR	05/07/2013	3V	N	ND (1.0)
MW-24BR	09/10/2013	3V	N	ND (1.0)
MW-24BR	12/03/2013	3V	N	ND (0.2)
MW-24BR	02/20/2014	3V	N	ND (1.0)
MW-24BR	04/29/2014	3V	N	ND (1.0)
MW-24BR	12/04/2014	3V	N	ND (1.0)
MW-24BR	12/02/2015	3V	N	ND (1.0)
MW-24BR	12/07/2016	3V	N	ND (1.0)
MW-24BR	12/08/2017	3V	N	ND (1.0)
MW-24BR	12/13/2018	3V	N	ND (1.0)
MW-24BR	12/04/2019	LF	N	ND (1.0)
MW-26	03/12/2008	3V	N	2,980
MW-26	03/12/2008	3V	FD	2,720
MW-26	10/08/2008	3V	N	2,560
MW-26	03/10/2009	3V	N	1,990
MW-26	03/10/2009	3V	FD	2,100
MW-26	09/22/2009	3V	N	2,140
MW-26	03/16/2010	3V	N	2,280
MW-26	12/15/2010	3V	N	1,890
MW-26	05/05/2011	3V	N	2,010
MW-26	12/09/2011	3V	N	1,840
MW-26	05/07/2012	3V	N	1,810

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-26	10/04/2012	3V	N	1,950
MW-26	10/04/2012	H	N	1,780
MW-26	10/04/2012	LF	N	1,680
MW-26	11/27/2012	3V	N	1,800
MW-26	11/27/2012	H	N	1,940
MW-26	11/27/2012	LF	N	1,600
MW-26	03/12/2013	3V	N	1,820
MW-26	03/12/2013	H	N	1,740
MW-26	03/12/2013	MPP	N	1,680
MW-26	05/07/2013	3V	N	1,790
MW-26	12/04/2013	3V	N	1,970
MW-26	05/05/2014	3V	N	2,200
MW-26	12/15/2014	LF	N	2,400
MW-26	12/15/2014	LF	FD	2,200
MW-26	05/19/2015	LF	N	2,400
MW-26	12/08/2015	LF	N	2,600
MW-26	12/08/2015	LF	FD	2,600
MW-26	04/28/2016	LF	N	2,500
MW-26	12/08/2016	LF	N	2,500
MW-26	12/08/2016	LF	FD	2,500
MW-26	04/26/2017	LF	N	2,300
MW-26	12/11/2017	LF	N	2,300
MW-26	12/11/2017	LF	FD	2,400
MW-26	05/01/2018	LF	N	2,300
MW-26	12/07/2018	LF	N	2,200
MW-26	05/22/2019	LF	N	2,300
MW-26	12/12/2019		FD	2,300
MW-26	12/12/2019	LF	N	2,300
MW-26	04/27/2020	LF	N	2,300
MW-38D	01/23/2008	3V	N	69
MW-38D	03/04/2008	3V	N	77
MW-38D	03/11/2008	3V	N	72
MW-38D	03/20/2008	3V	N	54
MW-38D	03/26/2008	3V	N	54
MW-38D	04/01/2008	3V	N	53
MW-38D	04/15/2008	3V	FD	62
MW-38D	04/28/2008	3V	N	62
MW-38D	05/13/2008	3V	N	10
MW-38D	05/27/2008	3V	N	189
MW-38D	06/10/2008	3V	N	64



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PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-38D	06/24/2008	3V	N	53
MW-38D	07/22/2008	3V	N	69
MW-38D	08/20/2008	3V	N	66
MW-38D	09/16/2008	3V	N	70
MW-38D	10/14/2008	3V	N	87
MW-38D	11/11/2008	3V	N	71
MW-38D	09/17/2013	3V	N	7.5
MW-38D	11/13/2013	3V	N	9.1
MW-38D	05/14/2014	3V	N	17
MW-38D	11/05/2014	3V	N	17
MW-38D	11/05/2014	MPP	N	18
MW-38D	04/30/2015	3V	N	16
MW-38D	04/30/2015	LF	N	20
MW-38D	12/01/2015	3V	N	20
MW-38D	12/01/2015	LF	N	19
MW-38D	05/03/2016	3V	N	18
MW-38D	05/03/2016	LF	N	19
MW-38D	12/07/2016	3V	N	21
MW-38D	12/07/2016	LF	N	20
MW-38D	05/03/2017	3V	N	17
MW-38D	05/03/2017	LF	N	16
MW-38D	12/07/2017	3V	N	21
MW-38D	12/07/2017	LF	N	20
MW-38D	05/02/2018	3V	N	15
MW-38D	05/02/2018	LF	N	15
MW-38D	12/12/2018	3V	N	20
MW-38D	12/12/2018	LF	N	21
MW-38D	05/17/2019	LF	N	21
MW-38D	12/18/2019	LF	N	19
MW-38D	04/23/2020	LF	N	19
MW-38S	01/23/2008	3V	N	899
MW-38S	03/04/2008	3V	N	1,200
MW-38S	03/11/2008	3V	N	1,300
MW-38S	03/20/2008	3V	N	1,140
MW-38S	03/26/2008	3V	N	1,260
MW-38S	04/01/2008	3V	N	1,280
MW-38S	04/15/2008	3V	N	1,180
MW-38S	04/28/2008	3V	N	1,340
MW-38S	05/13/2008	3V	N	1,120
MW-38S	05/27/2008	3V	N	1,180

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-38S	06/10/2008	3V	N	1,320
MW-38S	06/24/2008	3V	N	1,140
MW-38S	07/22/2008	3V	N	1,280
MW-38S	08/20/2008	3V	N	1,340
MW-38S	09/16/2008	3V	N	1,360
MW-38S	10/14/2008	3V	N	1,540
MW-38S	11/11/2008	3V	N	1,440
MW-38S	09/24/2013	3V	N	3.2
MW-38S	12/03/2013	3V	N	0.59
MW-38S	05/14/2014	3V	N	1.5
MW-38S	09/22/2014	3V	N	ND (0.2)
MW-38S	11/05/2014	3V	N	ND (0.2)
MW-38S	11/05/2014	MPP	N	ND (0.2)
MW-38S	02/09/2015	3V	N	ND (0.2)
MW-38S	02/09/2015	LF	N	0.22
MW-38S	04/30/2015	3V	N	ND (0.2)
MW-38S	04/30/2015	LF	N	ND (0.2)
MW-38S	09/28/2015	3V	N	ND (0.2)
MW-38S	09/28/2015	LF	N	ND (0.2)
MW-38S	12/01/2015	3V	N	ND (0.2)
MW-38S	12/01/2015	LF	N	ND (0.2)
MW-38S	02/24/2016	3V	N	ND (0.2)
MW-38S	02/24/2016	LF	N	ND (0.2)
MW-38S	05/03/2016	3V	N	ND (0.2)
MW-38S	05/03/2016	LF	N	ND (0.2)
MW-38S	09/29/2016	3V	N	0.99
MW-38S	09/29/2016	LF	N	ND (0.2)
MW-38S	12/07/2016	3V	N	2.7
MW-38S	12/07/2016	3V	FD	2.5
MW-38S	12/07/2016	LF	N	2.2
MW-38S	02/09/2017	3V	N	3.8
MW-38S	02/09/2017	LF	N	0.57
MW-38S	05/03/2017	3V	N	1.2
MW-38S	05/03/2017	LF	N	0.34
MW-38S	09/26/2017	3V	N	3.8 J
MW-38S	09/26/2017	LF	N	3.1
MW-38S	09/26/2017	LF	FD	3.1 J
MW-38S	12/07/2017	3V	N	2.9
MW-38S	12/07/2017	LF	N	2.3
MW-38S	02/23/2018	3V	N	2.8

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-38S	02/23/2018	LF	N	2.8
MW-38S	05/02/2018	3V	N	1.1
MW-38S	05/02/2018	LF	N	1.8
MW-38S	09/27/2018	3V	N	2.7
MW-38S	09/27/2018	LF	N	3
MW-38S	12/12/2018	3V	N	3.9
MW-38S	12/12/2018	LF	N	4.2
MW-38S	02/13/2019	LF	N	5.1
MW-38S	05/17/2019	LF	N	6
MW-38S	09/25/2019	LF	N	4.8
MW-38S	12/18/2019	LF	N	4.7
MW-38S	02/25/2020		FD	3.9
MW-38S	02/25/2020	LF	N	3.8
MW-38S	04/23/2020		FD	4
MW-38S	04/23/2020	LF	N	4
MW-48	03/11/2008	3V	N	ND (2.27)
MW-48	05/07/2008	3V	N	ND (1.0)
MW-48	10/01/2008	3V	N	ND (1.0)
MW-48	12/10/2008	3V	N	ND (1.05)
MW-48	03/11/2009	3V	N	ND (0.2)
MW-48	05/06/2009	3V	N	ND (1.05)
MW-48	09/23/2009	3V	N	ND (1.05)
MW-48	12/09/2009	3V	N	ND (1.05)
MW-48	04/08/2010	3V	N	ND (1.05)
MW-48	05/05/2010	3V	N	ND (1.0)
MW-48	09/29/2010	3V	N	ND (1.0)
MW-48	12/08/2010	3V	N	ND (1.0)
MW-48	02/09/2011	3V	N	ND (1.0)
MW-48	05/04/2011	3V	N	ND (1.0)
MW-48	09/30/2011	3V	N	ND (0.2)
MW-48	12/07/2011	3V	N	ND (1.0)
MW-48	02/08/2012	3V	N	ND (1.0)
MW-48	04/25/2012	3V	N	ND (1.0)
MW-48	09/13/2012	3V	N	ND (1.0)
MW-48	11/07/2012	3V	N	ND (1.0)
MW-48	02/07/2013	3V	N	ND (1.0)
MW-48	04/25/2013	3V	N	ND (1.0)
MW-48	09/11/2013	3V	N	ND (1.0)
MW-48	11/06/2013	3V	N	ND (1.0)
MW-48	02/20/2014	3V	N	ND (1.0)

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-48	04/23/2014	3V	N	ND (1.0)
MW-48	05/07/2015	3V	N	ND (1.0)
MW-48	12/04/2015	LF	N	ND (1.0)
MW-48	05/04/2016	G	N	ND (1.0)
MW-48	12/14/2016	G	N	ND (1.0)
MW-48	05/03/2017	G	N	ND (1.0)
MW-48	12/13/2017	LF	N	ND (1.0)
MW-48	05/03/2018	LF	N	ND (1.0)
MW-48	12/13/2018	LF	N	ND (1.0)
MW-48	05/23/2019	LF	N	ND (1.0)
MW-48	12/19/2019	3V	N	ND (1.0)
MW-48	05/01/2020	3V	N	ND (1.0)
MW-57-050	02/17/2010	3V	N	86
MW-57-070	02/11/2009	3V	N	660
MW-57-070	07/21/2009	3V	N	340
MW-57-070	09/24/2009	3V	N	132
MW-57-070	12/10/2009	3V	N	84.4
MW-57-070	03/16/2010	3V	N	542
MW-57-070	05/05/2010	3V	N	452
MW-57-070	09/30/2010	3V	N	856
MW-57-070	12/15/2010	3V	N	456 J
MW-57-070	12/15/2010	3V	FD	330 J
MW-57-070	02/10/2011	3V	N	507
MW-57-070	05/05/2011	3V	N	486
MW-57-070	05/05/2011	3V	FD	500
MW-57-070	09/29/2011	3V	N	309
MW-57-070	12/15/2011	3V	N	291
MW-57-070	02/15/2012	3V	N	454
MW-57-070	05/03/2012	3V	N	288
MW-57-070	09/12/2012	3V	N	609
MW-57-070	12/13/2012	3V	N	724
MW-57-070	12/13/2012	3V	FD	752
MW-57-070	02/20/2013	3V	N	272
MW-57-070	02/20/2013	3V	FD	268
MW-57-070	03/11/2013	3V	N	594
MW-57-070	05/06/2013	3V	N	611
MW-57-070	09/23/2013	3V	N	554
MW-57-070	12/12/2013	3V	N	461
MW-57-070	02/24/2014	3V	N	394
MW-57-070	04/28/2014	3V	N	430

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-57-070	12/10/2014	3V	N	530
MW-57-070	05/21/2015	3V	N	410
MW-57-070	12/04/2015	3V	N	520
MW-57-070	04/28/2016	3V	N	470
MW-57-070	12/13/2016	LF	N	400
MW-57-070	05/01/2017	LF	N	350
MW-57-070	12/11/2017	LF	N	420
MW-57-070	05/03/2018	LF	N	340
MW-57-070	12/07/2018	LF	N	410
MW-57-070	05/20/2019	LF	N	380
MW-57-070	12/06/2019	LF	N	420
MW-57-070	06/22/2020	LF	N	610
MW-57-185	07/20/2009	3V	N	1.4
MW-57-185	09/23/2009	3V	N	1.13
MW-57-185	12/09/2009	3V	N	2.09
MW-57-185	03/09/2010	3V	N	6.8
MW-57-185	05/05/2010	3V	N	3.9
MW-57-185	09/29/2010	3V	N	5.6
MW-57-185	12/09/2010	3V	N	3.7
MW-57-185	02/08/2011	3V	N	5.9
MW-57-185	05/03/2011	3V	N	6.3
MW-57-185	09/28/2011	3V	N	7
MW-57-185	12/13/2011	3V	N	7.4
MW-57-185	02/10/2012	3V	N	7.2
MW-57-185	02/10/2012	3V	FD	7.3
MW-57-185	04/30/2012	3V	N	7.1
MW-57-185	09/11/2012	3V	N	7.8
MW-57-185	11/08/2012	3V	N	9.5
MW-57-185	02/06/2013	3V	N	10.4
MW-57-185	04/23/2013	3V	N	10.2
MW-57-185	09/10/2013	3V	N	10.1
MW-57-185	11/07/2013	3V	N	9.5
MW-57-185	11/07/2013	3V	FD	9.7
MW-57-185	02/13/2014	3V	N	9.2
MW-57-185	04/22/2014	3V	N	8.8
MW-57-185	11/10/2014	3V	N	9.5
MW-57-185	05/11/2015	3V	N	10
MW-57-185	12/04/2015	3V	N	9.9
MW-57-185	04/28/2016	3V	N	4.6
MW-57-185	12/13/2016	3V	N	7.1

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-57-185	05/01/2017	3V	N	5.9
MW-57-185	12/11/2017	3V	N	8.2
MW-57-185	05/03/2018	3V	N	7.7
MW-57-185	12/07/2018	3V	N	6.4
MW-57-185	05/20/2019	LF	N	4.6
MW-57-185	05/20/2019	LF	FD	4.7
MW-57-185	12/06/2019	LF	N	3.7
MW-57-185	06/22/2020		FD	1.4
MW-57-185	06/22/2020	LF	N	1.3
MW-57-185_D	12/11/2017	LF	N	3.1
MW-57-185_D	05/03/2018	LF	N	4.8
MW-57-185_D	12/07/2018	LF	N	6.2
MW-57-185_S	12/11/2017	LF	N	3
MW-57-185_S	05/03/2018	LF	N	5.3
MW-57-185_S	12/07/2018	LF	N	5.4
MW-58-065	02/17/2010	3V	N	ND (0.2)
MW-58-115	07/22/2009	3V	N	ND (1.0)
MW-58-115	09/29/2009	3V	N	ND (1.05)
MW-58-115	12/16/2009	3V	N	ND (1.05)
MW-58-205	07/22/2009	3V	N	ND (1.0)
MW-58-205	09/29/2009	3V	N	4.69
MW-58-205	12/16/2009	3V	N	7.56
MW-58BR	03/25/2010	LF	N	9.1
MW-58BR	02/28/2013	MPP	N	ND (1.0)
MW-58BR	04/30/2013	LF	N	ND (1.0)
MW-58BR	09/19/2013	LF	N	0.73
MW-58BR	12/17/2013	LF	N	1.1
MW-58BR	02/25/2014	LF	N	2.3
MW-58BR	05/06/2014	LF	N	0.87
MW-58BR	09/24/2014	LF	N	2.1
MW-58BR	12/09/2014	LF	N	3.6
MW-58BR	02/10/2015	LF	N	3.6
MW-58BR	05/18/2015	LF	N	ND (0.2)
MW-58BR	09/30/2015	LF	N	ND (0.2)
MW-58BR	12/07/2015	LF	N	2.9
MW-58BR	02/24/2016	LF	N	4.1
MW-58BR	04/28/2016	LF	N	0.56
MW-58BR	04/28/2016	LF	FD	0.6
MW-58BR	09/27/2016	LF	N	2.7
MW-58BR	12/13/2016	LF	N	4.3

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-58BR	02/07/2017	LF	N	4.3
MW-58BR	05/02/2017	LF	N	5.4
MW-58BR	09/27/2017	LF	N	42
MW-58BR	12/11/2017	LF	N	39
MW-58BR	02/19/2018	LF	N	13
MW-58BR	05/03/2018	LF	N	9.3
MW-58BR	09/27/2018	LF	N	9.7
MW-58BR	12/13/2018	LF	N	10
MW-58BR	02/14/2019	LF	N	7.4
MW-58BR	05/21/2019	LF	N	12
MW-58BR	08/19/2019		FD	90
MW-58BR	08/19/2019	LF	N	90
MW-58BR	12/13/2019	LF	N	76
MW-58BR	02/17/2020	LF	N	120
MW-58BR	05/01/2020		N	43
MW-58BR_S	03/05/2009	3V	N	180
MW-58BR_S	03/05/2009	3V	N	200
MW-58BR_S	03/05/2009	3V	N	230
MW-59-100	03/18/2009	3V	N	4,300
MW-59-100	07/22/2009	3V	N	5,100
MW-59-100	07/22/2009	3V	FD	5,100
MW-59-100	09/24/2009	3V	N	4,630
MW-59-100	12/11/2009	3V	N	4,340
MW-59-100	03/17/2010	3V	N	5,320
MW-59-100	05/06/2010	3V	N	4,940
MW-59-100	09/30/2010	3V	N	5,140
MW-59-100	12/16/2010	3V	N	5,660
MW-59-100	02/10/2011	3V	N	5,090
MW-59-100	02/10/2011	3V	FD	5,110
MW-59-100	05/06/2011	3V	N	5,240
MW-59-100	10/04/2011	3V	N	4,330
MW-59-100	12/15/2011	3V	N	4,600
MW-59-100	12/15/2011	3V	FD	4,990
MW-59-100	02/22/2012	3V	N	4,070
MW-59-100	05/08/2012	3V	N	4,610
MW-59-100	10/02/2012	3V	N	4,510
MW-59-100	10/02/2012	H	N	5,530
MW-59-100	10/02/2012	LF	N	4,850
MW-59-100	11/28/2012	3V	N	3,980
MW-59-100	11/28/2012	H	N	6,550



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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-59-100	11/28/2012	LF	N	4,500
MW-59-100	02/27/2013	3V	N	3,920
MW-59-100	02/27/2013	H	N	4,780
MW-59-100	02/27/2013	MPP	N	3,980
MW-59-100	05/13/2013	3V	N	4,110
MW-59-100	09/25/2013	3V	N	4,180
MW-59-100	12/10/2013	3V	N	3,860
MW-59-100	02/25/2014	3V	N	3,740
MW-59-100	05/07/2014	3V	N	4,000
MW-59-100	12/15/2014	LF	N	4,100
MW-59-100	12/15/2014	LF	FD	4,200
MW-59-100	05/19/2015	LF	N	3,900
MW-59-100	12/03/2015	LF	N	4,500
MW-59-100	12/03/2015	LF	FD	4,400
MW-59-100	04/29/2016	LF	N	3,300
MW-59-100	12/07/2016	LF	N	3,600
MW-59-100	12/07/2016	LF	FD	3,400
MW-59-100	05/01/2017	LF	N	2,500
MW-59-100	12/07/2017	LF	N	3,600
MW-59-100	05/03/2018	LF	N	2,800
MW-59-100	12/07/2018	LF	N	3,100
MW-59-100	12/07/2018	LF	FD	3,100
MW-59-100	05/20/2019	LF	N	2,000
MW-59-100	05/20/2019	LF	FD	2,200
MW-59-100	12/13/2019		FD	2,700
MW-59-100	12/13/2019	LF	N	2,700
MW-59-100	06/22/2020	LF	N	2,100
MW-60-125	03/20/2009	3V	N	810
MW-60-125	07/21/2009	3V	N	780
MW-60-125	09/24/2009	3V	N	570
MW-60-125	12/10/2009	3V	N	532
MW-60-125	03/17/2010	3V	N	657
MW-60-125	05/06/2010	3V	N	1,120
MW-60-125	09/30/2010	3V	N	806
MW-60-125	12/16/2010	3V	N	1,090
MW-60-125	12/16/2010	3V	FD	1,070
MW-60-125	02/10/2011	3V	N	1,160
MW-60-125	05/05/2011	3V	N	1,040
MW-60-125	10/04/2011	3V	N	715
MW-60-125	12/14/2011	3V	N	901

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PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-60-125	02/15/2012	3V	N	918
MW-60-125	05/03/2012	3V	N	882
MW-60-125	09/20/2012	3V	N	848
MW-60-125	12/06/2012	3V	N	867
MW-60-125	02/20/2013	3V	N	1,020
MW-60-125	05/06/2013	3V	N	988
MW-60-125	09/24/2013	3V	N	1,120
MW-60-125	09/24/2013	3V	FD	1,100
MW-60-125	12/04/2013	3V	N	1,100
MW-60-125	02/25/2014	3V	N	1,030
MW-60-125	05/01/2014	3V	N	1,200
MW-60-125	12/10/2014	3V	N	950
MW-60-125	05/14/2015	3V	N	1,100
MW-60-125	12/04/2015	3V	N	960
MW-60-125	04/28/2016	3V	N	940
MW-60-125	12/14/2016	LF	N	880
MW-60-125	05/02/2017	LF	N	830
MW-60-125	12/06/2017	LF	N	770
MW-60-125	05/02/2018	LF	N	510
MW-60-125	12/06/2018	LF	N	980
MW-60-125	05/22/2019	LF	N	880
MW-60-125	12/06/2019	LF	N	580
MW-60-125	06/24/2020	LF	N	660
MW-60BR-245	08/09/2011	3V	N	64
MW-60BR-245	09/07/2011	3V	N	77
MW-60BR-245	11/16/2011	3V	N	130
MW-60BR-245	12/14/2011	3V	N	260
MW-60BR-245	02/16/2012	3V	N	250
MW-60BR-245	05/17/2012	3V	N	74.2
MW-60BR-245	09/19/2012	3V	N	89.7
MW-60BR-245	12/05/2012	3V	N	61.4
MW-60BR-245	03/14/2013	3V	N	90.6
MW-60BR-245	03/14/2013	3V	FD	93.9
MW-60BR-245	05/07/2013	3V	N	46.6
MW-60BR-245	09/17/2013	3V	N	ND (1.0)
MW-60BR-245	12/04/2013	3V	N	ND (1.0)
MW-60BR-245	02/19/2014	3V	N	ND (1.0)
MW-60BR-245	04/29/2014	3V	N	ND (1.0)
MW-60BR-245	09/25/2014	3V	N	1.5
MW-60BR-245	12/04/2014	3V	N	ND (1.0)

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-60BR-245	02/10/2015	3V	N	3.6
MW-60BR-245	05/14/2015	3V	N	ND (1.0)
MW-60BR-245	09/29/2015	3V	N	ND (1.0)
MW-60BR-245	12/04/2015	3V	N	61
MW-60BR-245	02/23/2016	3V	N	ND (1.0)
MW-60BR-245	04/29/2016	G	N	ND (1.0)
MW-60BR-245	09/29/2016	3V	N	ND (1.0)
MW-60BR-245	12/14/2016	3V	N	ND (1.0)
MW-60BR-245	02/08/2017	3V	N	ND (1.0)
MW-60BR-245	05/03/2017	3V	N	39
MW-60BR-245	09/26/2017	3V	N	ND (1.0)
MW-60BR-245	12/14/2017	3V	N	690
MW-60BR-245	02/21/2018	3V	N	69
MW-60BR-245	05/02/2018	3V	N	73
MW-60BR-245	09/25/2018	3V	N	76
MW-60BR-245	12/06/2018	3V	N	110
MW-60BR-245	02/14/2019	3V	N	110
MW-60BR-245	05/22/2019	3V	N	130
MW-60BR-245	12/12/2019	3V	N	64
MW-60BR-245	02/20/2020	3V	N	52
MW-60BR-245_D	12/13/2017	LF	N	ND (1.0)
MW-60BR-245_D	02/21/2018	LF	N	4.1
MW-60BR-245_D	05/02/2018	LF	N	1.2
MW-60BR-245_D	09/25/2018	LF	N	6.4
MW-60BR-245_D	12/06/2018	LF	N	20
MW-60BR-245_D	02/14/2019	LF	N	18
MW-60BR-245_D	05/23/2019	LF	N	68
MW-60BR-245_D	12/13/2019	LF	N	75
MW-60BR-245_D	02/21/2020	LF	N	72
MW-60BR-245_S	12/13/2017	LF	N	2.3
MW-60BR-245_S	02/21/2018	LF	N	ND (1.0)
MW-60BR-245_S	05/02/2018	LF	N	1.1
MW-60BR-245_S	09/25/2018	LF	N	ND (1.0)
MW-60BR-245_S	12/06/2018	LF	N	17
MW-60BR-245_S	02/14/2019	LF	N	25
MW-60BR-245_S	05/23/2019	LF	N	85
MW-60BR-245_S	12/13/2019	LF	N	86
MW-60BR-245_S	02/21/2020	LF	N	96
MW-60BR-245-LF_S	06/24/2020	LF	N	44
MW-61-110	03/23/2009	3V	N	620

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-61-110	07/21/2009	3V	N	240
MW-61-110	09/24/2009	3V	N	360
MW-61-110	12/10/2009	3V	N	433
MW-61-110	03/17/2010	3V	N	484
MW-61-110	05/06/2010	3V	N	480
MW-61-110	09/30/2010	3V	N	512
MW-61-110	12/15/2010	3V	N	567
MW-61-110	02/09/2011	3V	N	684
MW-61-110	05/05/2011	3V	N	522
MW-61-110	09/30/2011	3V	N	611
MW-61-110	12/14/2011	3V	N	682
MW-61-110	02/15/2012	3V	N	634
MW-61-110	05/03/2012	3V	N	486
MW-61-110	09/27/2012	3V	N	656
MW-61-110	09/27/2012	3V	FD	661
MW-61-110	09/27/2012	H	N	ND (1.0)
MW-61-110	09/27/2012	LF	N	504
MW-61-110	11/27/2012	3V	N	666
MW-61-110	11/27/2012	3V	FD	678
MW-61-110	11/27/2012	H	N	110
MW-61-110	11/27/2012	H	FD	107
MW-61-110	11/27/2012	LF	N	536
MW-61-110	11/27/2012	LF	FD	536
MW-61-110	02/25/2013	3V	N	637
MW-61-110	02/25/2013	H	N	8.5
MW-61-110	02/25/2013	MPP	N	120
MW-61-110	05/02/2013	3V	N	518
MW-61-110	09/23/2013	3V	N	576
MW-61-110	12/05/2013	3V	N	565
MW-61-110	12/05/2013	3V	FD	601
MW-61-110	02/19/2014	3V	N	588
MW-61-110	04/29/2014	3V	N	470
MW-61-110	12/10/2014	3V	N	570
MW-61-110	05/13/2015	3V	N	440
MW-61-110	12/04/2015	3V	N	540
MW-61-110	04/29/2016	LF	N	410
MW-61-110	12/13/2016	3V	N	520
MW-61-110	05/02/2017	3V	N	370
MW-61-110	12/06/2017	LF	N	410
MW-61-110	05/04/2018	LF	N	330

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-61-110	12/13/2018	LF	N	430
MW-61-110	12/13/2018	LF	FD	460
MW-61-110	05/23/2019	LF	N	280
MW-61-110	12/06/2019	LF	N	480
MW-62-065	03/27/2009	3V	N	720
MW-62-065	07/22/2009	3V	N	290
MW-62-065	09/24/2009	3V	N	236
MW-62-065	12/10/2009	3V	N	219
MW-62-065	03/16/2010	3V	N	397
MW-62-065	05/06/2010	3V	N	436
MW-62-065	09/30/2010	3V	N	500
MW-62-065	12/15/2010	3V	N	598
MW-62-065	02/09/2011	3V	N	481
MW-62-065	05/05/2011	3V	N	488
MW-62-065	09/29/2011	3V	N	457
MW-62-065	12/13/2011	3V	N	532
MW-62-065	02/17/2012	3V	N	452
MW-62-065	05/02/2012	3V	N	443
MW-62-065	09/12/2012	3V	N	588
MW-62-065	12/10/2012	3V	N	505
MW-62-065	02/19/2013	3V	N	404
MW-62-065	04/25/2013	3V	N	589
MW-62-065	09/23/2013	3V	N	500
MW-62-065	12/11/2013	3V	N	471
MW-62-065	02/20/2014	3V	N	469
MW-62-065	04/29/2014	3V	N	550
MW-62-065	09/23/2014	3V	N	540
MW-62-065	12/09/2014	3V	N	530
MW-62-065	02/16/2015	3V	N	520
MW-62-065	02/16/2015	3V	FD	530
MW-62-065	05/13/2015	3V	N	580
MW-62-065	05/13/2015	3V	FD	580
MW-62-065	10/07/2015	3V	N	560
MW-62-065	12/03/2015	3V	N	570
MW-62-065	02/23/2016	3V	N	560
MW-62-065	05/02/2016	3V	N	670
MW-62-065	09/28/2016	LF	N	350
MW-62-065	12/13/2016	LF	N	600
MW-62-065	02/09/2017	3V	N	550
MW-62-065	05/02/2017	LF	N	580

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-62-065	09/25/2017	LF	N	430
MW-62-065	09/25/2017	LF	FD	450
MW-62-065	12/06/2017	LF	N	510
MW-62-065	02/19/2018	LF	N	560
MW-62-065	02/19/2018	LF	FD	550
MW-62-065	05/01/2018	LF	N	520
MW-62-065	09/26/2018	LF	N	540
MW-62-065	12/07/2018	LF	N	540
MW-62-065	02/11/2019	LF	N	470
MW-62-065	05/21/2019	LF	N	570
MW-62-065	10/01/2019	LF	N	490
MW-62-065	12/03/2019	LF	N	560
MW-62-065	02/19/2020	LF	N	480
MW-62-065	04/28/2020	LF	N	580
MW-62-110	07/22/2009	Flute	N	74
MW-62-110	09/29/2009	Flute	N	4.4
MW-62-110	12/16/2009	Flute	N	381
MW-62-110	03/11/2010	Flute	N	628
MW-62-110	05/04/2010	Flute	N	579
MW-62-110	09/29/2010	Flute	N	414
MW-62-110	12/16/2010	Flute	N	390
MW-62-110	02/09/2011	Flute	N	565
MW-62-110	05/05/2011	Flute	N	569
MW-62-110	09/29/2011	Flute	N	598
MW-62-110	12/14/2011	Flute	N	1,140
MW-62-110	02/16/2012	Flute	N	842
MW-62-110	05/10/2012	Flute	N	828
MW-62-110	09/13/2012	Flute	N	894
MW-62-110	12/11/2012	Flute	N	904
MW-62-110	02/26/2013	Flute	N	1,050
MW-62-110	05/08/2013	Flute	N	733
MW-62-110	09/18/2013	Flute	N	808
MW-62-110	11/13/2013	Flute	N	910
MW-62-110	02/19/2014	Flute	N	976
MW-62-110	05/07/2014	Flute	N	910
MW-62-110	09/23/2014	Flute	N	1,000
MW-62-110	12/09/2014	Flute	N	1,200
MW-62-110	02/11/2015	Flute	N	1,200
MW-62-110	05/19/2015	Flute	N	1,000
MW-62-110	10/01/2015	Flute	N	ND (10)

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-62-110	12/04/2015	3V	N	0.29
MW-62-110	02/24/2016	3V	N	ND (1.0)
MW-62-110	05/03/2016	Tap	N	1.2
MW-62-110	09/28/2016	Flute	N	ND (1.0)
MW-62-110	12/14/2016	G	N	ND (1.0)
MW-62-110	02/08/2017	3V	N	0.45
MW-62-110	05/03/2017	Tap	N	ND (1.0)
MW-62-110	09/27/2017	Tap	N	ND (1.0)
MW-62-110	12/07/2017	Tap	N	ND (1.0)
MW-62-110	02/21/2018	Tap	N	ND (1.0)
MW-62-110	05/03/2018	G	N	ND (1.0)
MW-62-110	09/26/2018	3V	N	ND (1.0)
MW-62-110	12/13/2018	G	N	0.32
MW-62-110	02/14/2019	LF	N	ND (1.0)
MW-62-110	05/22/2019	G	N	ND (1.0)
MW-62-110	09/25/2019	G	N	ND (1.0)
MW-62-110	12/04/2019	G	N	0.59
MW-62-110	02/18/2020		N	ND (0.2)
MW-62-110	04/29/2020	Tap	N	ND (1.0)
MW-62-190	07/22/2009	Flute	N	ND (1.0)
MW-62-190	09/29/2009	Flute	N	147
MW-62-190	12/16/2009	Flute	N	ND (1.05)
MW-62-190	03/11/2010	Flute	N	ND (1.05)
MW-62-190	05/04/2010	Flute	N	ND (1.0)
MW-62-190	09/29/2010	Flute	N	ND (1.0)
MW-62-190	12/16/2010	Flute	N	ND (1.0)
MW-62-190	02/09/2011	Flute	N	ND (1.0)
MW-62-190	05/05/2011	Flute	N	ND (1.0)
MW-62-190	09/29/2011	Flute	N	ND (1.0)
MW-62-190	12/14/2011	Flute	N	ND (1.0)
MW-62-190	02/16/2012	Flute	N	ND (1.0)
MW-62-190	05/10/2012	Flute	N	ND (1.0)
MW-62-190	09/13/2012	Flute	N	ND (1.0)
MW-62-190	12/11/2012	Flute	N	ND (1.0)
MW-62-190	02/26/2013	Flute	N	ND (1.0)
MW-62-190	05/08/2013	Flute	N	ND (1.0)
MW-62-190	09/18/2013	Flute	N	ND (1.0)
MW-62-190	11/13/2013	Flute	N	ND (1.0)
MW-62-190	02/19/2014	Flute	N	ND (1.0)
MW-62-190	05/07/2014	Flute	N	ND (1.0)



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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-62-190	12/09/2014	Flute	N	ND (1.0)
MW-62-190	05/19/2015	Flute	N	ND (0.2)
MW-62-190	12/04/2015	3V	N	ND (1.0)
MW-62-190	05/03/2016	Tap	N	ND (1.0)
MW-62-190	12/14/2016	G	N	ND (1.0)
MW-62-190	05/03/2017	Tap	N	ND (1.0)
MW-62-190	12/07/2017	Tap	N	ND (1.0)
MW-62-190	12/07/2017	Tap	FD	ND (1.0)
MW-62-190	05/03/2018	G	N	ND (1.0)
MW-62-190	12/13/2018	LF	N	ND (1.0)
MW-62-190	05/22/2019	G	N	ND (1.0)
MW-62-190	12/04/2019	LF	N	ND (1.0)
MW-62-190	04/29/2020		FD	ND (1.0)
MW-62-190	04/29/2020	Tap	N	ND (1.0)
MW-65-160	06/13/2011	3V	N	13
MW-65-160	07/11/2011	3V	N	14
MW-65-160	08/09/2011	3V	N	24
MW-65-160	08/09/2011	3V	FD	23
MW-65-160	09/07/2011	3V	N	30
MW-65-160	10/17/2011	3V	N	18
MW-65-160	11/15/2011	3V	N	64
MW-65-160	12/15/2011	3V	N	45
MW-65-160	02/16/2012	3V	N	32
MW-65-160	05/01/2012	3V	N	51
MW-65-160	09/18/2012	3V	N	75.7
MW-65-160	12/04/2012	3V	N	78.5
MW-65-160	02/19/2013	3V	N	78.8
MW-65-160	05/01/2013	3V	N	111
MW-65-160	09/19/2013	3V	N	113
MW-65-160	12/02/2013	3V	N	96.8
MW-65-160	02/19/2014	3V	N	125
MW-65-160	04/24/2014	3V	N	110
MW-65-160	09/25/2014	LF	N	90
MW-65-160	12/03/2014	LF	N	97
MW-65-160	03/24/2015	LF	N	140
MW-65-160	05/11/2015	LF	N	110
MW-65-160	05/11/2015	LF	FD	110
MW-65-160	09/30/2015	LF	N	140
MW-65-160	12/02/2015	LF	N	130
MW-65-160	02/24/2016	LF	N	140

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-65-160	05/03/2016	LF	N	130
MW-65-160	09/29/2016	LF	N	150
MW-65-160	12/06/2016	LF	N	160
MW-65-160	02/08/2017	LF	N	170
MW-65-160	05/04/2017	LF	N	99
MW-65-160	09/26/2017	LF	N	120
MW-65-160	12/05/2017	LF	N	160
MW-65-160	02/22/2018	LF	N	190
MW-65-160	04/30/2018	LF	N	160
MW-65-160	09/27/2018	LF	N	170
MW-65-160	12/05/2018	LF	N	160
MW-65-160	02/13/2019	LF	N	220
MW-65-160	05/16/2019	LF	N	160
MW-65-160	09/26/2019	LF	N	150
MW-65-160	12/03/2019	LF	N	260
MW-65-160	02/20/2020	LF	N	250
MW-65-160	04/29/2020	LF	N	190
MW-65-225	06/13/2011	3V	N	120
MW-65-225	07/11/2011	3V	N	210
MW-65-225	08/09/2011	3V	N	230
MW-65-225	09/07/2011	3V	N	250
MW-65-225	10/17/2011	3V	N	250
MW-65-225	11/15/2011	3V	N	310
MW-65-225	11/15/2011	3V	FD	310
MW-65-225	12/15/2011	3V	N	350
MW-65-225	02/16/2012	3V	N	360
MW-65-225	05/02/2012	3V	N	365
MW-65-225	09/18/2012	3V	N	528
MW-65-225	12/05/2012	3V	N	634
MW-65-225	02/19/2013	3V	N	630
MW-65-225	05/02/2013	3V	N	534
MW-65-225	05/02/2013	3V	FD	548
MW-65-225	09/23/2013	3V	N	583
MW-65-225	09/23/2013	3V	FD	579
MW-65-225	12/02/2013	3V	N	551
MW-65-225	02/19/2014	3V	N	513
MW-65-225	04/29/2014	3V	N	460
MW-65-225	09/25/2014	LF	N	130
MW-65-225	12/03/2014	LF	N	120
MW-65-225	02/17/2015	LF	N	150

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PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-65-225	05/11/2015	LF	N	160
MW-65-225	09/30/2015	LF	N	180
MW-65-225	12/02/2015	LF	N	250
MW-65-225	02/24/2016	LF	N	510
MW-65-225	05/03/2016	LF	N	130
MW-65-225	09/29/2016	LF	N	87
MW-65-225	12/06/2016	LF	N	150
MW-65-225	02/08/2017	LF	N	530
MW-65-225	05/04/2017	LF	N	530
MW-65-225	05/04/2017	LF	FD	520
MW-65-225	09/26/2017	LF	N	480
MW-65-225	12/05/2017	LF	N	210
MW-65-225	02/22/2018	LF	N	510
MW-65-225	04/30/2018	LF	N	110
MW-65-225	09/27/2018	LF	N	180
MW-65-225	09/27/2018	LF	FD	180
MW-65-225	12/05/2018	LF	N	220
MW-65-225	02/13/2019	LF	N	490
MW-65-225	05/16/2019	LF	N	180
MW-65-225	09/26/2019		FD	330
MW-65-225	09/26/2019	LF	N	330
MW-65-225	12/03/2019	LF	N	480
MW-65-225	02/20/2020	LF	N	460
MW-65-225	04/29/2020	LF	N	280
MW-66-165	06/13/2011	3V	N	560
MW-66-165	07/12/2011	3V	N	560
MW-66-165	07/12/2011	3V	FD	550
MW-66-165	08/09/2011	3V	N	560
MW-66-165	10/18/2011	3V	N	440
MW-66-165	11/15/2011	3V	N	500
MW-66-165	12/15/2011	3V	N	490
MW-66-165	02/17/2012	3V	N	570
MW-66-165	05/02/2012	3V	N	651
MW-66-165	09/17/2012	3V	N	653
MW-66-165	12/06/2012	3V	N	622
MW-66-165	02/20/2013	3V	N	636
MW-66-165	05/02/2013	3V	N	737
MW-66-165	09/23/2013	3V	N	631
MW-66-165	12/03/2013	3V	N	595
MW-66-165	02/19/2014	3V	N	594

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-66-165	05/01/2014	3V	N	750
MW-66-165	05/01/2014	3V	FD	720
MW-66-165	12/10/2014	LF	N	590
MW-66-165	05/13/2015	LF	N	650
MW-66-165	12/02/2015	LF	N	490
MW-66-165	04/25/2016	LF	N	660
MW-66-165	12/05/2016	LF	N	460
MW-66-165	04/25/2017	LF	N	430
MW-66-165	12/05/2017	LF	N	500
MW-66-165	04/30/2018	LF	N	540
MW-66-165	12/05/2018	LF	N	480
MW-66-165	05/16/2019	LF	N	550
MW-66-165	05/16/2019	LF	FD	540
MW-66-165	12/03/2019	LF	N	480
MW-66-165	04/29/2020	LF	N	530
MW-66-230	06/14/2011	3V	N	5,100
MW-66-230	07/12/2011	3V	N	5,000
MW-66-230	08/10/2011	3V	N	5,100
MW-66-230	10/19/2011	3V	N	4,400
MW-66-230	11/17/2011	3V	N	4,900
MW-66-230	12/15/2011	3V	N	5,400
MW-66-230	02/22/2012	3V	N	5,800
MW-66-230	05/10/2012	3V	N	5,880
MW-66-230	05/10/2012	3V	FD	5,560
MW-66-230	09/17/2012	3V	N	6,200
MW-66-230	12/10/2012	3V	N	6,190
MW-66-230	02/21/2013	3V	N	6,510
MW-66-230	05/13/2013	3V	N	6,520
MW-66-230	09/25/2013	3V	N	5,120
MW-66-230	12/12/2013	3V	N	6,630 J
MW-66-230	02/26/2014	3V	N	5,730
MW-66-230	05/07/2014	3V	N	6,700
MW-66-230	12/22/2014	LF	N	5,500
MW-66-230	05/21/2015	LF	N	6,500
MW-66-230	12/03/2015	LF	N	7,700
MW-66-230	04/25/2016	LF	N	7,500
MW-66-230	12/05/2016	LF	N	7,000
MW-66-230	04/25/2017	LF	N	6,800
MW-66-230	12/05/2017	LF	N	6,500
MW-66-230	04/30/2018	LF	N	6,700

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PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-66-230	04/30/2018	LF	FD	6,800
MW-66-230	12/05/2018	LF	N	6,100
MW-66-230	05/16/2019	LF	N	6,400
MW-66-230	12/03/2019	LF	N	6,800
MW-66-230	04/29/2020		FD	6,600
MW-66-230	04/29/2020	LF	N	6,700
MW-66BR-270	11/17/2011	3V	N	ND (1.0)
MW-66BR-270	01/16/2012	3V	N	ND (1.0)
MW-66BR-270	03/07/2012	3V	N	ND (1.0)
MW-66BR-270	05/24/2012	3V	N	ND (1.0)
MW-66BR-270	10/02/2012	3V	N	ND (1.0)
MW-66BR-270	12/20/2012	3V	N	ND (1.0)
MW-66BR-270	03/12/2013	3V	N	ND (1.0)
MW-66BR-270	06/18/2013	3V	N	ND (1.0)
MW-66BR-270	09/23/2013	3V	N	ND (1.0)
MW-66BR-270	12/17/2013	3V	N	ND (1.0)
MW-66BR-270	02/26/2014	3V	N	ND (1.0)
MW-66BR-270	05/13/2014	3V	N	ND (1.0)
MW-66BR-270	12/16/2014	3V	N	ND (1.0)
MW-66BR-270	05/18/2015	3V	N	ND (0.2)
MW-66BR-270	12/09/2015	3V	N	ND (1.0)
MW-66BR-270	05/04/2016	3V	N	ND (0.2)
MW-66BR-270	12/15/2016	3V	N	ND (0.2)
MW-66BR-270	05/04/2017	3V	N	ND (0.2)
MW-66BR-270	12/14/2017	3V	N	ND (0.2)
MW-66BR-270	05/02/2018	3V	N	ND (1.0)
MW-66BR-270	12/07/2018	3V	N	ND (1.0)
MW-66BR-270	05/22/2019	3V	N	ND (1.0)
MW-66BR-270	12/10/2019	3V	N	ND (1.0)
MW-66BR-270	06/24/2020	3V	N	ND (1.0)
MW-67-185	10/18/2011	3V	N	1,100
MW-67-185	10/18/2011	3V	FD	1,100
MW-67-185	11/16/2011	3V	N	1,500
MW-67-185	12/14/2011	3V	N	1,700
MW-67-185	02/21/2012	3V	N	2,000
MW-67-185	05/03/2012	3V	N	2,180
MW-67-185	09/20/2012	3V	N	2,370
MW-67-185	12/06/2012	3V	N	2,300
MW-67-185	02/21/2013	3V	N	2,190
MW-67-185	02/21/2013	3V	FD	2,180

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-67-185	05/09/2013	3V	N	2,400
MW-67-185	09/25/2013	3V	N	2,280
MW-67-185	12/04/2013	3V	N	2,180
MW-67-185	02/24/2014	3V	N	1,960
MW-67-185	05/05/2014	3V	N	2,300
MW-67-185	12/11/2014	LF	N	1,900
MW-67-185	05/20/2015	LF	N	1,800
MW-67-185	12/02/2015	LF	N	1,700
MW-67-185	05/03/2016	LF	N	1,800
MW-67-185	12/05/2016	LF	N	1,600
MW-67-185	05/03/2017	LF	N	1,600
MW-67-185	12/04/2017	LF	N	1,500
MW-67-185	04/30/2018	LF	N	1,800
MW-67-185	12/05/2018	LF	N	1,800
MW-67-185	05/16/2019	LF	N	2,100
MW-67-185	12/04/2019	LF	N	3,100
MW-67-185	04/30/2020	LF	N	2,000
MW-67-225	06/14/2011	3V	N	1,900
MW-67-225	07/12/2011	3V	N	2,100
MW-67-225	08/09/2011	3V	N	2,400
MW-67-225	09/08/2011	3V	N	2,600
MW-67-225	10/19/2011	3V	N	2,800
MW-67-225	11/17/2011	3V	N	3,100
MW-67-225	12/14/2011	3V	N	3,200
MW-67-225	02/21/2012	3V	N	3,200
MW-67-225	02/21/2012	3V	FD	3,100
MW-67-225	05/07/2012	3V	N	3,180
MW-67-225	09/20/2012	3V	N	3,200
MW-67-225	12/10/2012	3V	N	3,210
MW-67-225	02/21/2013	3V	N	3,310
MW-67-225	05/09/2013	3V	N	3,140
MW-67-225	09/25/2013	3V	N	3,100
MW-67-225	12/09/2013	3V	N	3,070
MW-67-225	02/24/2014	3V	N	2,890
MW-67-225	05/06/2014	3V	N	3,200
MW-67-225	12/11/2014	LF	N	3,200
MW-67-225	05/20/2015	LF	N	3,200
MW-67-225	12/02/2015	LF	N	3,400
MW-67-225	05/03/2016	LF	N	3,400
MW-67-225	05/03/2016	LF	FD	3,500

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-67-225	12/05/2016	LF	N	3,000
MW-67-225	05/04/2017	LF	N	2,700
MW-67-225	12/04/2017	LF	N	3,100
MW-67-225	04/30/2018	LF	N	2,800
MW-67-225	12/05/2018	LF	N	2,900
MW-67-225	05/16/2019	LF	N	3,100
MW-67-225	12/04/2019	LF	N	3,300
MW-67-225	04/30/2020	LF	N	3,000
MW-67-260	06/14/2011	3V	N	1,800
MW-67-260	07/12/2011	3V	N	1,900
MW-67-260	08/09/2011	3V	N	2,000
MW-67-260	09/08/2011	3V	N	2,100
MW-67-260	10/19/2011	3V	N	1,900
MW-67-260	11/17/2011	3V	N	2,000
MW-67-260	12/14/2011	3V	N	2,300
MW-67-260	02/21/2012	3V	N	1,700
MW-67-260	05/07/2012	3V	N	2,130
MW-67-260	09/20/2012	3V	N	2,130
MW-67-260	12/06/2012	3V	N	2,020
MW-67-260	02/21/2013	3V	N	2,130
MW-67-260	05/09/2013	3V	N	2,120
MW-67-260	05/09/2013	3V	FD	2,140
MW-67-260	09/25/2013	3V	N	2,040
MW-67-260	09/25/2013	3V	FD	2,050
MW-67-260	12/09/2013	3V	N	1,980
MW-67-260	02/24/2014	3V	N	1,940
MW-67-260	05/05/2014	3V	N	2,000
MW-67-260	12/11/2014	LF	N	740
MW-67-260	05/20/2015	LF	N	700
MW-67-260	12/02/2015	LF	N	1,100
MW-67-260	05/03/2016	LF	N	620
MW-67-260	12/05/2016	LF	N	1,000
MW-67-260	12/05/2016	LF	FD	1,000
MW-67-260	05/03/2017	LF	N	440
MW-67-260	12/04/2017	LF	N	590
MW-67-260	04/30/2018	LF	N	820
MW-67-260	12/05/2018	LF	N	660
MW-67-260	05/16/2019	LF	N	800
MW-67-260	12/04/2019	LF	N	390
MW-67-260	04/30/2020	LF	N	1,100



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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-68-180	06/14/2011	3V	N	2,600
MW-68-180	06/14/2011	3V	FD	2,700
MW-68-180	07/12/2011	3V	N	1,400
MW-68-180	09/08/2011	3V	N	18,000
MW-68-180	10/18/2011	3V	N	19,000
MW-68-180	11/17/2011	3V	N	20,000
MW-68-180	12/15/2011	3V	N	22,000
MW-68-180	02/22/2012	3V	N	16,000
MW-68-180	05/10/2012	3V	N	5,970
MW-68-180	09/20/2012	3V	N	16,400
MW-68-180	12/11/2012	3V	N	20,200
MW-68-180	12/11/2012	3V	FD	20,400
MW-68-180	02/21/2013	3V	N	17,300
MW-68-180	05/13/2013	3V	N	5,010
MW-68-180	09/26/2013	3V	N	19,200
MW-68-180	12/12/2013	3V	N	21,100
MW-68-180	12/12/2013	3V	FD	20,900
MW-68-180	02/27/2014	3V	N	22,900
MW-68-180	05/12/2014	3V	N	10,000
MW-68-180	09/30/2014	LF	N	27,000
MW-68-180	12/09/2014	LF	N	30,000
MW-68-180	02/18/2015	LF	N	31,000
MW-68-180	05/18/2015	LF	N	12,000
MW-68-180	09/30/2015	LF	N	32,000
MW-68-180	09/30/2015	LF	FD	32,000
MW-68-180	12/02/2015	LF	N	36,000
MW-68-180	02/24/2016	LF	N	37,000
MW-68-180	05/04/2016	LF	N	12,000
MW-68-180	09/29/2016	LF	N	31,000
MW-68-180	12/06/2016	LF	N	38,000
MW-68-180	02/08/2017	LF	N	35,000
MW-68-180	02/08/2017	LF	FD	36,000
MW-68-180	05/03/2017	LF	N	12,000
MW-68-180	09/26/2017	LF	N	20,000
MW-68-180	02/22/2018	LF	N	24,000
MW-68-180	05/01/2018	LF	N	5,600
MW-68-180	09/27/2018	LF	N	8,500
MW-68-180	12/07/2018	LF	N	22,000
MW-68-180	02/13/2019	LF	N	37,000
MW-68-180	05/22/2019	LF	N	5,400

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-68-180	09/26/2019	LF	N	9,700
MW-68-180	12/04/2019	LF	N	34,000
MW-68-180	02/20/2020	LF	N	25,000
MW-68-180	04/30/2020	LF	N	41,000
MW-68-240	06/14/2011	3V	N	420
MW-68-240	07/12/2011	3V	N	920
MW-68-240	09/07/2011	3V	N	1,100
MW-68-240	09/07/2011	3V	FD	1,100
MW-68-240	10/18/2011	3V	N	1,300
MW-68-240	11/16/2011	3V	N	1,500
MW-68-240	12/14/2011	3V	N	1,600
MW-68-240	02/17/2012	3V	N	1,800
MW-68-240	05/03/2012	3V	N	1,820
MW-68-240	09/20/2012	3V	N	2,000
MW-68-240	12/06/2012	3V	N	1,990
MW-68-240	02/20/2013	3V	N	1,970
MW-68-240	05/08/2013	3V	N	2,050
MW-68-240	09/24/2013	3V	N	2,120
MW-68-240	12/04/2013	3V	N	1,960
MW-68-240	02/25/2014	3V	N	2,020
MW-68-240	05/06/2014	3V	N	2,200
MW-68-240	05/06/2014	3V	FD	2,200
MW-68-240	12/18/2014	LF	N	2,100
MW-68-240	05/21/2015	LF	N	2,200
MW-68-240	12/02/2015	LF	N	2,300
MW-68-240	05/04/2016	LF	N	2,100
MW-68-240	12/06/2016	LF	N	2,100
MW-68-240	05/03/2017	LF	N	2,100
MW-68-240	02/22/2018	LF	N	2,100
MW-68-240	05/01/2018	LF	N	2,000
MW-68-240	12/05/2018	LF	N	2,000
MW-68-240	05/23/2019	LF	N	2,000
MW-68-240	05/23/2019	LF	FD	1,900
MW-68-240	12/04/2019	LF	N	2,100
MW-68-240	04/30/2020	LF	N	2,000
MW-68BR-280	09/08/2011	3V	N	ND (5.0)
MW-68BR-280	10/21/2011	3V	N	ND (5.0)
MW-68BR-280	11/16/2011	3V	N	ND (5.0)
MW-68BR-280	12/14/2011	3V	N	ND (5.0)
MW-68BR-280	02/14/2012	3V	N	ND (1.0)

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-68BR-280	05/09/2012	3V	N	ND (1.0)
MW-68BR-280	10/03/2012	3V	N	ND (1.0)
MW-68BR-280	11/12/2012	3V	N	ND (1.0)
MW-68BR-280	02/18/2013	3V	N	ND (1.0)
MW-68BR-280	05/08/2013	3V	N	ND (1.0)
MW-68BR-280	09/18/2013	3V	N	ND (1.0)
MW-68BR-280	12/18/2013	3V	N	ND (1.0)
MW-68BR-280	02/27/2014	3V	N	ND (1.0)
MW-68BR-280	05/13/2014	3V	N	ND (1.0)
MW-68BR-280	12/18/2014	3V	N	ND (1.0)
MW-68BR-280	05/27/2015	3V	N	ND (1.0)
MW-68BR-280	12/03/2015	LF	N	ND (1.0)
MW-68BR-280	05/04/2016	LF	N	ND (1.0)
MW-68BR-280	12/06/2016	3V	N	ND (1.0)
MW-68BR-280	05/04/2017	3V	N	ND (1.0)
MW-68BR-280	05/04/2017	3V	FD	ND (1.0)
MW-68BR-280	02/22/2018	LF	N	ND (1.0)
MW-68BR-280	05/01/2018	LF	N	ND (1.0)
MW-68BR-280	12/05/2018	LF	N	ND (1.0)
MW-68BR-280	05/22/2019	LF	N	ND (1.0)
MW-68BR-280	12/04/2019	LF	N	ND (1.0)
MW-68BR-280	04/30/2020	3V	N	ND (1.0)
MW-69-195	07/11/2011	3V	N	140
MW-69-195	08/09/2011	3V	N	210
MW-69-195	09/07/2011	3V	N	260
MW-69-195	10/18/2011	3V	N	310
MW-69-195	11/15/2011	3V	N	380
MW-69-195	12/14/2011	3V	N	360
MW-69-195	02/17/2012	3V	N	280
MW-69-195	05/02/2012	3V	N	446
MW-69-195	09/19/2012	3V	N	789
MW-69-195	12/05/2012	3V	N	849
MW-69-195	02/20/2013	3V	N	909
MW-69-195	05/06/2013	3V	N	919
MW-69-195	09/24/2013	3V	N	938
MW-69-195	12/03/2013	3V	N	932
MW-69-195	02/19/2014	3V	N	893
MW-69-195	05/01/2014	3V	N	1,000
MW-69-195	09/25/2014	3V	N	860
MW-69-195	09/25/2014	3V	FD	930

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-69-195	12/11/2014	3V	N	950
MW-69-195	02/17/2015	3V	N	930
MW-69-195	05/14/2015	3V	N	970
MW-69-195	05/14/2015	3V	FD	980
MW-69-195	10/01/2015	3V	N	890
MW-69-195	12/04/2015	3V	N	830
MW-69-195	02/24/2016	3V	N	620
MW-69-195	02/24/2016	3V	FD	610
MW-69-195	04/25/2016	3V	N	660
MW-69-195	09/29/2016	LF	N	640
MW-69-195	12/06/2016	LF	N	670
MW-69-195	02/09/2017	LF	N	180
MW-69-195	05/03/2017	LF	N	270
MW-69-195	09/26/2017	LF	N	350
MW-69-195	12/04/2017	LF	N	470
MW-69-195	02/22/2018	LF	N	120
MW-69-195	05/01/2018	LF	N	210
MW-69-195	09/27/2018	LF	N	460
MW-69-195	12/07/2018	LF	N	460
MW-69-195	02/13/2019	LF	N	110
MW-69-195	05/16/2019	LF	N	120
MW-69-195	09/26/2019	LF	N	78
MW-69-195	12/03/2019	LF	N	180
MW-69-195	02/25/2020	LF	N	150
MW-69-195	05/01/2020		FD	180
MW-69-195	05/01/2020	LF	N	170
MW-70-105	06/13/2011	3V	N	0.38
MW-70-105	07/11/2011	3V	N	3.8
MW-70-105	08/08/2011	3V	N	18
MW-70-105	09/06/2011	3V	N	13
MW-70-105	11/14/2011	3V	N	31
MW-70-105	12/12/2011	3V	N	55
MW-70-105	02/16/2012	3V	N	13
MW-70-105	05/01/2012	3V	N	76.3
MW-70-105	09/12/2012	3V	N	80.8
MW-70-105	12/04/2012	3V	N	65.1
MW-70-105	02/19/2013	3V	N	93.2
MW-70-105	04/25/2013	3V	N	198
MW-70-105	09/23/2013	3V	N	122
MW-70-105	12/04/2013	3V	N	163

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-70-105	02/17/2014	3V	N	145
MW-70-105	04/28/2014	3V	N	75
MW-70-105	12/02/2014	3V	N	130
MW-70-105	05/07/2015	3V	N	150
MW-70-105	12/07/2015	3V	N	150
MW-70-105	04/28/2016	LF	N	120
MW-70-105	12/14/2016	LF	N	140
MW-70-105	05/02/2017	LF	N	130
MW-70-105	12/11/2017	LF	N	160
MW-70-105	05/03/2018	LF	N	160
MW-70-105	12/13/2018	LF	N	120
MW-70-105	05/21/2019	LF	N	170
MW-70-105	12/17/2019	LF	N	60
MW-70BR-225	11/16/2011	3V	N	2,300
MW-70BR-225	12/15/2011	3V	N	2,200
MW-70BR-225	02/16/2012	3V	N	2,200
MW-70BR-225	05/17/2012	3V	N	2,460
MW-70BR-225	05/17/2012	3V	FD	2,380
MW-70BR-225	09/18/2012	3V	N	2,410
MW-70BR-225	12/13/2012	3V	N	1,980
MW-70BR-225	02/26/2013	3V	N	1,960
MW-70BR-225	05/07/2013	3V	N	2,000
MW-70BR-225	09/24/2013	3V	N	2,170
MW-70BR-225	12/10/2013	3V	N	1,950
MW-70BR-225	02/25/2014	3V	N	1,900
MW-70BR-225	05/05/2014	3V	N	2,400
MW-70BR-225	12/16/2014	3V	N	1,900
MW-70BR-225	05/27/2015	3V	N	2,300
MW-70BR-225	12/07/2015	3V	N	2,000
MW-70BR-225	04/28/2016	3V	N	2,000
MW-70BR-225	12/14/2016	3V	N	1,900
MW-70BR-225	12/14/2016	3V	FD	1,900
MW-70BR-225	05/02/2017	3V	N	1,800
MW-70BR-225	12/11/2017	3V	N	1,700
MW-70BR-225	12/11/2017	LF	N	1,400
MW-70BR-225	05/03/2018	3V	N	1,800
MW-70BR-225	05/03/2018	LF	N	1,300
MW-70BR-225	12/13/2018	3V	N	1,800
MW-70BR-225	12/13/2018	LF	N	1,200
MW-70BR-225	05/21/2019	LF	N	1,600

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-70BR-225	12/17/2019	LF	N	1,300
MW-70BR-289	07/24/2020		N	11
MW-70BR-289	07/24/2020		N	3.2
MW-70BR-289	07/24/2020		N	ND (1.0)
MW-70BR-289	08/21/2020	LF	N	330
MW-70BR-289	08/21/2020	LF	N	370
MW-70BR-289	08/21/2020	LF	N	350
MW-71-035	11/15/2011	3V	N	ND (1.0)
MW-71-035	12/14/2011	3V	N	ND (1.0)
MW-71-035	02/15/2012	3V	N	ND (1.0)
MW-71-035	05/03/2012	3V	N	ND (1.0)
MW-71-035	09/19/2012	3V	N	ND (0.2)
MW-71-035	11/08/2012	3V	N	ND (0.2)
MW-71-035	02/07/2013	3V	N	0.78
MW-71-035	04/30/2013	3V	N	0.44
MW-71-035	09/10/2013	3V	N	ND (1.0)
MW-71-035	12/11/2013	3V	N	0.47
MW-71-035	02/18/2014	3V	N	0.32
MW-71-035	04/24/2014	3V	N	1
MW-71-035	05/06/2015	LF	N	ND (1.0)
MW-71-035	12/04/2015	LF	N	1.2
MW-71-035	05/03/2016	LF	N	ND (1.0)
MW-71-035	05/03/2016	LF	FD	ND (1.0)
MW-71-035	12/14/2016	G	N	ND (1.0)
MW-71-035	05/03/2017	LF	N	ND (1.0)
MW-71-035	12/12/2017	LF	N	ND (1.0)
MW-71-035	05/02/2018	LF	N	ND (1.0)
MW-71-035	12/11/2018	LF	N	ND (1.0)
MW-71-035	12/11/2018	LF	FD	ND (1.0)
MW-71-035	05/23/2019	LF	N	ND (1.0)
MW-71-035	12/18/2019	LF	N	ND (1.0)
MW-71-035	05/01/2020	LF	N	ND (1.0)
MW-79-058	02/28/2019	PD	N	2,200
MW-79-058	03/19/2019	LF	N	2.5
MW-79-058	04/15/2019	LF	N	210
MW-79-058	05/15/2019	3V	N	1,600
MW-79-058	05/15/2019	LF	N	1,300
MW-79-058	06/26/2019	3V	N	2,100
MW-79-058	06/26/2019	LF	N	1,800
MW-79-058	07/25/2019	3V	N	2,400

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-79-058	07/25/2019	LF	N	2,000
MW-79-058	09/27/2019	LF	N	2,400
MW-79-058	12/02/2019	LF	N	2,900
MW-79-058	02/21/2020		FD	620 J
MW-79-058	02/21/2020	LF	N	1,800 J
MW-79-058	05/29/2020		FD	540
MW-79-058	05/29/2020	LF	N	540
MW-79-058	08/18/2020		FD	2,000
MW-79-058	08/18/2020	LF	N	2,000
MW-79-102	02/27/2019	PD	N	1,700
MW-79-102	03/19/2019		FD	270
MW-79-102	03/19/2019	LF	N	260
MW-79-102	04/15/2019	LF	N	2,000
MW-79-102	05/15/2019	LF	N	2,600
MW-79-102	06/26/2019	LF	N	2,900
MW-79-102	09/27/2019	LF	N	3,100
MW-79-102	12/02/2019	LF	N	3,500
MW-79-102	02/21/2020	LF	N	3,400
MW-79-102	05/29/2020	LF	N	3,000
MW-79-102	08/18/2020	LF	N	3,500
MW-80-057	03/02/2019	PD	N	560
MW-80-057	03/19/2019	LF	N	270
MW-80-057	04/16/2019	LF	N	450
MW-80-057	05/13/2019		FD	2,000
MW-80-057	05/13/2019	LF	N	2,000
MW-80-057	06/24/2019	LF	N	660
MW-80-057	09/27/2019	LF	N	810
MW-80-057	12/02/2019		FD	840
MW-80-057	12/02/2019	LF	N	840
MW-80-057	02/24/2020	LF	N	750
MW-80-057	05/21/2020	LF	N	800
MW-80-057	08/18/2020	LF	N	690
MW-80-082	03/02/2019	PD	N	1,500
MW-80-082	03/19/2019	LF	N	1,600
MW-80-082	04/16/2019	LF	N	1,700
MW-80-082	05/15/2019	LF	N	2,000
MW-80-082	09/27/2019	LF	N	2,000
MW-80-082	12/02/2019	LF	N	2,200
MW-80-082	02/24/2020		FD	1,900
MW-80-082	02/24/2020	LF	N	1,900

## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-80-082	05/21/2020		FD	1,600
MW-80-082	05/21/2020	LF	N	1,600
MW-80-082	08/18/2020	LF	N	1,600
MW-81-043	01/08/2020	PD	N	ND (0.2)
MW-81-043	01/28/2020	LF	N	1.8
MW-81-043	02/18/2020	LF	N	4.4
MW-81-043	03/18/2020	LF	N	2.1
MW-81-043	04/21/2020	LF	N	7.4
MW-81-043	05/21/2020	LF	N	2.4
MW-81-043	08/18/2020	LF	N	1.5
MW-81-098	12/19/2019	PD	N	ND (0.2)
MW-81-098	01/28/2020	LF	N	ND (0.2)
MW-81-098	02/18/2020	LF	N	ND (0.2)
MW-81-098	03/18/2020	LF	N	0.31
MW-81-098	04/21/2020		N	ND (0.2)
MW-81-098	05/21/2020	LF	N	0.29
MW-81-098	08/18/2020		FD	ND (1.0)
MW-81-098	08/18/2020	LF	N	ND (1.0)
MW-83-090	03/29/2019	PD	N	18
MW-83-090	04/17/2019	LF	N	22
MW-83-090	05/14/2019	LF	N	28
MW-83-090	06/25/2019	LF	N	35
MW-83-090	09/25/2019	LF	N	41
MW-83-090	12/11/2019	LF	N	53
MW-83-090	02/19/2020	LF	N	49
MW-83-090	05/28/2020		FD	44
MW-83-090	05/28/2020	LF	N	44
MW-83-090	08/26/2020	LF	N	49
MW-83-180	03/28/2019	PD	N	ND (1.0)
MW-83-180	04/17/2019	LF	N	ND (1.0)
MW-83-180	05/14/2019	LF	N	ND (1.0)
MW-83-180	06/25/2019	LF	N	ND (1.0)
MW-83-180	07/25/2019		FD	ND (1.0)
MW-83-180	07/25/2019	LF	N	ND (1.0)
MW-83-180	08/22/2019	LF	N	2.8
MW-83-180	09/25/2019	LF	N	3.1
MW-83-180	10/25/2019	LF	N	5.9
MW-83-180	11/22/2019	LF	N	7.7
MW-83-180	12/11/2019	LF	N	7
MW-83-180	01/29/2020	LF	N	7.7



## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-83-180	02/19/2020	LF	N	8.4
MW-83-180	03/17/2020	LF	N	8.8
MW-83-180	04/23/2020	LF	N	7.9
MW-83-180	05/28/2020	LF	N	9.1
MW-83-180	06/15/2020	LF	N	6
MW-83-180	07/22/2020	LF	N	8.5
MW-83-180	08/26/2020	LF	N	8.4
MW-83-225	03/29/2019	PD	N	380
MW-83-225	04/16/2019	LF	N	500
MW-83-225	05/14/2019	LF	N	530
MW-83-225	06/25/2019	LF	N	490
MW-83-225	09/25/2019	LF	N	480
MW-83-225	12/11/2019	LF	N	470
MW-83-225	02/19/2020	LF	N	450
MW-83-225	05/28/2020	LF	N	510
MW-83-225	08/26/2020	LF	N	460
MW-83-245	03/03/2019	PD	N	15
MW-83-245	03/19/2019	LF	N	3.6
MW-83-245	04/16/2019	LF	N	2.5
MW-83-245	05/14/2019	LF	N	ND (1.0)
MW-83-245	09/25/2019		FD	ND (1.0)
MW-83-245	09/25/2019	LF	N	ND (2.0)
MW-83-245	12/11/2019		FD	32
MW-83-245	12/11/2019	LF	N	33
MW-83-245	02/19/2020	LF	N	1.7
MW-83-245	05/22/2020	LF	N	4.5
MW-83-245	08/26/2020	LF	N	9.2
MW-85-129	04/03/2019	PD	N	46
MW-85-129	04/16/2019	LF	N	88
MW-85-129	05/13/2019	LF	N	130
MW-85-129	06/25/2019		FD	140
MW-85-129	06/25/2019	LF	N	140
MW-85-129	09/24/2019		FD	140
MW-85-129	09/24/2019	LF	N	140
MW-85-129	12/11/2019	LF	N	150
MW-85-129	02/18/2020		FD	150
MW-85-129	02/18/2020	LF	N	150
MW-85-129	05/20/2020	LF	N	130 J
MW-85-129	08/21/2020	LF	N	140
MW-85-217	04/02/2019	PD	N	110

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### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
MW-85-217	04/16/2019	LF	N	74
MW-85-217	05/13/2019	LF	N	150
MW-85-217	06/25/2019	LF	N	870
MW-85-217	07/23/2019	LF	N	0.66
MW-85-217	08/22/2019	LF	N	900
MW-85-217	09/24/2019	LF	N	990
MW-85-217	10/25/2019	LF	N	1,000
MW-85-217	12/11/2019	LF	N	1,200
MW-85-217	02/18/2020	LF	N	1,100
MW-85-217	05/20/2020	LF	N	870 J
MW-85-217	08/21/2020	LF	N	1,100
MW-85-237	04/01/2019	PD	N	1,500
MW-85-237	04/16/2019	LF	N	1,200
MW-85-237	05/13/2019		FD	1,600
MW-85-237	05/13/2019	LF	N	1,600
MW-85-237	06/25/2019	LF	N	1,200
MW-85-237	09/24/2019	LF	N	1,900
MW-85-237	12/11/2019	LF	N	2,100
MW-85-237	02/18/2020	LF	N	2,100
MW-85-237	05/20/2020	LF	N	1,300 J
MW-85-237	08/21/2020	LF	N	2,300
MW-88-107	11/13/2019	PD	N	29
MW-88-107	12/18/2019	LF	N	36
MW-88-107	01/29/2020	LF	N	49
MW-88-107	02/25/2020	LF	N	59
MW-88-107	05/28/2020	LF	N	69
MW-88-107	08/19/2020	LF	N	76
MW-95-113	06/10/2020		N	ND (0.2)
MW-95-113	06/18/2020	LF	N	0.32
MW-95-113	07/21/2020	LF	N	0.44
MW-95-113	08/19/2020	LF	N	0.76
MW-95-157	06/09/2020		N	ND (0.2)
MW-95-157	06/25/2020	LF	N	0.63
MW-95-157	07/21/2020	LF	N	2.3
MW-95-157	08/19/2020	LF	N	4.2
PT8D	01/23/2008	3V	N	6,980
PT8D	03/05/2008	3V	N	6,220
PT8D	03/13/2008	3V	N	5,740
PT8D	03/18/2008	3V	N	5,460
PT8D	03/25/2008	3V	N	5,700

## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
PT8D	04/02/2008	3V	N	4,800
PT8D	04/16/2008	3V	N	6,480
PT8D	04/29/2008	3V	N	4,940
PT8D	05/14/2008	3V	N	3,800
PT8D	05/28/2008	3V	N	1,220
PT8D	06/11/2008	3V	N	3,960
PT8D	06/25/2008	3V	N	2,920
PT8D	07/23/2008	3V	N	3,660
PT8D	08/20/2008	3V	N	4,100
PT8D	09/17/2008	3V	N	3,820
PT8D	10/15/2008	3V	N	512
PT8D	11/12/2008	3V	N	596
PT8D	07/09/2013	3V	N	1,080
PT8D	07/24/2019	LF	N	1,300
PT8M	01/23/2008	3V	N	4,660
PT8M	03/05/2008	3V	N	3,680
PT8M	03/13/2008	3V	N	4,060
PT8M	03/19/2008	3V	N	3,340
PT8M	03/25/2008	3V	N	4,100
PT8M	04/02/2008	3V	N	4,100
PT8M	04/16/2008	3V	N	4,080
PT8M	04/29/2008	3V	N	4,120
PT8M	05/14/2008	3V	N	3,820
PT8M	05/28/2008	3V	N	4,220
PT8M	06/11/2008	3V	N	3,860
PT8M	06/25/2008	3V	N	4,140
PT8M	06/25/2008	3V	FD	4,140
PT8M	07/23/2008	3V	N	4,000
PT8M	08/20/2008	3V	N	3,140
PT8M	09/17/2008	3V	N	2,460
PT8M	10/15/2008	3V	N	2,940
PT8M	11/12/2008	3V	N	2,200
PT8M	07/09/2013	3V	N	37.7
PT8M	07/24/2019	LF	N	ND (0.2)
PT8S	01/23/2008	3V	N	1,980
PT8S	03/05/2008	3V	N	1,040
PT8S	03/13/2008	3V	N	390
PT8S	03/18/2008	3V	N	162
PT8S	03/25/2008	3V	N	306
PT8S	04/02/2008	3V	N	1,080

## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
PT8S	04/16/2008	3V	N	667
PT8S	04/29/2008	3V	N	180
PT8S	05/14/2008	3V	N	60
PT8S	05/28/2008	3V	N	32
PT8S	06/11/2008	3V	N	18
PT8S	06/25/2008	3V	N	46
PT8S	07/23/2008	3V	N	500
PT8S	08/20/2008	3V	N	12
PT8S	09/17/2008	3V	N	10
PT8S	10/15/2008	3V	N	28
PT8S	11/12/2008	3V	N	11
PT8S	07/09/2013	3V	N	ND (0.2)
PT8S	07/24/2019	LF	N	ND (0.2)
PT9D	01/22/2008	3V	N	17,400
PT9D	01/22/2008	3V	FD	16,400
PT9D	03/05/2008	3V	N	15,820
PT9D	03/12/2008	3V	N	14,060
PT9D	03/19/2008	3V	N	13,580
PT9D	03/26/2008	3V	N	12,220
PT9D	04/02/2008	3V	N	13,980
PT9D	04/16/2008	3V	N	14,130
PT9D	04/29/2008	3V	N	10,790
PT9D	05/14/2008	3V	N	10,850
PT9D	05/28/2008	3V	N	14,450
PT9D	06/11/2008	3V	N	13,660
PT9D	06/11/2008	3V	FD	13,660
PT9D	06/25/2008	3V	N	10,400
PT9D	07/24/2008	3V	N	10,780
PT9D	08/20/2008	3V	N	14,400
PT9D	09/17/2008	3V	N	15,180
PT9D	10/15/2008	3V	N	9,300
PT9D	11/12/2008	3V	N	13,900
PT9D	07/10/2013	3V	N	12,100
PT9D	07/24/2019	LF	N	9,500
PT9M	01/22/2008	3V	N	3,000
PT9M	03/05/2008	3V	N	2,100
PT9M	03/12/2008	3V	N	2,740
PT9M	03/19/2008	3V	N	2,420
PT9M	03/26/2008	3V	N	2,480
PT9M	04/02/2008	3V	N	2,800

## Appendix A

### Analytical Data Summary

PG&E Topock Compressor Station, Needles, California

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
PT9M	04/16/2008	3V	N	2,940
PT9M	04/29/2008	3V	N	2,760
PT9M	05/14/2008	3V	N	2,760
PT9M	05/28/2008	3V	N	2,640
PT9M	06/11/2008	3V	N	2,980
PT9M	06/25/2008	3V	N	2,800
PT9M	07/24/2008	3V	N	2,800
PT9M	08/20/2008	3V	N	2,800
PT9M	09/17/2008	3V	N	2,860
PT9M	10/15/2008	3V	N	3,280
PT9M	11/12/2008	3V	N	3,180
PT9M	07/10/2013	3V	N	958
PT9M	07/24/2019	LF	N	200
PT9S	01/22/2008	3V	N	1,580
PT9S	03/05/2008	3V	N	1,360
PT9S	03/12/2008	3V	N	1,480
PT9S	03/19/2008	3V	N	1,200
PT9S	03/26/2008	3V	N	1,580
PT9S	04/02/2008	3V	N	1,540
PT9S	04/16/2008	3V	N	1,640
PT9S	04/29/2008	3V	N	1,360
PT9S	05/14/2008	3V	N	1,240
PT9S	05/28/2008	3V	N	1,540
PT9S	06/11/2008	3V	N	1,540
PT9S	06/25/2008	3V	N	1,420
PT9S	07/24/2008	3V	N	1,740
PT9S	08/20/2008	3V	N	1,760
PT9S	09/17/2008	3V	N	1,880
PT9S	10/15/2008	3V	N	1,100
PT9S	11/12/2008	3V	N	760
PT9S	07/10/2013	3V	N	272
PT9S	07/24/2019	LF	N	65
TW-01	09/22/2009	3V	N	3,740
TW-01	03/15/2010	3V	N	3,430
TW-01	05/05/2010	3V	N	3,700
TW-01	09/28/2010	3V	N	3,690
TW-01	12/09/2010	3V	N	3,520
TW-01	02/09/2011	3V	N	3,710
TW-01	05/05/2011	3V	N	3,700
TW-01	09/28/2011	3V	N	3,200

## Appendix A

### Analytical Data Summary

*PG&E Topock Compressor Station, Needles, California*

Location	Sample Date	Sample Method	Sample type	Hexavalent Chromium (ppb)
TW-01	12/15/2011	3V	N	3,610
TW-01	02/10/2012	3V	N	3,460
TW-01	05/16/2012	3V	N	3,090
TW-01	10/01/2012	3V	N	3,190
TW-01	12/11/2012	3V	N	3,100
TW-01	12/11/2012	3V	FD	2,980
TW-01	02/21/2013	3V	N	2,830
TW-01	05/14/2013	3V	N	2,830
TW-01	09/26/2013	3V	N	2,770
TW-01	12/17/2013	3V	N	2,770
TW-01	02/20/2014	3V	N	2,500
TW-01	05/13/2014	3V	N	2,800
TW-01	05/27/2015	3V	N	2,500
TW-01	12/01/2015	3V	N	2,400
TW-01	05/03/2016	Tap	N	2,400
TW-01	05/03/2017	LF	N	2,200
TW-01	12/13/2017	3V	N	2,200
TW-01	12/13/2017	LF	FD	2,200
TW-01	05/01/2018	3V	N	2,400
TW-01	12/05/2018	3V	N	2,100
TW-01	05/24/2019	LF	N	2,300
TW-01	12/03/2019	LF	N	2,200

#### Notes:

3V- three volume purge

FD- field duplicate

LF- low flow

N- normal

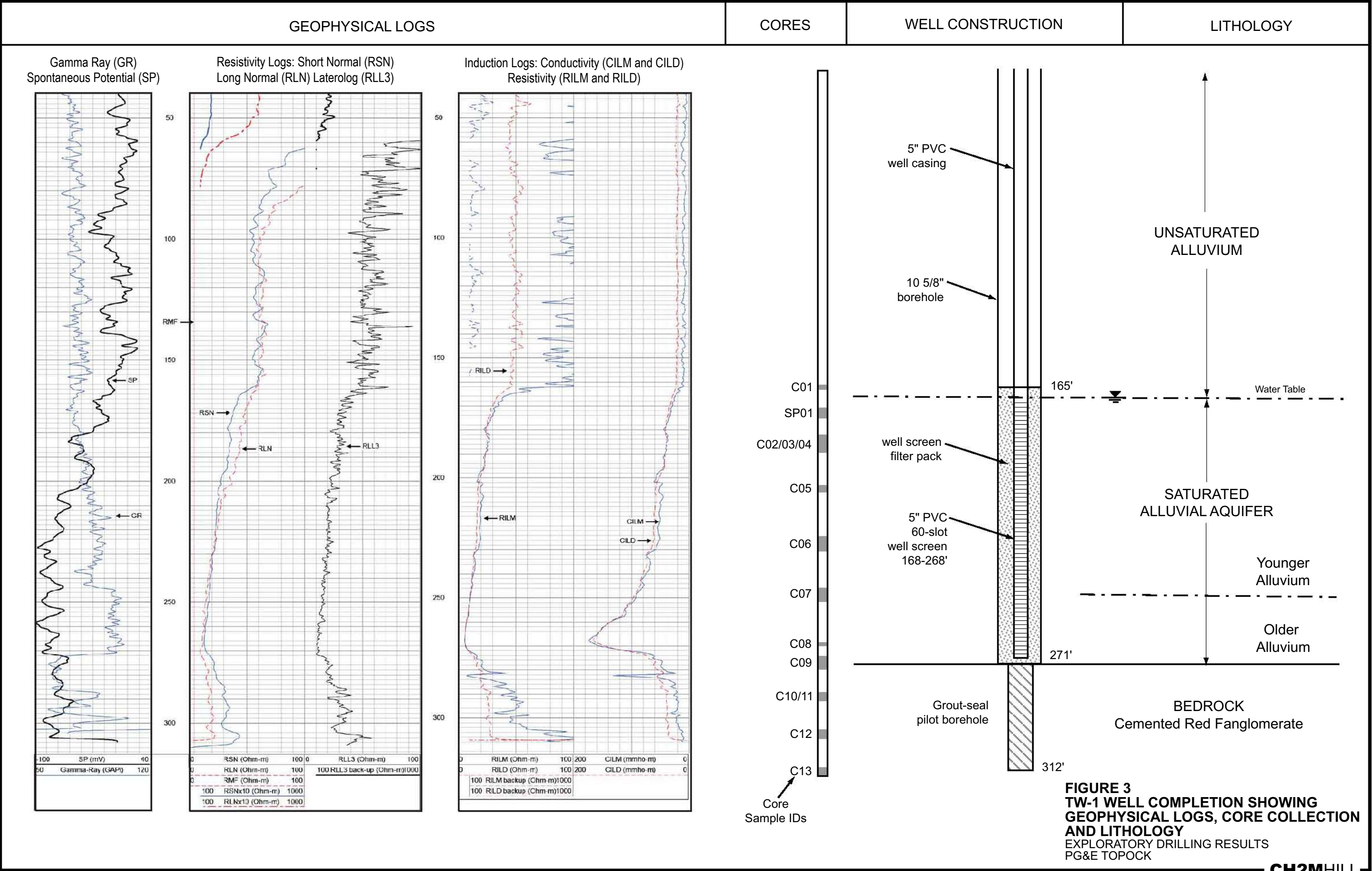
ND - not detected at reporting limit in parentheses

ppb - parts per billion

# APPENDIX B


Boring Logs for Select Wells










SHEET 1 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1	
SOIL BORING LOG							
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM	
						DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
5				SM	SILTY SAND WITH GRAVEL (SM) - light brown, 40% well-graded gravel, 40% m-f sand, 20% silt, loose, dry, some broken from drilling.	10 1/2 surface casing installed to a depth of 20' using Air Rotary Casing Hammer (ARCH). Soil logging imprecise in this interval due to mixing of cuttings.  Much drill chatter in this interval.  Exterior of casing sealed with hydrated bentonite at surface. Interior of casing sealed at bottom prior to advancement of 6 5/8 bit.  Pilot boring drilled with mud rotary; soil descriptions to 160' from drill cuttings.	
10							
15							
20							
25				GP	POORLY GRADED GRAVEL (GP) - m ang sand up to 1/4, trace fine sand and silt, freshly broken.  - c. ang sand up to 3/8 gravel	Drill chatter.	
30							
35				SC	CLAYEY SAND (SC) 70-75% m-c ang sand, 15-20% lt brn clay, 10% f ang gravel to 1/4, some fine sand.		


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SHEET 2 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1			
SOIL BORING LOG									
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA			
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM		DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core			
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS			
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.			
40				SW-SC	WELL GRADED SAND WITH CLAY (SW-SC) - 85% m-c ang sand, 10% clay, 5% vf ang gravel, overall decreasing particle size and clay content.				
45					WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.				
50									
55									
60									
65									
70									
<div> CH2MHILL</div>									


SHEET 3 of 10				PROJECT NUMBER: 315024.IM.02			BORING NUMBER: TW-1		
SOIL BORING LOG									
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0			DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA		
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78			DATE AND TIME STARTED: 11/11/2003 10:15:00 AM		DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---			DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core		
LOCATION: PG & E Topock Facility							LOGGED BY: D. Thomas / R. Edwards		
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS			
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.			
75				SW	WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.				
80					- orange streaking				
85									
90					- orange streaking				
95					- orange streaking				
100					- orange streaking				
105					- orange and white streaking				

CH2MHILL


SHEET 4 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1			
SOIL BORING LOG									
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA			
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM		DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core			
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS			
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.			
110				SW	WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.				
					- orange and white streaking				
115					- orange and white streaking				
120					- red, orange, and white streaks in cuttings, mostly m-c ang sand, some fines, trace gravel up to 1/4				
125									
130				- trace of silt					
135									
140				- orange and white streaking					
									

SHEET 5 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1	
SOIL BORING LOG							
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM	
						DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
145					WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.		
150					- orange and white streaking		
155					- m-c ang sand with some fine sands and silt	Mud Properties (155' during borehole ream) viscosity = 37 seconds density = 9.2 lbs/gallon half press filter test = 3.4 mL in 7.5 min with firm 1-mm cake	
160					- trace vf ang gravel	Mud properties at 155' during borehole ream	
165					- brown, 80% angular sand, 20% subangular to angular gravel up to 2, medium dense, wet	Start 94 mm coring at 10' intervals. First core met refusal after 8.	
170				SM	SILTY SAND (SM) - brown matrix with red, orange, white, dk and lt green clasts, 70% well-graded ang sand, 30% silt, medium dense, wet.	First attempted SimulProbe groundwater sample (no recovery). Continue with 94 mm coring.	
175							


SHEET 6 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1	
SOIL BORING LOG							
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM	
						DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
180				SW	WELL GRADED SAND (SW) - m-c ang sand, some vf ang gravel.	3 attempts for a total of 6' core.	
185				SM	SILTY SAND WITH GRAVEL (SM) - color varies widely, 60% well graded ang sand, 15-20% silt, 10-15% angular gravel to 1, soft to medium firm, wet.		
190				SW	WELL GRADED SAND (SW) - m-c ang sand, trace vf ang gravel.		
195				SW-SC	WELL GRADED SAND WITH CLAY (SW-SC) - 80% well-graded ang sand, 20% clay in layers.		
200				SM	SILTY SAND WITH GRAVEL (SM) - color varies widely with minerals present, 60% well graded ang sand, 15-20% silt, 10-15% angular gravel to 1, soft to medium firm, wet.		
205					WELL GRADED SAND (SW) - orange streaks in cuttings, m-c ang sand, trace ang gravel to 3/16.		
210							


**CH2MHILL**

SHEET 7 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1	
SOIL BORING LOG							
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM	
						DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
215				SW	WELL GRADED SAND (SW) - orange streaks in cuttings, m-c ang sand, trace ang gravel to 3/16.  - red-orange clay	Loss of circulation briefly.    - 41% gravel in core sample based on grain size analysis	
220				GW	WELL GRADED GRAVEL WITH SAND (GW) - 65-70% well-graded, angular sand, 15-20% silt, 15% f ang gravel to 1/4, trace orange clay, loose to medium firm, wet.		
225							
230							
235				SW	WELL GRADED SAND (SW) - some ang gravel to 3/16.		
240				SC	CLAYEY SAND (SC) - medium brn, 65% well-graded ang sand, 35% medium plasticity fines, trace of ang gravel to 3/16, soft, wet. - becoming reddish		
245							


**CH2MHILL**

SHEET 8 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1	
SOIL BORING LOG							
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM	
						DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
250				SW	WELL GRADED SAND (SW) - slight red color, trace gravel to 3/16.	<p>Large rock in shoe blocked collection of core.</p> <p>- C09 core contains dense, stiff clayey sand, red in color, not consolidated</p> <p><u>Mud Properties at (270' during borehole ream)</u>  Viscosity = 38 seconds  Density = 9.3 lbs/gallon  Half press filter test = 4.0 mL in 7.5 min with firm 1.5-mm firm cake  Sand content = 0.5%  Viscosity = 38 seconds  Density = 9.3 lbs/gallon</p> <p>Contact with consolidated bedrock interpreted from core, geophysical logs, and change in drilling fluid color at 275'  Sand content = 0.5%  Drill cuttings and mud return changed to red in color (notes at 275'); bedrock contact suspected between 270' and 275'</p>	
255					- 15% fines, ang gravel		
260					- 25% f ang gravel to 1/8		
265				CL	SANDY CLAY (CL) - (10YR 4/4), 60% fines, 40% well-graded ang sand, soft, medium plasticity, wet.		
270				SC	CLAYEY SAND (SC) wet, loose, 70% well-graded, angular sand, 30% fines. Becoming red, stiff to friable.		
275					SANDY MUDSTONE - reddish (2.5YR 4/6), 70% fines, 30% f-m ang sand, consolidated.		
280							


**CH2MHILL**



SHEET 9 of 10				PROJECT NUMBER: 315024.IM.02		BORING NUMBER: TW-1	
SOIL BORING LOG							
PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)				HOLE DEPTH (ft): 312.0		DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 621.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,173.17		EASTING (CCS NAD 27 Z 5): 7,615,150.78		DATE AND TIME STARTED: 11/11/2003 10:15:00 AM	
						DATE AND TIME COMPLETED: 11/13/2003 5:00:00 PM	
DRILLING METHOD: Mud Rotary				WATER LEVEL (ft): ---		DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: PG & E Topock Facility						LOGGED BY: D. Thomas / R. Edwards	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
285				BR	SANDY MUDSTONE - reddish (2.5YR 4/6), 70% fines, 30% f-m ang sand, consolidated.  - consolidated, sandy to silty	Mud Properties at (during borehole ream) Viscosity = 43 seconds Density = 9.1 lbs/gallon Full press filter test = 5.7 mL in 7.5 min with firm 2/32-inch firm cake Sand content = 0.6% Core collected at 281' is consolidated bedrock (I.e., Red Fanglomerate).	
290					CLAYEY SANDSTONE - medium brown, 70% well-graded ang sand, 30% fines.		
295							
300				BR			
305							
310				BR	SANDY MUDSTONE - medium brown with white calcareous streaks, firm.	Pilot boring terminated at 312' bgs.	
					Boring Terminated at 312 ft  ABBREVIATIONS cc = continuous core run		

PROJECT NUMBER:  
315024.IM.02BORING NUMBER:  
TW-1

## SOIL BORING LOG

<b>PROJECT NAME:</b> PG&E Topock IM Investigation (Phase 5 2004)		<b>HOLE DEPTH (ft):</b> 312.0	<b>DRILLING CONTRACTOR:</b> WDC Exploration and Wells, Montclair, CA	
<b>SURFACE ELEVATION:</b> 621.0 ft. MSL	<b>NORTHING (CCS NAD 27 Z 5):</b> 2,101,173.17	<b>EASTING (CCS NAD 27 Z 5):</b> 7,615,150.78	<b>DATE AND TIME STARTED:</b> 11/11/2003 10:15:00 AM	<b>DATE AND TIME COMPLETED:</b> 11/13/2003 5:00:00 PM
<b>DRILLING METHOD:</b> Mud Rotary		<b>WATER LEVEL (ft):</b> ---	<b>DRILLING EQUIPMENT:</b> Speedstar 30K Rig with 94-mm Punch Core	
<b>LOCATION:</b> PG & E Topock Facility			<b>LOGGED BY:</b> D. Thomas / R. Edwards	

DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
					brn = brown lt = light dk = dark vf = very fine-grained f = fine-grained m = medium-grained c = coarse-grained vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	



CH2MHILL



**ALISTO ENGINEERING GROUP**  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-9

Page 1 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06

DATE DRILLED: 07/01/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

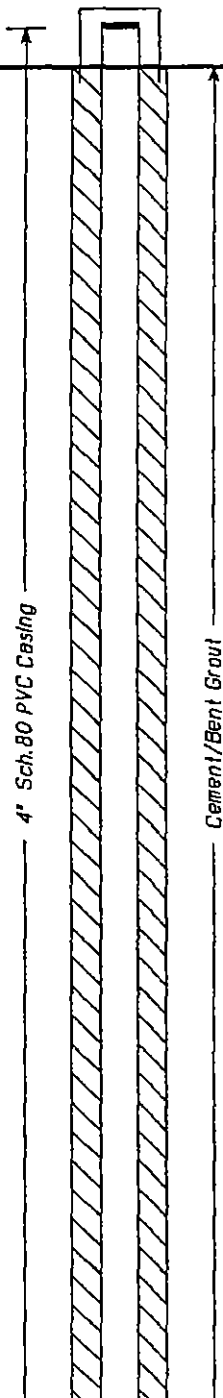
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 536.18

LOGGED BY: Dan Salaices

APPROVED BY: Dan Salaices

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

GP

sandy GRAVEL: Pale yellowish brown, to light gray; 85% gravel, 4-40 mm, subangular; 15% sand, mostly fine; dry.

SP

SAND: Moderate yellowish brown; fine grained, dry, fill ?

GM

silty GRAVEL: moderate brown to dark yellowish brown; 70% gravel, 4-30 mm, subangular.

GP

sandy GRAVEL: Pale yellowish brown, to light gray; 85% gravel, 4-40 mm, subangular; 15% sand, mostly fine; dry.

8.5' sandy GRAVEL: Light olive gray; 80% gravel, 4-30 mm, subangular; 40% sand, fine to coarse.

7.5' color change to yellowish gray; 80% gravel, 4-40 mm, subangular; 20% sand, mostly fine and coarse, dry.

GM

sandy silty GRAVEL: Pale yellowish brown; 70% gravel, 4-30 mm, subangular, occasional cobble fragment; 15% sand, fine and coarse grained; 15% fines; dry.

Same: color change to moderate brown, moist.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-9

Page 2 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 07/01/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 538.18

LOGGED BY: Dan Salaices

APPROVED BY: Dan Salaices

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch.80 PVC Casing

Cement/Bent Grout

Bentonite

GM

Same: 80% gravel; 20% sand, fine to coarse grained; 20% fines; dry.

GP  
SP

gravelly SAND/sandy GRAVEL: moderate yellowish brown; appears to be 50% gravel, 4-30mm; 50% sand, fine to coarse grained; moist.

GP  
GC

sandy clayey GRAVEL: moderate yellowish brown; 70% gravel, 4-30 mm, subangular; 20% sand, fine to coarse grained; 10% fines; damp.

GP

sandy GRAVEL: moderate yellowish brown; 70% gravel, 4-30 mm, subangular and somewhat fractured; 30% sand, fine to coarse grained; damp.

GM

sandy silty GRAVEL: Moderate yellowish brown; 70% gravel, 4-50 mm, subangular and somewhat fractured; 15% sand, fine to coarse; 15% fines; moist.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-9

Page 3 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06

DATE DRILLED: 07/01/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

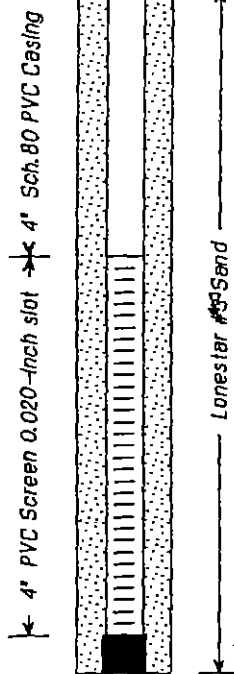
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 536.18

LOGGED BY: Dan Salaices

APPROVED BY: Dan Salaices

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

75

80

85

90

95

100

GM

GP

GM

GC

GM

sandy silty GRAVEL: moderate brown; 70% gravel, 4-30 mm, subangular; 20% sand, fine to coarse grained; 10% fines; very moist.

clayey GRAVEL: dark yellowish brown; 80% gravel, 4-30 mm, occasional cobble fragments; 20% sand, fine grained; 20% fines; wet.

RED FANGLOMERATE

sandy silty GRAVEL: (GM although rock at 88.5) moderate reddish brown, wet to 88.5, dry at 88.5.

refusal at 88 feet. Total depth of borehole is 88 feet.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-10

Page 1 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06

DATE DRILLED: 06/27/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

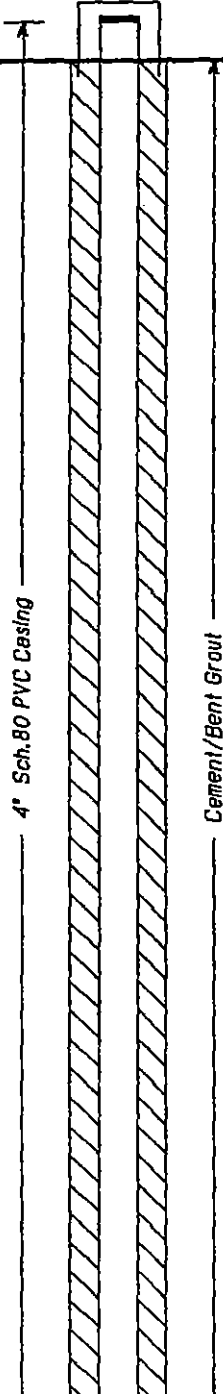
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 530.24

LOGGED BY: Dan Salasces

APPROVED BY: Dan Salasces

WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

GP

sandy GRAVEL: various shades of gray; 70-80% gravel, 4-30 mm, subangular; 20-30% sand, fine to coarse grained; dry.

5

GP

SP

sandy gravel/gravelly SAND: light olive gray; 50% gravel, 4-50 mm, cobble fragments at 7'; 50% sand, fine to coarse grained; dry.

10

GP

sandy GRAVEL: light gray to light olive gray; 80-90% gravel, 4-40 mm, subangular, cobble fragments at 11'; 10-20% sand, fine to coarse grained; dry.

15

GP

ALLUVIUM/OLDER ALLUVIUM CONTACT AT 12 FEET

sandy GRAVEL: dark yellowish brown; 80% gravel, 4-40 mm, subangular; 40% sand, fine to coarse grained; dry.

at 13.5 feet: color varies from light olive gray to dark yellowish brown.

at 15.5 feet: 75-85% gravel

20

SP

gravelly SAND: dark yellowish brown to light olive gray; 80% sand, fine to coarse grained; 40% gravel, 4-20 mm; moist.

25

GP

sandy GRAVEL: dark yellowish brown; 70% gravel, 4-40 mm, 30% sand, fine to coarse grained; moist.

30

GP

GC

sandy clayey GRAVEL: moderate brown; 70% gravel, 4-50 mm,



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-10

Page 2 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 06/27/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 530.24

LOGGED BY: Dan Salalces

APPROVED BY: Dan Salalces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

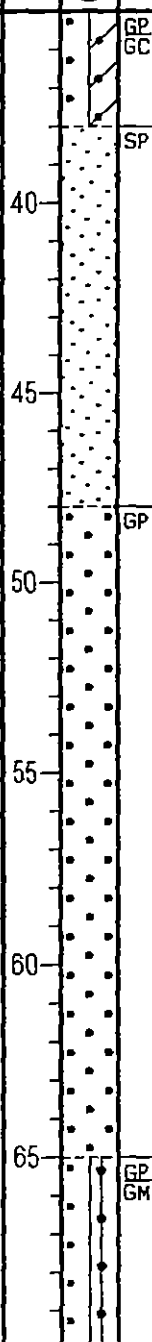
SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch.80 PVC Casing

Cement/Bent Grout

Bentonite



subangular, some fracturing; 20% sand, fine to medium grained; 10% fines; moist.  
cobble at 38.0 feet, 100 mm.

gravelly SAND: dark yellowish brown; 60% sand, fine to coarse grained; 40% gravel, 4-50 mm, some cobble fragments; moist.

sandy GRAVEL: dark yellowish brown; 80% gravel, 4-50 mm, subangular; 30% sand, fine to coarse grained; 10% cobble fragments; moist; some gravel appears to be cemented by calcite or gypsum.  
contained minor amounts of plastic fines.

sandy silty GRAVEL: dark yellowish brown; 60% gravel, 4-40 mm; 30% sand, fine to coarse grained; 10% fines; moist.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-10

Page 3 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06

DATE DRILLED: 08/27/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

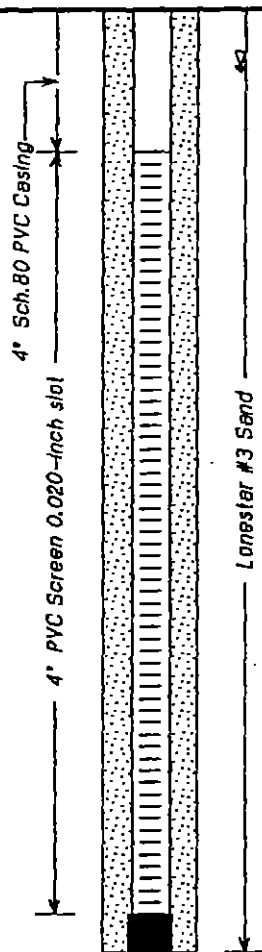
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 530.24

LOGGED BY: Dan Salalces

APPROVED BY: Dan Salalces

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

GP  
GM

GC

clayey GRAVEL: dark yellowish brown; 80% gravel, 4-30 mm; 20% sand, fine to coarse grained, 20% fines, plastic; moist.

GP

sandy GRAVEL: dark yellowish brown; 80% gravel, 4-30 mm, subangular; 30-40% sand, coarse grained; 0-10% fines, wet.

GP  
GC

sandy clayey GRAVEL: dark yellowish brown; 70% gravel, 4-30 mm; 20% sand, medium to coarse grained; 10% fines; wet.

No recovery from 85-88

GP

sandy GRAVEL: dark yellowish brown; 80% gravel, 4-40 mm, subrounded to subangular; 40% sand, medium to coarse grained; wet.

GP  
GC

sandy clayey GRAVEL: dark yellowish brown; 70% gravel, 4-30 mm; 20% sand, fine to coarse grained; 10% fines.

Total depth of boring 89 feet.





ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-11

Page 1 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06

DATE DRILLED: 06/29-30/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Tapack Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

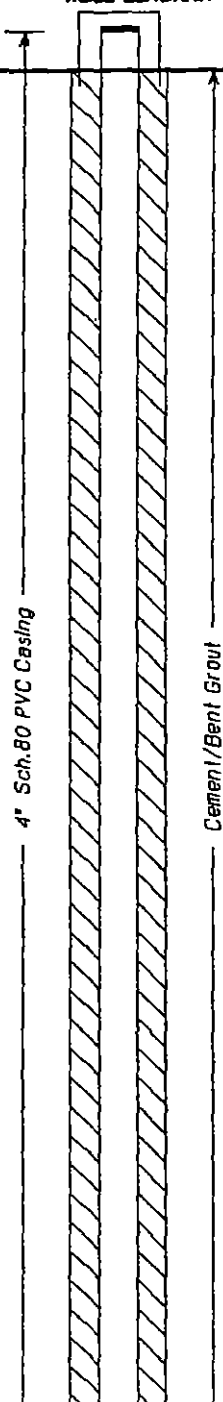
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 522.19

LOGGED BY: Dan Salasces

APPROVED BY: Dan Salasces

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

sandy GRAVEL: various shades of gray; 85% gravel, 4-30 mm, subangular; 15% sand, fine to coarse grained; a few cobble fragments; dry.

ALLUVIUM/OLDER ALLUVIUM CONTACT AT 10.5 FEET

sandy GRAVEL: moderate yellowish brown; 80% gravel, 4-50 mm, subangular, occasional cobble fragments; 40% sand, fine to coarse grained; dry.

No Recovery

sandy GRAVEL: moderate yellowish brown; 80% gravel, 4-50 mm, subangular, occasional cobble fragments; 40% sand, fine to coarse grained; dry.

Cobbles at 20 feet

gravelly SAND: moderate yellowish brown; 80% sand, fine and coarse grained; 40% gravel, 4-50 mm, subangular, cobble at 27 feet.

sandy GRAVEL: moderate yellowish brown; 80-70% gravel, 4-50 mm, subangular, occasional cobble; 30-40% sand, fine to coarse grained; damp.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-11

Page 2 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 08/29-30/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 522.19

LOGGED BY: Dan Salasces

APPROVED BY: Dan Salasces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

Bentonite

Lonestar #3 Sand

40

45

50

55

60

65

GP

at 38.5' dark yellowish brown; 80% gravel, 4-40 mm; 40% sand, mostly fine grained.

SP

gravelly SAND: dark yellowish brown; 80% sand, fine to coarse grained; 40% gravel, 4-30 mm, subangular, occasional cobble; moist.

GP

sandy GRAVEL: dark yellowish brown; 80% gravel, 4-40 mm, subangular, occasional cobbles; 40% sand, fine to coarse grained.

SP

gravelly SAND: dark yellowish brown; 80-70% sand, fine to coarse grained; 30-40% gravel, 4-20 mm, subrounded; appears wet at 63 feet.

SC

gravelly clayey SAND: dark yellowish brown; 80% sand, fine to coarse grained; 20% gravel, subrounded, 4-20mm; 20% fines, low plasticity; wet.

GC

See next page



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-11

Page 3 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06

DATE DRILLED: 06/29-30/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

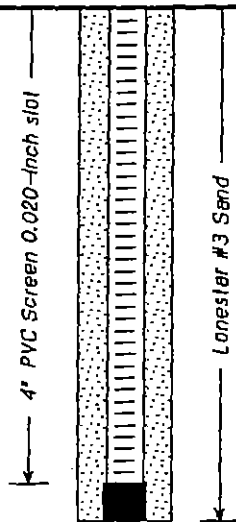
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 522.19

LOGGED BY: Dan Salaices

APPROVED BY: Dan Salaices

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

sandy clayey GRAVEL: dark yellowish brown; 80% gravel, 4-20 mm, subangular, occasional cobble; 20% sand, fine to coarse grained; 20% fines; wet.

No Recovery

gravelly SAND: dark yellowish brown; 80-70% sand, medium to coarse grained, subrounded; 30-40% gravel, 4-20 mm, subrounded to subangular; wet.

sandy clayey GRAVEL: dark yellowish brown; 80% gravel, 4-20 mm, subrounded to subangular; 20% sand, fine to coarse grained; 20% fines; wet.

gravelly SAND: dark yellowish brown; 80-70% sand, medium to coarse grained, subrounded; 30-40% gravel, 4-20 mm, subrounded to subangular, occasional cobble fragments; wet.

gravelly clayey SAND: dark yellowish brown; 80% sand, medium grained; 20-30% gravel, 4-20mm; 10-20% fines, wet.

At 83 feet, color change to moderate brown.

Total Depth of Boring is 88.5 feet



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-12

Page 1 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 07/08/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

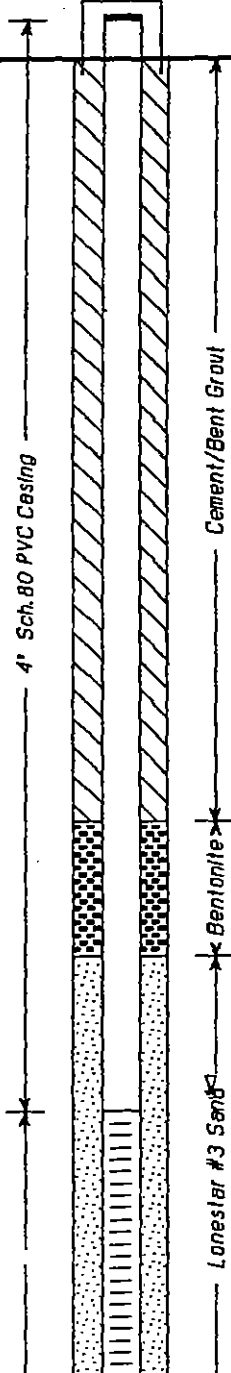


DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 483.58

LOGGED BY: Ted Moise/Dan Birch

APPROVED BY: Dan Salasces

WELL DIAGRAM		DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
 <p>4" Sch. 80 PVC Casing</p> <p>Cement/Bent Grout</p> <p>Bentonite</p> <p>Laneslar #3 Sand</p>		0	SW	gravelly SAND: pale yellowish brown; 50% sand, very fine to coarse grained, well graded; 35% gravel, 4-20 mm, subangular; 15% fines; dry.	
		5	SW		
		10	SM		silty SAND: pale yellowish brown; 80% sand, very fine to fine grained; 30% fines; 10% gravel, 4-20 mm, subangular; dry.  at 10 feet, angular gravel to 40 mm.
		15	SP		gravelly SAND: pale brown; 75% sand, fine to medium grained; 15% gravel, 4-15 mm, subrounded; 10% fines; dry.  at 15 feet, color change to moderate brown; 80% sand, fine to coarse grained; 40% gravel, 4-20 mm, subangular, occasional cobble; dry.
		20	SP		at 20 feet; 80% sand, fine to medium grained; 40% gravel, 4-25 mm, subangular; dry to very moist.
		25	SP		Wet at 28 feet.
		30	GP		sandy GRAVEL: pale brown; 55% gravel, 4-20 mm, subangular; 35% sand, fine to medium grained; 10% fines; wet.
		35	SP		gravelly SAND: pale brown; 80% sand, fine to medium grained; 40% gravel, 4-20 mm, subangular; wet.



**ALISTO ENGINEERING GROUP**  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-12

Page 2 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 07/08/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

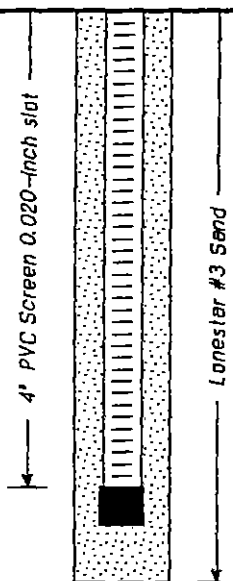
DRILLING COMPANY: Boart Longyear

CASING ELEVATION: 483.58

LOGGED BY: Ted Moise/Dan Birch

APPROVED BY: Dan Salasces

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

SP

SAME

GM

silty GRAVEL: pale brown; 50% gravel, 4-35 mm, angular to subangular, occasional cobble; 30% sand, fine to coarse grained; 20% fines; wet.

SP

gravelly SAND: pale brown; 80% sand, fine to medium grained; 40% gravel, 4-35 mm, subangular, occasional cobble; wet.

SM

RED FANGLOMERATE AT 47 feet.

silty SAND: grayish red; 80% sand, fine to medium grained; 20% fines; wet.

Total depth of boring 50 feet.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-21

Page 1 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 05/19/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

DRILLING METHOD: Rotasonic

DRILLING COMPANY: Boart Longyear

CASING ELEVATION:

LOGGED BY: Ted Malse

APPROVED BY: Dan Salasces

## WELL DIAGRAM

4" Sch. 80 PVC Casing

Cement/Bent Grout

Bentonite

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

sandy GRAVEL: pale yellowish-brown to grayish-orange-pink; ~55% gravel, subangular to subrounded, to 45 mm; ~40% sand, fine- to coarse-grained sand; ~5% fines; dry.

gravelly SAND: grayish-orange-pink; ~80% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 65 mm; dry.

Cobble, rounded, 120 mm at 8 feet.

Change at 14 feet of ~75% sand; ~20% gravel, angular to rounded; ~5% fines; cobble, to 120 mm.

sandy GRAVEL: light brownish-gray; ~75% gravel, subangular to subrounded, to 60 mm; ~20% sand, fine- to coarse-grained; ~5% fines.

gravelly SAND: grayish-orange-pink; ~80% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 65 mm; ~5% fines; dry.

sandy GRAVEL: light brownish-gray; ~75% gravel, subangular to subrounded, to 60 mm; ~20% sand, fine- to coarse-grained; ~5% fines.

Changes at 22 feet of color to pale red to grayish-orange pink; ~80% gravel, angular to subrounded, to 45 mm; ~40% sand.

gravelly SAND: light brownish-gray; ~85% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 55 mm.



**ALISTO ENGINEERING GROUP**  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-21

Page 2 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 05/19/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Rotasonic

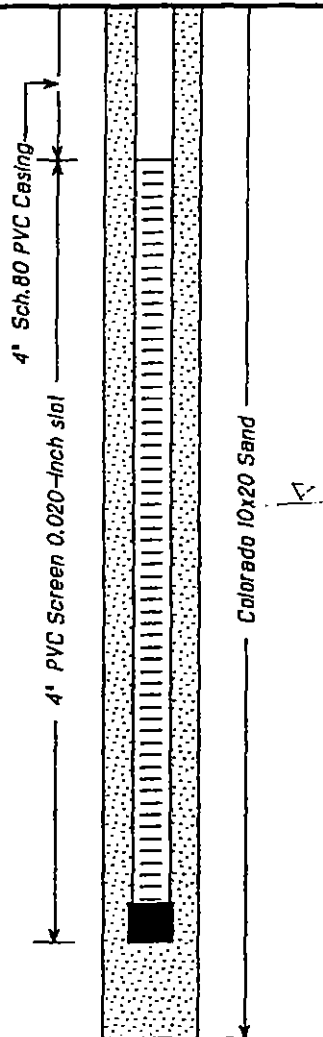
DRILLING COMPANY: Boart Longyear

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

## WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

SP gravelly SAND continued.

Changes at 40 feet of ~50% sand; ~45% gravel, to 40 mm; ~5% fines.

Color change at 42 feet to pale yellowish-brown.

GP sandy GRAVEL: light brown to grayish-orange-pink; ~80% gravel, angular to subrounded, to 50 mm; ~35% sand, fine- to coarse-grained; ~5% fines.

Changes at 45 feet of color to pale red; ~70-75% gravel, ~20-25% sand.

SP gravelly SAND: grayish-red to dusky-red; ~70% sand, fine- to coarse-grained; ~30% gravel, angular to rounded, to 40 mm; damp.

Wet at 48 feet.

GP GM gravelly SAND: light brownish-gray; ~85% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 55 mm.

sandy silty GRAVEL: pale-red to grayish-red; ~80% gravel, angular to subrounded, to 70 mm; ~30 sand, fine- to coarse-grained; ~10% fines.

Cobbles, rounded, to 100 mm at 58 feet.

SP gravelly SAND: dusky-red to grayish-red; ~55% sand, fine- to coarse-grained, ~45% gravel, subangular to rounded, to 70 mm.

Total depth of borehole is 82 feet.

65

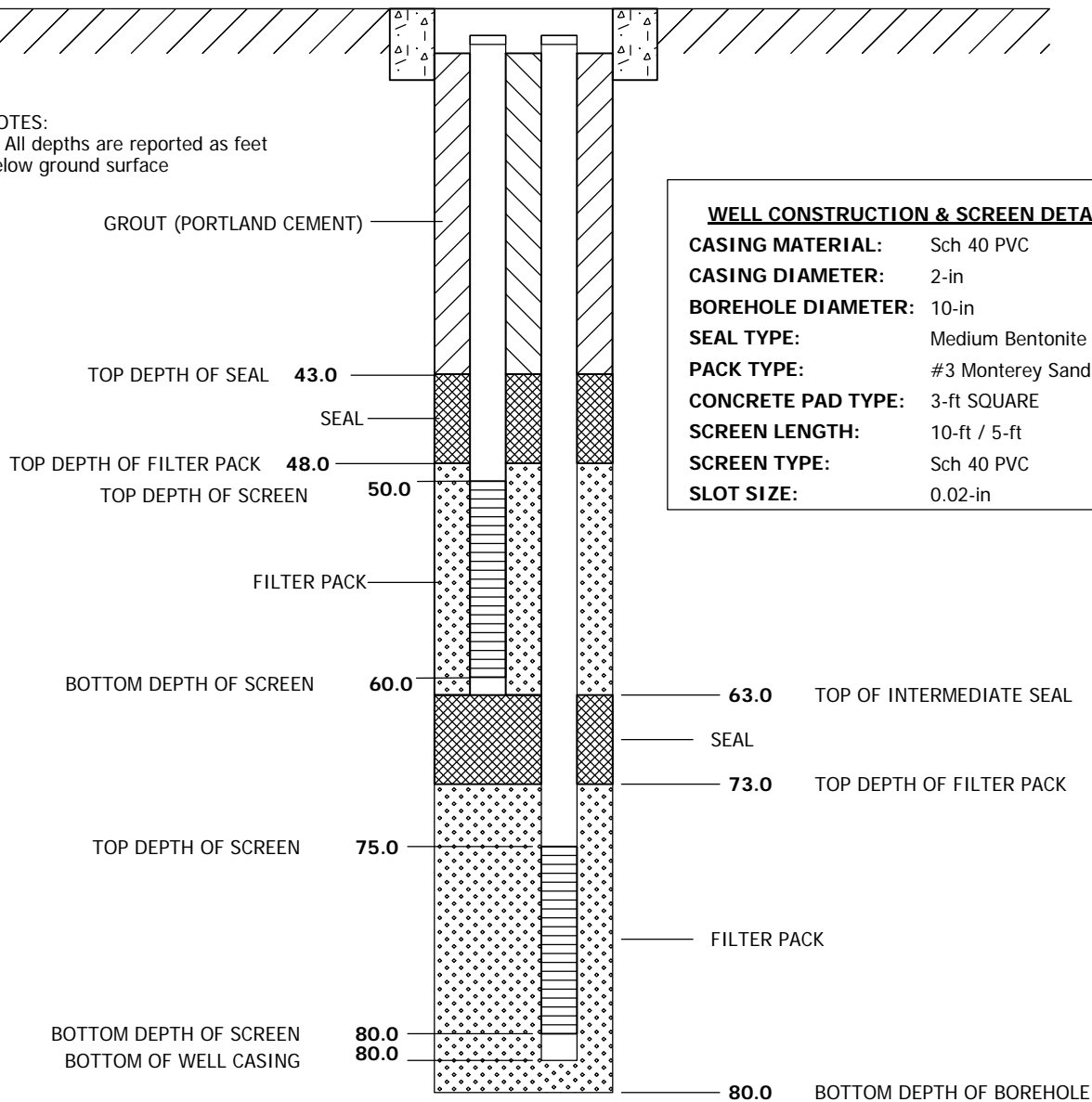
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i>MW-23-060</i> <i>MW-23-080</i>
<b>LOCATION:</b> Former MW-23		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 4/30/2009	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 5/2/2009	
<b>LOGGER:</b> B. Pelletier (Northstar)	<b>WELL COMPLETION DATE:</b> 5/2/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 504.6 ft AMSL	<b>GENERAL REMARKS:</b> Existing monitoring well MW-23 was over-drilled and reconstructed within the same borehole as two nested monitoring wells	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2101286.32 <b>EASTING (CCS NAD 83 Z 5):</b> 7616448.50		

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)

### NOTES:

1. All depths are reported as feet below ground surface



### WELL CONSTRUCTION & SCREEN DETAILS

<b>CASING MATERIAL:</b>	Sch 40 PVC
<b>CASING DIAMETER:</b>	2-in
<b>BOREHOLE DIAMETER:</b>	10-in
<b>SEAL TYPE:</b>	Medium Bentonite Chips
<b>PACK TYPE:</b>	#3 Monterey Sand
<b>CONCRETE PAD TYPE:</b>	3-ft SQUARE
<b>SCREEN LENGTH:</b>	10-ft / 5-ft
<b>SCREEN TYPE:</b>	Sch 40 PVC
<b>SLOT SIZE:</b>	0.02-in

WELL DIAGRAM IS NOT TO SCALE





ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-23

Page 1 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/06/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Dan Salasces

APPROVED BY: Dan Salasces

## WELL DIAGRAM

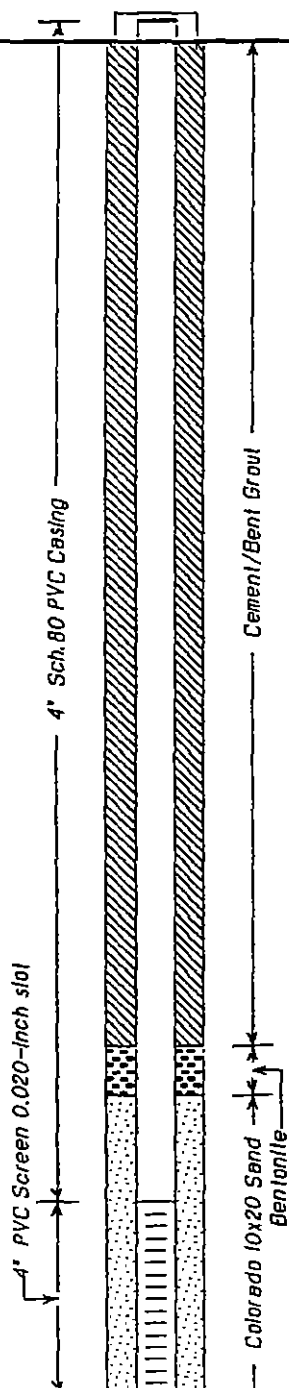
DEPTH  
feet

SAMPLES

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION



10

20

30

40

50

60

GP

sandy GRAVEL: light to medium gray; (fill).

RED FANGLOMERATE.


appears to be a cemented sandy GRAVEL: pale reddish-brown to moderate reddish-brown; hard; dry.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-23

Page 2 of 2

WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
 <p>4" PVC Screen 0.020-inch slot</p> <p>Colorado 10x20 Sand</p>	80				RED FANGLOMERATE continued.
	90				Total depth of borehole is 80 feet.
	100				
	110				
	120				
	130				
	140				
	150				



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24A

Page 1 of 3

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 05/12-13/96

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

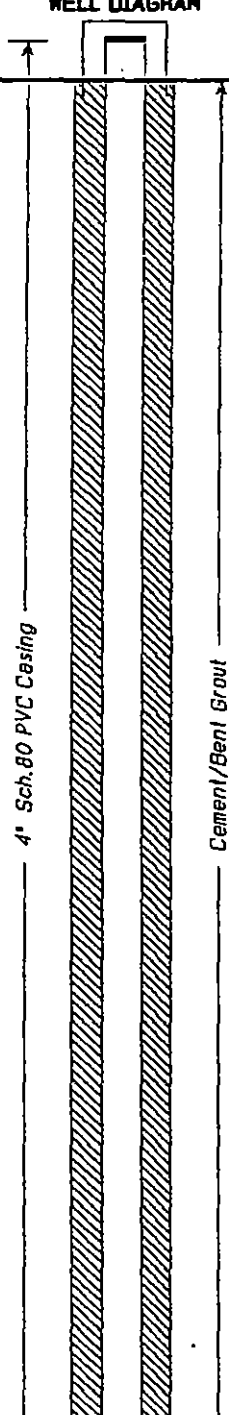
DRILLING METHOD: Rotasonic

DRILLING COMPANY: Boart Longyear

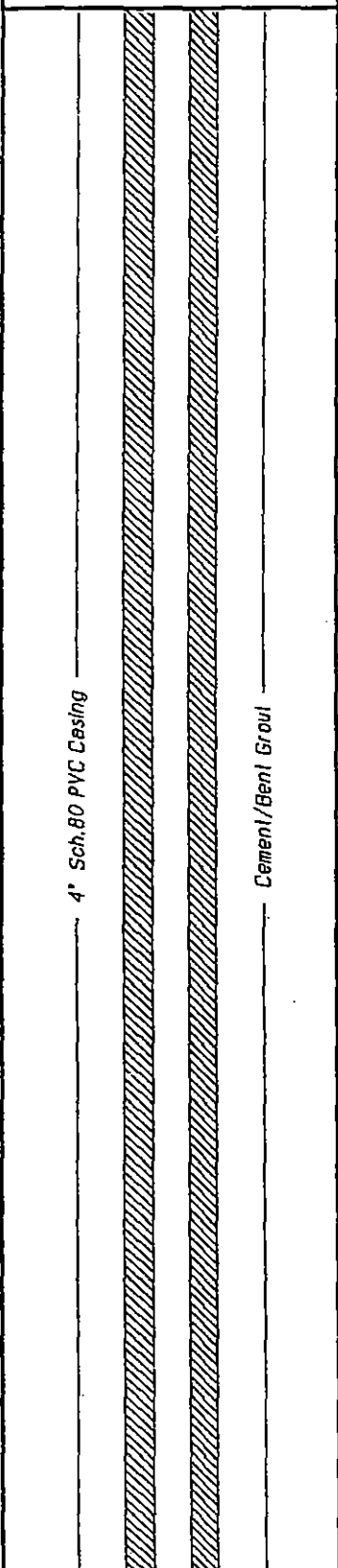









CASING ELEVATION:

LOGGED BY: Ted Moise

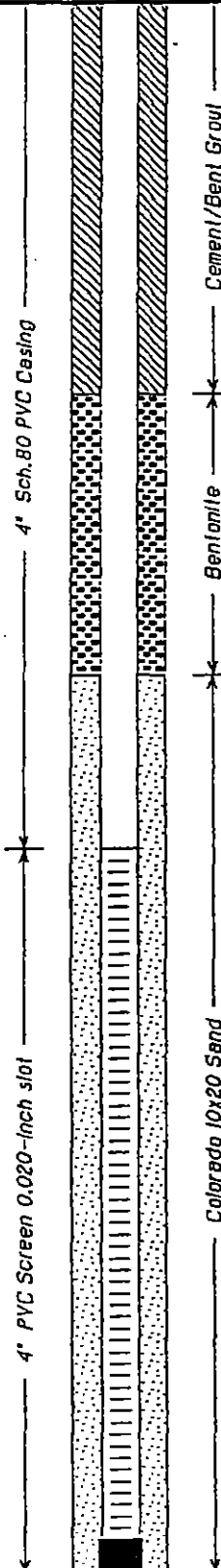
APPROVED BY: Dan Salsices

WELL DIAGRAM		DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
					NL	sandy SILT: light gray; ~15% sand, fine- to medium-grained; dry.
		5			GP	sandy GRAVEL: gray; ~80% gravel, subrounded to subangular, to 80 mm; ~35% sand, fine- to coarse-grained; ~5% fines; dry.
					ML	sandy SILT: light gray; ~15% sand, fine- to medium-grained; dry.
		10			GP	sandy GRAVEL: light gray to gray; ~50% gravel, subrounded to subangular, to 50 mm; ~45% sand, fine- to coarse-grained; minor fines; dry.
		15			SP	gravelly SAND: gray; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 80 mm; ~5% fines; dry.
		20				Changes at 20' of color to light gray to gray; ~55% sand; ~40% gravel, subrounded to angular, to 40 mm.
		25				
		30			GP GM	sandy silty GRAVEL: light gray to gray; ~80% gravel, subrounded to angular, to 80 mm; ~30% sand, fine- to coarse-grained; ~10% fines.
						Cobble, subrounded, to 80 mm, at 33.5 feet.
					SP	gravelly SAND: light gray to gray; ~50% sand, fine- to coarse-grained; ~45% gravel, subangular, to 45 mm; ~5% fines.



WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
 <p>4" Sch. 80 PVC Casing</p> <p>Cement/Bent Grout</p>				SP	gravelly SAND continued.
	40			GP GM	sandy silty GRAVEL: pale red to reddish-gray; ~25% gravel, subrounded to angular, to 75 mm; ~25% sand, fine- to coarse-grained; ~10% fines. Color change to gray, at 40 feet.  Changes at 48 feet of ~50% gravel; ~40% sand.
	45			SP	gravelly SAND: gray; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to angular, to 55 mm; ~5% fines.
	50			GP GM	silty GRAVEL: light gray; ~80% gravel, subangular to angular, to 70 mm; ~40% fines (rock flour).
	55			SP	gravelly SAND: gray; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to angular, to 55 mm; ~5% fines.
	60			GP	sandy GRAVEL: gray; ~80% gravel, subrounded to subangular; ~35% sand, fine- to medium-grained; ~5% fines.
	65			SP	gravelly SAND: gray to pinkish-gray; ~55% sand, fine- to medium-grained; ~40% gravel, rounded to subangular, to 80 mm; ~5% fines; one cobble, rounded, 120 mm.
	70			GP	
	75			SP	



WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
 <p>4" Sch. 80 PVC Casing</p> <p>4" PVC Screen 0.020-inch slot</p> <p>Cement/Bent Grout</p> <p>Bentonite</p> <p>Colorado 10x20 Sand</p>	85			SP	gravelly SAND: pinkish-gray to light brown; ~55% sand, fine- to medium-grained; ~40% gravel, subrounded to angular, to 80 mm; ~5% fines. One cobble, 150 mm, at 81 feet.  Changes at 85 feet of color to light brown; ~85% sand, fine- to medium-grained; ~30% gravel, to 70 mm.
	90	■		GP	sandy GRAVEL: reddish-brown; ~50% gravel, subrounded to subangular, to 40 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
	95			GM	silty GRAVEL: light gray; ~80% gravel, subangular to angular, to 70 mm; ~40% fines (rock flour).
	100			GP	sandy GRAVEL: reddish-brown; ~50% gravel, subrounded to subangular, to 40 mm; ~45% sand, fine- to coarse-grained; ~5% fines; damp.
	105			GP GM	sandy silty GRAVEL: reddish-brown; ~80% gravel, subrounded to angular, to 70 mm; ~30% sand, fine- to coarse-grained; ~10% fines; wet.
	110			SP SM	gravelly silty SAND: reddish-brown; ~80% sand, fine- to coarse-grained; ~30% gravel, subrounded to angular, to 70 mm; ~10% fines; wet.  Changes at 117 feet of ~75% sand; ~15% gravel, to 50 mm.
	115				
	120				Total depth of borehole is 124.5 feet.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24B

Page 1 of 8

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 05/13-16/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Rotasonic

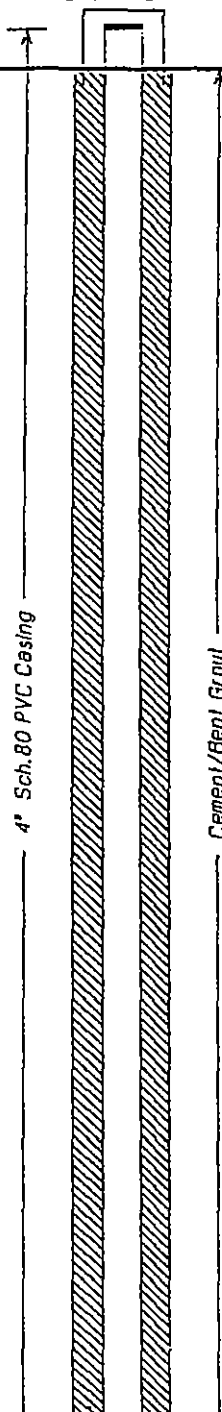
DRILLING COMPANY: Boart Longyear

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salices

## WELL DIAGRAM



DEPTH  
feet

SAMPLES

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

SP  
SM

Gravelly silty SAND: light gray; ~50% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 40 mm; ~10% fines.

GP

sandy GRAVEL: light gray; ~50% gravel, subrounded to subangular, to 70 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

GM

sandy silty GRAVEL: light gray; ~50% gravel; ~35% sand, fine- to coarse-grained; ~15% fines.

At 11.5 and 12.5 feet, cobble, to 95 mm.

GP

sandy GRAVEL: reddish-gray; ~50% gravel, subrounded to subangular, to 50 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

Changes at 19 feet of, ~85% gravel; ~35% sand.

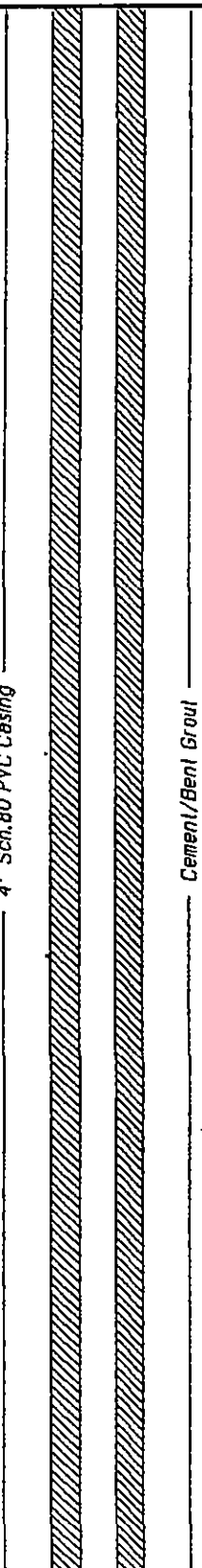
SP

gravelly SAND: pale red; ~55% sand, fine- to medium-grained; ~40% gravel, subrounded to subangular, to 40 mm; ~5% fines.

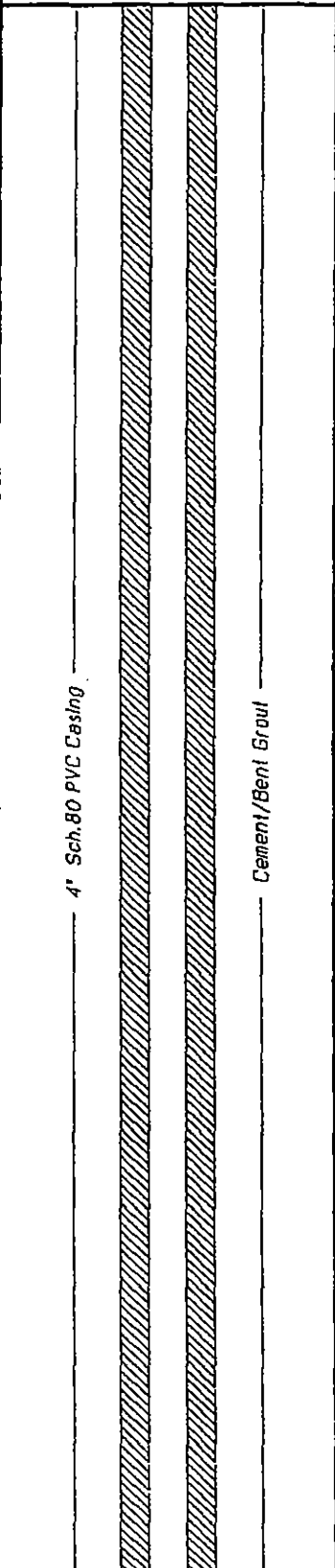



At 25 feet cobble, to 95 mm.

Changes at 28 feet of, ~85% sand, fine- to coarse-grained; ~30% gravel, to 50 mm.



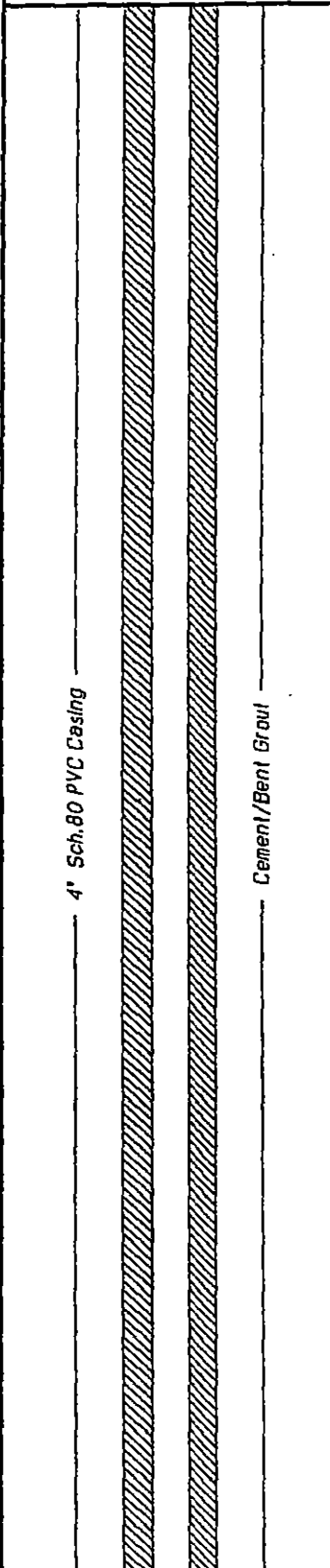
WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
				SP	gravelly SAND continued.
				GP	sandy GRAVEL: light gray to pale red; ~50% gravel, subrounded to subangular, to 80 mm; ~35% sand, fine- to coarse-grained; ~5% fines.
	40			SP	gravelly SAND: pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 50 mm; ~5% fines.
	45				
	50			GM GP	silty GRAVEL: light gray; ~80% gravel, to 70 mm; ~40% fines (rock flour). sandy GRAVEL: light gray to light olive-gray; ~50% gravel, subrounded to subangular, to 50 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
	55				
	60				Changes at 61 feet are, ~85% gravel; ~30% sand.
	65				
	70				
	75			SP	gravelly SAND: light gray; ~50% sand, fine- to medium-grained; ~45% gravel, subrounded to subangular, to 80 mm; ~5% fines. Changes at 78 feet of, color to light brownish-gray; ~80% sand; ~35% gravel.



WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
 <p>4" Sch. 80 PVC Casing</p> <p>Cement/Bent Gravel</p>				SP	gravelly SAND continued.
				GP	<p>sandy GRAVEL: light gray to light brownish-gray; ~50% gravel, subrounded to subangular, to 60 mm; ~45% sand, fine- to coarse-grained. ~5% fines.</p> <p>Changes at 88 feet of, ~75% gravel; ~20% sand; cobble, to 90 mm.</p> <p>Changes at 89 feet of, ~60% gravel; ~35% sand.</p> <p>Changes at 103 feet of, color to pale brown; ~50% gravel, to 50 mm; ~45% sand.</p> <p>Wet at 104 feet.</p>
				GP GM	sandy silty GRAVEL: dark yellowish-brown; ~50% gravel, subrounded to subangular, to 65 mm; ~40% sand, fine- to coarse-grained; ~10% fines;



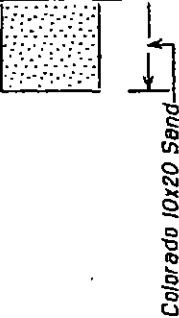



WELL DIAGRAM		DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	
 <p>4" Sch. 80 PVC Casing</p> <p>Cement/Bent Grout</p>		130			GP	sandy GRAVEL: pale brown; ~50% gravel, subrounded to subangular, to 85 mm; ~45% sand, fine- to coarse-grained; ~5% fines.	
		135					
		140				SP	gravelly SAND: pale yellowish-brown; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 85 mm; ~5% fines.
		145					
		150				GP	sandy GRAVEL: pale yellowish-brown to light gray; ~75% gravel, subrounded to angular, to 70 mm; ~20% sand, fine- to coarse-grained; ~5% fines.
	155						
	160					SP	gravelly SAND: pale brown to grayish-red; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 55 mm; ~5% fines.
	165					GP GM	sandy silty GRAVEL: grayish-red; ~55% gravel, subrounded to subangular, to 80 mm; ~40% sand, fine- to coarse-grained; ~10% fines; wet.



WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
<p>4" Sch. 80 PVC Casing</p> <p>4" PVC Screen 0.020-inch slot</p> <p>Cement/Bent Grout</p> <p>Bentonite</p> <p>Colorado 10x20 Sand</p>	175			GP	sandy silty GRAVEL continued.
	180			GP	sandy GRAVEL: grayish-red; ~50% gravel, subrounded to angular, to 85 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
	185			SP	gravelly SAND: pale brown to pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40 gravel, subrounded to angular, to 70 mm; ~5% fines.
	190				
	195				
	200			GP	sandy GRAVEL: pale red to pale reddish-brown; ~55% gravel, subrounded to angular, to 70 mm; ~45% sand, fine- to coarse-grained.
	205			SP	gravelly SAND: pale brown to pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to angular, to 70 mm; ~5% fines.
				GP	sandy GRAVEL: grayish red to pale red; ~80% gravel, subrounded to angular, to 70 mm; ~35% sand, fine- to coarse-grained; ~5% fines.
	210				Changes at 209.5 feet of, color to grayish-red to dark reddish-brown; ~70% gravel; ~25% sand.
					At 214.5 feet cobble, angular, to 100 mm.



WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
				GP	sandy GRAVEL continued.
	220				Total depth of borehole is 217.5 feet.
	225				
	230				
	235				
	240				
	245				
	250				
	255				



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

Page 1 of 13

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersoll Rand STRATEX/Air rotary

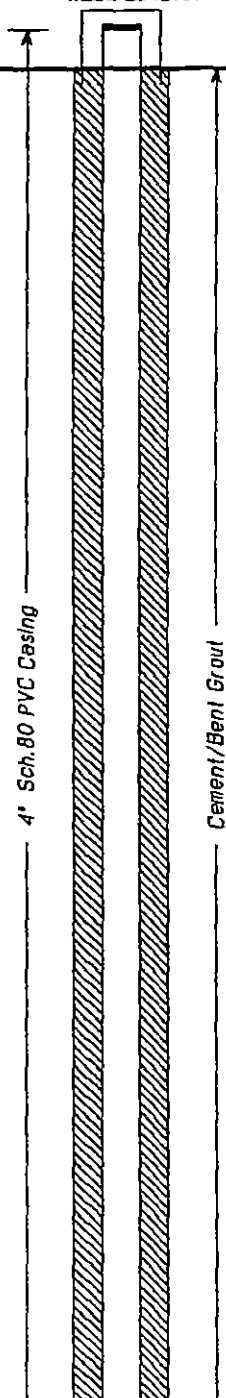
DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

WELL DIAGRAM



DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

SP  
SM

Gravelly silty SAND: light gray; ~50% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 40 mm; ~10% fines.

GP

sandy GRAVEL: light gray; ~50% gravel, subrounded to subangular, to 70 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

5

GM

sandy silty GRAVEL: light gray; ~50% gravel; ~35% sand, fine- to coarse-grained; ~15% fines.

10

At 11.5 and 12.5 feet, cobble, to 95 mm.

GP

sandy GRAVEL: reddish-gray; ~50% gravel, subrounded to subangular, to 50 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

15

Changes at 18 feet of, ~85% gravel; ~35% sand.

20

SP

gravelly SAND: pale red; ~55% sand, fine- to medium-grained; ~40% gravel, subrounded to subangular, to 40 mm; ~5% fines.

25

At 25 feet cobble, 95 mm.

Changes at 28 feet of, ~85% sand, fine- to coarse-grained; ~30% gravel, to 50 mm.

30



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

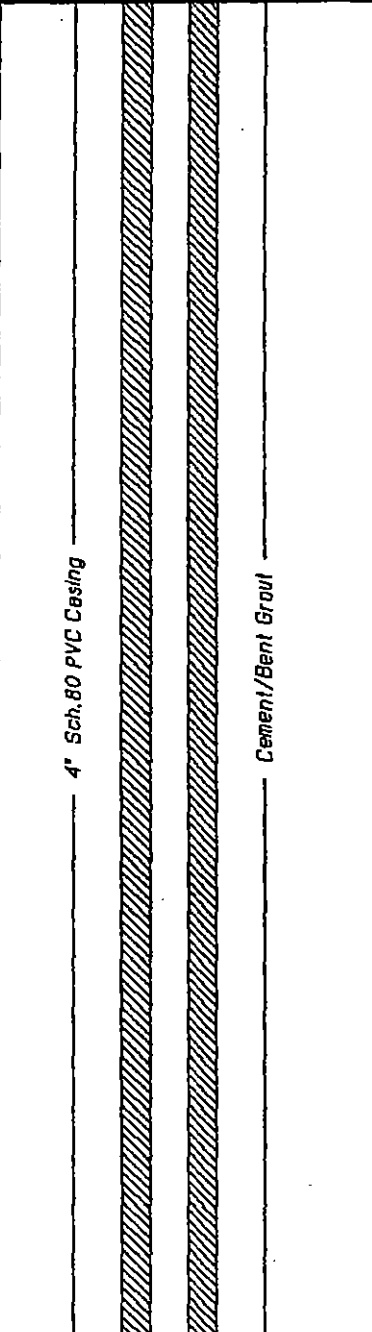
DRILLING METHOD: Ingersoll Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			SP	gravelly SAND continued.
			GP	sandy GRAVEL: light gray to pale red; ~50% gravel, subrounded to subangular, to 80 mm; ~35% sand, fine- to coarse-grained; ~5% fines.
	40		SP	gravelly SAND: pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 50 mm; ~5% fines.
	45		GM GP	silty GRAVEL: light gray; ~80% gravel, to 70 mm; ~40% fines (rock flour).
	50		GP	sandy GRAVEL: light gray to light olive-gray; ~50% gravel, subrounded to subangular, to 50 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
	55			
	60			
	65			Changes at 61 feet are, ~85% gravel; ~30% sand.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

Page 3 of 13

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

75  
80  
85  
90  
95  
100

GP

SP

gravelly SAND: light gray; ~50% sand, fine- to medium-grained; ~45% gravel, subrounded to subangular, to 80 mm; ~5% fines.

Changes at 78 feet of, color to light brownish-gray; ~80% sand; ~35% gravel.

gravelly SAND continued.

GP

sandy GRAVEL: light gray to light brownish-gray; ~50% gravel, subrounded to subangular, to 80 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

Changes at 88 feet of, ~75% gravel; ~20% sand; cobble, to 80 mm.

Changes at 89 feet of, ~80% gravel; ~35% sand.

Changes at 103 feet of, color to pale brown; ~50% gravel, to 50 mm; ~45% sand.  
Wet at 104 feet.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

DRILLING METHOD: Ingersoll Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

110

115

120

125

130

135

GP

GP  
GM

GP

SP

sandy silty GRAVEL: dark yellowish-brown; ~50% gravel, subrounded to subangular, to 85 mm; ~40% sand, fine- to coarse-grained; ~10% fines;

sandy GRAVEL: pale brown; ~50% gravel, subrounded to subangular, to 85 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

gravelly SAND: pale yellowish-brown; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 85 mm; ~5% fines.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

Page 5 of 13

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

45

150

155

160

165

170

SP

GP

SP

GP

GM

sandy GRAVEL: pale yellowish-brown to light gray; ~75% gravel, subrounded to angular, to 70 mm; ~20% sand, fine- to coarse-grained; ~5% fines.

gravelly SAND: pale brown to grayish-red; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 55 mm; ~5% fines.

sandy silty GRAVEL: grayish-red; ~55% gravel, subrounded to subangular, to 80 mm; ~40% sand, fine- to coarse-grained; ~10% fines; wet.

sandy silty GRAVEL continued.

GP





ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salas

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch.80 PVC Casing

Cement/Bent Grout

180

185

190

195

200

205

GP

sandy GRAVEL: grayish-red; ~50% gravel, subrounded to angular, to 85 mm; ~45% sand, fine- to coarse-grained; ~5% fines.

SP

gravelly SAND: pale brown to pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to angular, to 70 mm; ~5% fines.

GP

sandy GRAVEL: pale red to pale reddish-brown; ~55% gravel, subrounded to angular, to 70 mm; ~45% sand, fine- to coarse-grained.

SP

gravelly SAND: pale brown to pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to angular, to 70 mm; ~5% fines.

GP

sandy GRAVEL: grayish red to pale red; ~60% gravel, subrounded to angular, to 70 mm; ~35% sand, fine- to coarse-grained; ~5% fines.

Color change at 209.5 feet to grayish-red to dark reddish-brown; ~70% gravel, ~25% sand.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersoll Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salas

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

215

220

225

230

235

240

GP

At 214.5 feet cobble, angular, 100 mm  
sandy GRAVEL continued.

SP

gravelly SAND: grayish-red; ~85% sand, fine- to coarse-grained; ~35%  
gravel, subrounded to subangular.

RED FANGLOMERATE (rock): grayish-red; comprised of sands and  
gravels, very hard.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topack Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salalces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

250

255

260

265

270

275

RED FANGOLMERATE continued.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salices

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" Sch. 80 PVC Casing

Cement/Bent Grout

285

290

295

300

305

310

RED FANGOLMERATE continued.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

SANDSTONE: pale yellowish-brown.

RED FANGLOMERATE (rock): grayish-red.

4" Sch. 80 PVC Casing

Cement/Bent Grout

20  
25  
30  
35  
40  
45



**ALISTO ENGINEERING GROUP**  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

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SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salasces

## WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

RED FANGOLMERATE continued.

4" Sch.80 PVC Casing

Cement/Bent Grout

Bentonite

Colorado 10x20 Sand

355

360

365

370

375

380

SANDSTONE: pale yellowish-brown.



**ALISTO ENGINEERING GROUP**  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

Page 12 of 13

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salalces

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" PVC Screen 0.020-Inch slot

Colorado 10x20 Sand

390

395

400

405

410

415

SANDSTONE continued.

RED FANGLOMERATE (rock): grayish-red.



ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-24BR

Page 13 of 13

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08

DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling

CASING ELEVATION:

LOGGED BY: Ted Moise

APPROVED BY: Dan Salices

WELL DIAGRAM

DEPTH  
feet

GRAPHIC LOG

SOIL CLASS

GEOLOGIC DESCRIPTION

4" PVC Screen 0.020-inch slot

Colorado 10x20 Sand

25  
30  
35  
40  
45  
50

RED FANGOLMERATE continued.

Total depth of borehole is 441.5 feet.





ALISTO ENGINEERING GROUP  
WALNUT CREEK, CALIFORNIA

# LOG OF WELL MW-26

Page 1 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-09

DATE DRILLED: 4/24-25/99

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

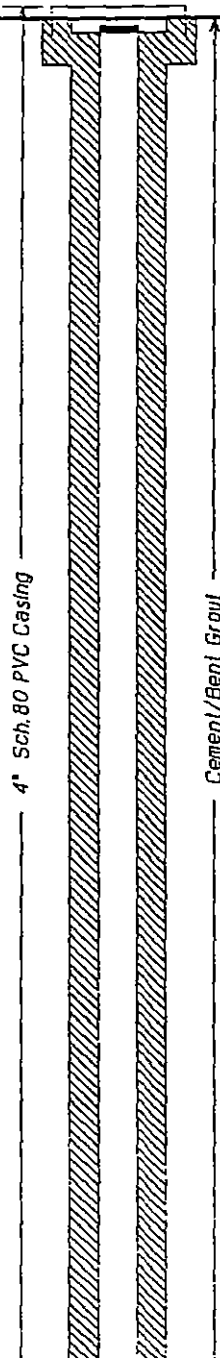
DRILLING COMPANY: Boart Longyear

CASING ELEVATION:

LOGGED BY: Chris Reinheimer

APPROVED BY: Dan Hidalgo

## WELL DIAGRAM



DEPTH  
feet

SAMPLES

GRAPHIC LOG

SOIL CLASS

## GEOLOGIC DESCRIPTION

SP  
gravelly SAND: medium reddish-brown; ~80% sand, medium- to coarse-grained; ~20% gravel, subrounded to angular; dry.

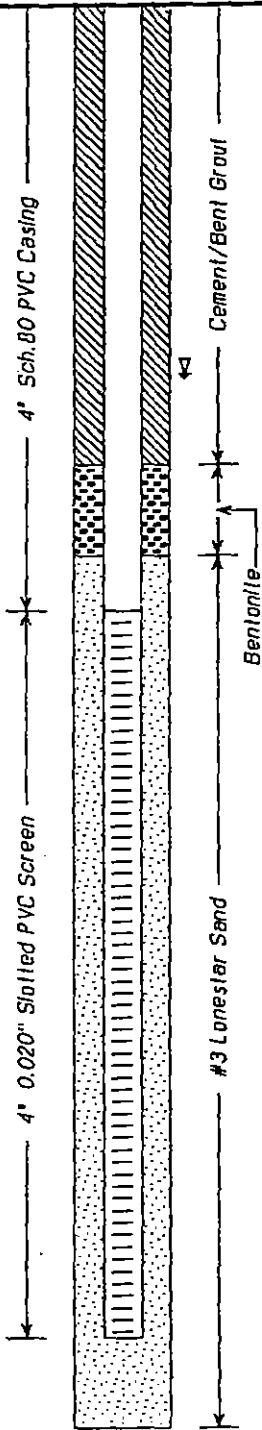


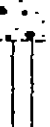
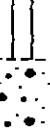
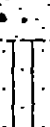




Approximately 20% cobbles to 2".

At 20 feet color change to medium grayish-green; 30% gravel; ~5% cobbles to 4".

SW

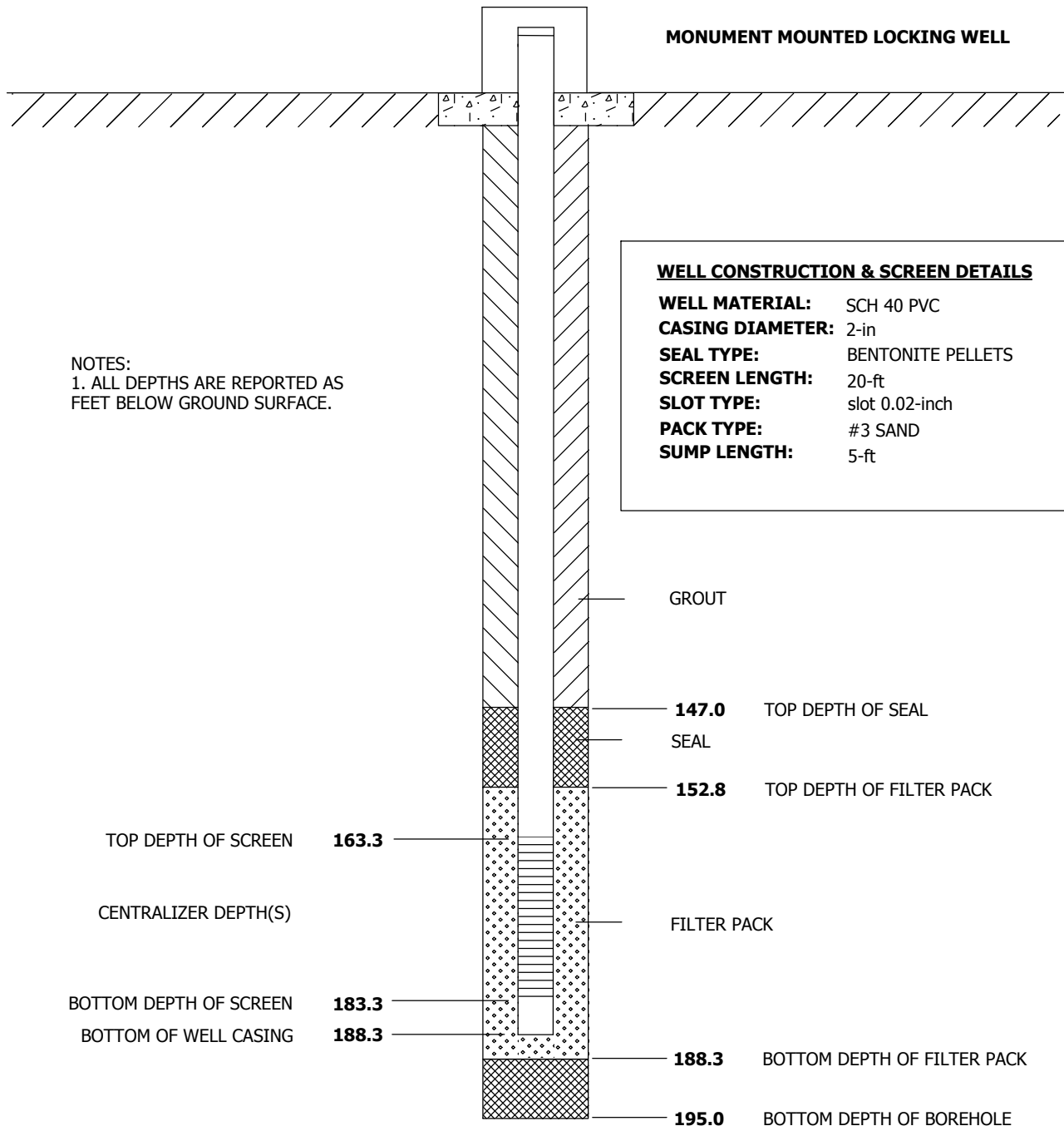
gravelly SAND: medium reddish-brown; sand, fine- to coarse-grained; ~30% gravel; ~10% cobbles to 2"; damp to dry.



WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
	40			SW	gravelly Sand continued.
	45			GW	sandy GRAVEL: ~75% gravel, subrounded to angular, fine to coarse; fine- to coarse-grained sand; damp to moist. At approximately 45 feet, wet.
	50			ML	sandy SILT: medium reddish-brown; ~80% fines fraction, slightly plastic; ~30% sand, fine- to coarse-grained; ~10% gravel to 2"; moist to wet.
	55			GW	sandy GRAVEL: medium reddish-brown; ~80% gravel, subrounded to angular; sand, fine- to coarse-grained; damp to moist.
	60			SM	gravelly silty SAND: medium reddish-brown; sand, medium- to coarse-grained; ~25% gravel, subrounded to angular to 2"; ~20% fines, slight plasticity; moist to wet.
	65			SP	gravelly SAND: sand, coarse-grained; ~10% gravel to 1.5"; ~5% fines; moist to wet.
	70			ML	sandy SILT: medium reddish-brown; sand, fine- to medium-grained; ~20% gravel to 3/4"; ~40% fines, slightly plastic; damp to moist.
	75			SP	gravelly SAND: sand, coarse-grained; ~10% gravel to 1.5"; ~5% fines; moist to wet. Changes at 88 feet to wet; ~10% gravel.
				ML	sandy SILT: medium reddish-brown; ~80% fines fraction, slightly plastic; ~30% sand, fine- to coarse-grained; ~10% gravel to 2"; damp to moist.
					Total depth of borehole is 74 feet.

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 315024.IM.02	<b>PROJECT:</b> PG&E Topock IM Investigation (Phase 5 2004)	<b>WELL NO:</b> MW-38D
<b>LOCATION:</b> South Bat Cave Wash Topock, CA. - Approximately 575' south of I-40. Access by PG&E station northeast gate, or by long road from Park Moabi exit South.		
<b>DRILLING CONTRACTOR:</b> WDC Exploration and Wells, Montclair, CA	<b>DRILLING START DATE:</b> 04/06/2004	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END DATE:</b> 04/11/2004	
<b>LOGGER:</b> R. Edwards / S. Cooper	<b>WELL COMPLETION DATE:</b> 04/10/2004	
<b>TOP OF WELL CASING (NGVD 29):</b> 525.31	<b>NORTHING COORDINATE (CCS DAND 27, ZONE 5):</b> 2101264.32	
<b>GROUND SURFACE ELEVATION (NGVD 29):</b> 523.00	<b>EASTING COORDINATE (CCS NAD 27 ZONE 5):</b> 7614918.79	



NOTES:  
1. ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE.

WELL DIAGRAM IS NOT TO SCALE

SHEET 1 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
SOIL BORING LOG							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:      DATE AND TIME COMPLETED:	
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
5				GW	WELL GRADED GRAVEL (GW) - 7.5YR5/3, 60% subang to ang f-m gravel, 40% well graded subang to ang sand, trace coarse gravel and cobbles, moist.	grain size	
10					Core unloggable due to interference of hydrated bentonite from casing.		
15				SC	CLAYEY SAND (SC) - 50% well graded subang sand, 40% fines, 10% ang gravel up to 1, qtz, slightly moist.		
20				ML	SANDY SILT WITH GRAVEL (ML) - 7.5YR6/1, 65% silt grading into silty gravel, 25% f sand, 10% gravel, ang, loose, dry.		
25							
30				SC	CLAYEY SAND (SC) - 7.5YR6/1, 60% well graded ang to subang sand, 30% fines, 10% subang gravel up to 0.25, dry.		
35						lost all but top 2' of core. Broke drill pipe when attempting to retrieve logging based on mixed material	

# SOIL BORING LOG

**PROJECT NAME:**

**HOLE DEPTH (ft):** 195.0

**DRILLING CONTRACTOR:**

**SURFACE ELEVATION:**  
523.0 ft. MSL

**NORTHING (CCS NAD 27 Z 5):**  
2.101.264.32

**EASTING (CCS NAD 27 Z 5):**  
7.614.918.79

DATE AND TIME STARTED:

DATE AND TIME COMPLETED:

**DRILLING METHOD:**


**WATER LEVEL (ft):**

<b>DRILLING EQUIPMENT:</b>
----------------------------


**LOCATION:****LOGGED BY:**[illegible]**CH2MHILL**

SHEET 3 of 6				PROJECT NUMBER:		BORING NUMBER: <b>MW-38</b>	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:	DATE AND TIME COMPLETED:
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
75				SC	CLAYEY SAND (SC) - lighter color 7.5YR7/1, 60% well graded ang sand, 20% f ang gravel, 20% fines, limestone, qtz, cohesive but not cemented, moist.  - cobbles	casing ~173' @12:30	
80				CL	LEAN CLAY WITH SAND (CL) - 10YR7/1, 80% fines, 20% well graded subang to ang sand, medium plasticity, dry.		
85				SC	CLAYEY SAND (SC) - 7.5YR5/2, 50% well graded ang sand, 30% ang f gravel, 20% clay, wet.  - less gravel	preserved core	
90				GC	CLAYEY GRAVEL (GC) - 50% f ang gravel, 30% well graded ang sand, 20% fines, high dry strength.		
95				SC	CLAYEY SAND (SC) - 50% well graded subang to ang sand, 30% fines, 10% subrnd to subang f gravel, qtz, gneiss, low to medium dry strength, low to medium plasticity, wet.	preserved core', chromium jar qtz, green mineral with bonding	
				CL	<div style="border: 1px solid black; padding: 2px;"> SANDY CLAY (CL) - multicolored 7.5YR5/3, 5YR5/1, some lt green areas and red staining, 60% clay, 30% subang sand, 10% gravel, qtz perphyroblasts, gneiss, subang black igneous, wet. </div>		
				SC			
100				GC	CLAYEY GRAVEL (GC) - 10YR4/2, 40% subang to ang f gravel, 30% well graded f-m sand, 30% fines, high dry strength, medium plasticity.		
105							

SHEET 4 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:	
DRILLING METHOD:		WATER LEVEL (ft): ---		DRILLING EQUIPMENT:			
LOCATION:				LOGGED BY:			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
110				GC	CLAYEY GRAVEL (GC) - 10YR4/2, 40% subang to ang f gravel, 30% well graded f-m sand, 30% fines, high dry strength, medium plasticity.  - grading into clay	chromium jar	
115				SW/SC	WELL GRADED SAND WITH CLAY (SW/SC) - 75% well graded subang to ang sand, 15% fines, 10% vf-f subang gravel, thin zone of decreased clay.	preserved core, chromium jar	
120				NR	No Recovery	preserved core	
125				GC	CLAYEY GRAVEL (GC) - 35% subang vf-f gravel, 35% fines, 30% well graded ang fines, m stiff, medium plasticity, wet, 7.5YR4/3.	chromium jar	
130				SC	CLAYEY SAND (SC) - slightly moist, not as cohesive, crumbly.	chromium jar	
135				CL	LEAN CLAY WITH SAND (CL) - 80% silty clay, 20% f-m sand, soft, wet, 7.5YR5/3.	chromium jar	
140				GC	CLAYEY GRAVEL (GC) - increasing sand, increasing gravel, m stiff, wet, white, orange and bright green deposits of heavily weathered minerals, 10YR4/2.	chromium jar	



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SHEET 5 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:	
DRILLING METHOD:		WATER LEVEL (ft): ---		DRILLING EQUIPMENT:			
LOCATION:				LOGGED BY:			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
145				GC	<b>CLAYEY GRAVEL (GC)</b> - 10YR4/2, white orange and bright green deposits of heavily weathered minerals, increasing sand, increasing gravel, m stiff, wet. <b>CLAYEY SAND (SC)</b> - grading into clayey sand	preserved core, chromium jar	
				SC			
150				GC	<b>CLAYEY GRAVEL (GC)</b> - ang f gravel, clay, uniform core, 10YR4/2.	grain size, chromium jar	
155				GC		preserved core, chromium jar	
160				GP	<b>POORLY GRADED GRAVEL (GP)</b> - 75% ang vf-f gravel, 15% well graded ang sand, 10% fines, loose, very wet.	chromium jar	
165				GW/GC	<b>WELL GRADED GRAVEL WITH CLAY (GW/GC)</b> - 60% well graded ang f-c gravel up to 2, 30% well graded ang sand, 10% clay.	grain size	
170				GC	<b>CLAYEY GRAVEL (GC)</b> - 7.5YR3/2, 25% clay, subrnd to ang gravel.  - layer of heavily weathered rock with clay		
175				SC/GC	<b>CLAYEY SAND WITH GRAVEL (SC/GC)</b> - some reddish areas but mostly medium brn, very firm, slightly moist.		


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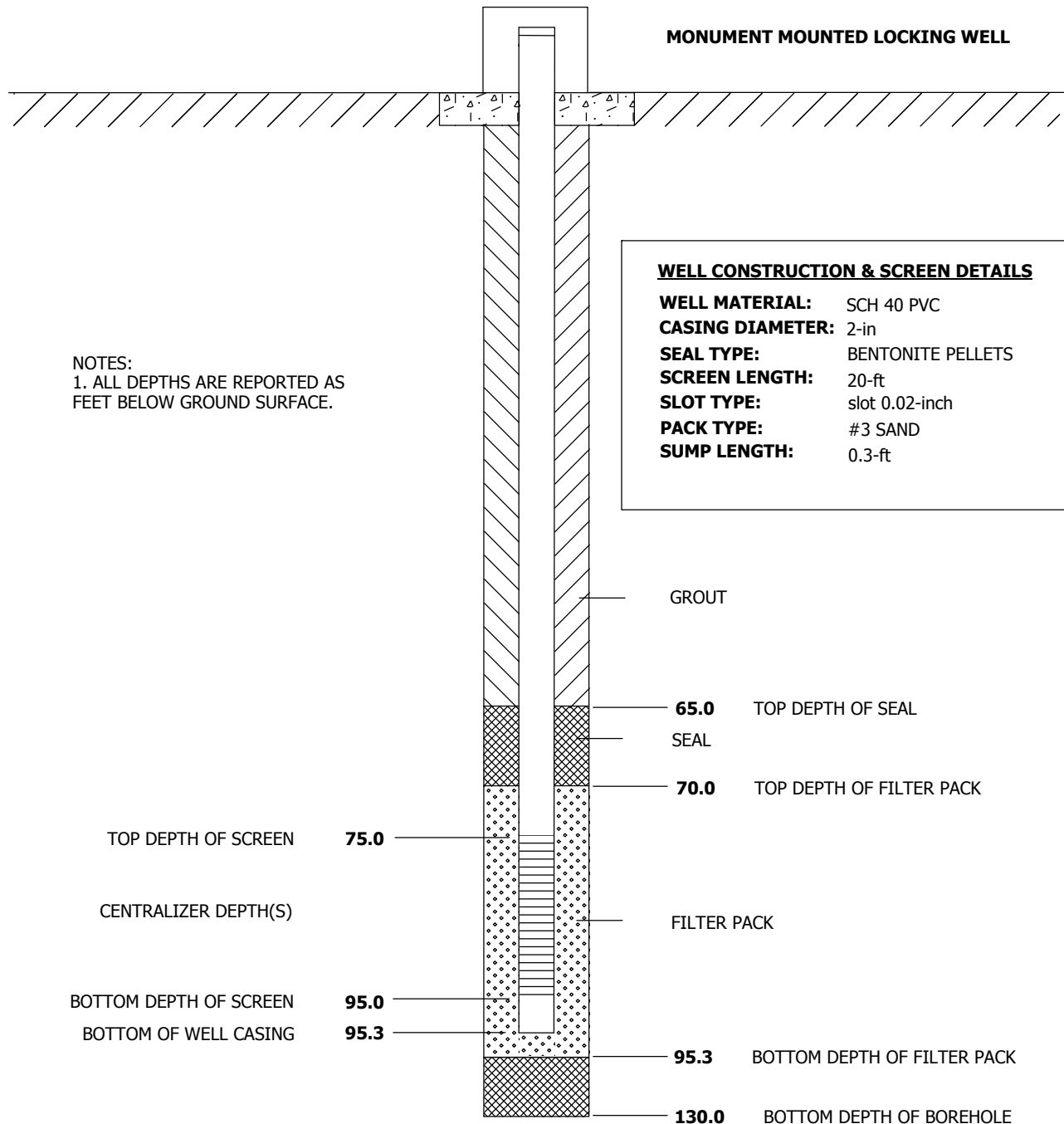


SHEET 6 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:      DATE AND TIME COMPLETED:	
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
180				SC/GC	CLAYEY SAND WITH GRAVEL (SC/GC) - some reddish areas but mostly medium brn, very firm, slightly moist.		
185				SC	CLAYEY SAND (SC) - 50% well graded sand, 30% fines, 20% f gravel, soft, wet, soft.		
190					- 65% well graded subang sand, 25% fines, 10% subang vf gravel, soft, very wet		
195					- loosely consolidated bedrock, f sand, multicolored, moist - very stiff and moist	refusal, broken bit	
					Boring Terminated at 195 ft	refusal, no core	
					<b>ABBREVIATIONS</b> cc = continuous core run brn = brown lt = light dk = dark vf = very fine-grained f = fine-grained m = medium-grained c = coarse-grained vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz		


**CH2MHILL**

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 315024.IM.02	<b>PROJECT:</b> PG&E Topock IM Investigation (Phase 5 2004)	<b>WELL NO:</b> MW-38S
<b>LOCATION:</b> South Bat Cave Wash Topock, CA. - Approximately 575' south of I-40. Access by PG&E station northeast gate, or by long road from Park Moabi exit South.		
<b>DRILLING CONTRACTOR:</b> WDC Exploration and Wells, Montclair, CA	<b>DRILLING START DATE:</b> 04/11/2004	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END DATE:</b> 04/11/2004	
<b>LOGGER:</b> S. Cooper	<b>WELL COMPLETION DATE:</b> 04/12/2004	
<b>TOP OF WELL CASING (NGVD 29):</b> 525.51	<b>NORTHING COORDINATE (CCS DAND 27, ZONE 5):</b> 2101279.65	
<b>GROUND SURFACE ELEVATION (NGVD 29):</b> 522.80	<b>EASTING COORDINATE (CCS NAD 27 ZONE 5):</b> 7614918.75	



WELL DIAGRAM IS NOT TO SCALE

SHEET 1 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:      DATE AND TIME COMPLETED:	
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
5				GW	<b>WELL GRADED GRAVEL (GW)</b> - 7.5YR5/3, 60% subang to ang f-m gravel, 40% well graded subang to ang sand, trace coarse gravel and cobbles, moist.	<p>grain size</p> <p>lost all but top 2' of core. Broke drill pipe when attempting to retrieve logging based on mixed material</p>	
10					Core unloggable due to interference of hydrated bentonite from casing.		
15				SC	<b>CLAYEY SAND (SC)</b> - 50% well graded subang sand, 40% fines, 10% ang gravel up to 1, qtz, slightly moist.		
20				ML	<b>SANDY SILT WITH GRAVEL (ML)</b> - 7.5YR6/1, 65% silt grading into silty gravel, 25% f sand, 10% gravel, ang, loose, dry.		
25							
30				SC	<b>CLAYEY SAND (SC)</b> - 7.5YR6/1, 60% well graded ang to subang sand, 30% fines, 10% subang gravel up to 0.25, dry.		
35							

# SOIL BORING LOG

**PROJECT NAME:**

**HOLE DEPTH (ft):**  
195.0

**DRILLING CONTRACTOR:**

**SURFACE ELEVATION:**  
523.0 ft. MSL

<b>NORTHING (CCS NAD 27 Z 5):</b>	2,101,264.32
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**EASTING (CCS NAD 27 Z 5):**  
7.614.918.79

DATE AND TIME STARTED:

DATE AND TIME COMPLETED:

**DRILLING METHOD:**


**WATER LEVEL (ft):**

<b>DRILLING EQUIPMENT:</b>
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**LOCATION:****LOGGED BY:**[illegible]**CH2MHILL**

SHEET 3 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:	DATE AND TIME COMPLETED:
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
75				SC	CLAYEY SAND (SC) - lighter color 7.5YR7/1, 60% well graded ang sand, 20% f ang gravel, 20% fines, limestone, qtz, cohesive but not cemented, moist.  - cobbles	casing ~173' @12:30	
80				CL	LEAN CLAY WITH SAND (CL) - 10YR7/1, 80% fines, 20% well graded subang to ang sand, medium plasticity, dry.		
85				SC	CLAYEY SAND (SC) - 7.5YR5/2, 50% well graded ang sand, 30% ang f gravel, 20% clay, wet.  - less gravel	preserved core	
90				GC	CLAYEY GRAVEL (GC) - 50% f ang gravel, 30% well graded ang sand, 20% fines, high dry strength.		
95				SC	CLAYEY SAND (SC) - 50% well graded subang to ang sand, 30% fines, 10% subrnd to subang f gravel, qtz, gneiss, low to medium dry strength, low to medium plasticity, wet.	preserved core', chromium jar qtz, green mineral with bonding	
				CL	<div style="border: 1px solid black; padding: 2px;">           SANDY CLAY (CL) - multicolored 7.5YR5/3, 5YR5/1, some lt green areas and red staining, 60% clay, 30% subang sand, 10% gravel, qtz perphyroblasts, gneiss, subang black igneous, wet.            CLAYEY SAND (SC) - 7.5YR5/3, decreasing clay.         </div>		
				SC			
100				GC	CLAYEY GRAVEL (GC) - 10YR4/2, 40% subang to ang f gravel, 30% well graded f-m sand, 30% fines, high dry strength, medium plasticity.		
105							


SHEET 4 of 6				PROJECT NUMBER:		BORING NUMBER: <b>MW-38</b>	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:      DATE AND TIME COMPLETED:	
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS  DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)				
110				GC	CLAYEY GRAVEL (GC) - 10YR4/2, 40% subang to ang f gravel, 30% well graded f-m sand, 30% fines, high dry strength, medium plasticity.  - grading into clay	chromium jar	
115				SW/SC	WELL GRADED SAND WITH CLAY (SW/SC) - 75% well graded subang to ang sand, 15% fines, 10% vf-f subang gravel, thin zone of decreased clay.	preserved core, chromium jar	
120				NR	No Recovery	preserved core  chromium jar	
125				GC	CLAYEY GRAVEL (GC) - 35% subang vf-f gravel, 35% fines, 30% well graded ang fines, m stiff, medium plasticity, wet, 7.5YR4/3.	chromium jar	
130				SC	CLAYEY SAND (SC) - slightly moist, not as cohesive, crumbly.	chromium jar	
135				CL	LEAN CLAY WITH SAND (CL) - 80% silty clay, 20% f-m sand, soft, wet, 7.5YR5/3.	chromium jar	
140				GC	CLAYEY GRAVEL (GC) - increasing sand, increasing gravel, m stiff, wet, white, orange and bright green deposits of heavily weathered minerals, 10YR4/2.	chromium jar	


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SHEET 5 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:      DATE AND TIME COMPLETED:	
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
145				GC	<b>CLAYEY GRAVEL (GC)</b> - 10YR4/2, white orange and bright green deposits of heavily weathered minerals, increasing sand, increasing gravel, m stiff, wet. <b>CLAYEY SAND (SC)</b> - grading into clayey sand	preserved core, chromium jar	
				SC			
150				GC	<b>CLAYEY GRAVEL (GC)</b> - ang f gravel, clay, uniform core, 10YR4/2.	grain size, chromium jar	
155				GC		preserved core, chromium jar	
160				GP	<b>POORLY GRADED GRAVEL (GP)</b> - 75% ang vf-f gravel, 15% well graded ang sand, 10% fines, loose, very wet.	chromium jar	
165				GW/GC	<b>WELL GRADED GRAVEL WITH CLAY (GW/GC)</b> - 60% well graded ang f-c gravel up to 2, 30% well graded ang sand, 10% clay.	grain size	
170				GC	<b>CLAYEY GRAVEL (GC)</b> - 7.5YR3/2, 25% clay, subrnd to ang gravel.  - layer of heavily weathered rock with clay		
175				SC/GC	<b>CLAYEY SAND WITH GRAVEL (SC/GC)</b> - some reddish areas but mostly medium brn, very firm, slightly moist.		


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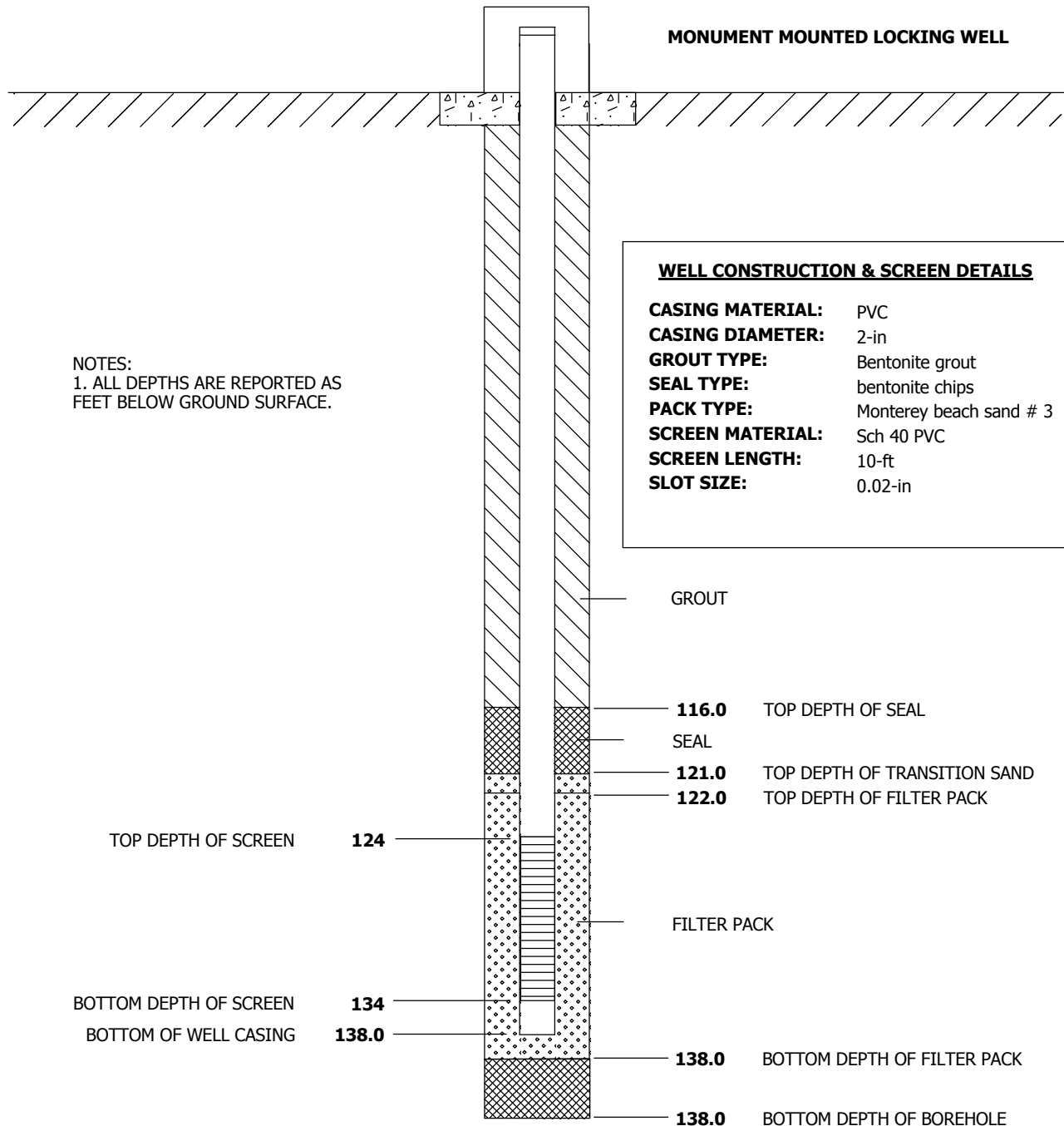
SHEET 6 of 6				PROJECT NUMBER:		BORING NUMBER: MW-38	
<b>SOIL BORING LOG</b>							
PROJECT NAME:				HOLE DEPTH (ft): 195.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 523.0 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,264.32		EASTING (CCS NAD 27 Z 5): 7,614,918.79		DATE AND TIME STARTED:	DATE AND TIME COMPLETED:
DRILLING METHOD:				WATER LEVEL (ft): ---		DRILLING EQUIPMENT:	
LOCATION:						LOGGED BY:	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
180				SC/GC	CLAYEY SAND WITH GRAVEL (SC/GC) - some reddish areas but mostly medium brn, very firm, slightly moist.		
185				SC	CLAYEY SAND (SC) - 50% well graded sand, 30% fines, 20% f gravel, soft, wet, soft.		
190					- 65% well graded subang sand, 25% fines, 10% subang vf gravel, soft, very wet		
195					- loosely consolidated bedrock, f sand, multicolored, moist - very stiff and moist	refusal, broken bit	
					Boring Terminated at 195 ft	refusal, no core	
					<b>ABBREVIATIONS</b> cc = continuous core run brn = brown lt = light dk = dark vf = very fine-grained f = fine-grained m = medium-grained c = coarse-grained vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz		


**CH2MHILL**




# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 326128.01.16.EN	<b>PROJECT:</b> IMPM Drill Program	<b>WELL NO:</b> <i><b>MW-48</b></i>
<b>LOCATION:</b> PG&E Compressor Station - Flood Plain, Topock, California		
<b>DRILLING CONTRACTOR:</b> Prosonic (Denzel Roberts = Driller)	<b>DRILLING START DATE:</b> 5/3/2006	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END DATE:</b> 5/4/2006	
<b>LOGGER:</b> J. Blei	<b>WELL COMPLETION DATE:</b> 5/4/2006	
<b>TOP OF WELL CASING (NGVD 29):</b> 486.22	<b>NORTHING COORDINATE (CCS DAND 27, ZONE 5):</b> 2101435.28	
<b>GROUND SURFACE ELEVATION (NGVD 29):</b> 484.41	<b>EASTING COORDINATE (CCS NAD 27 ZONE 5):</b> 7615915.90	




WELL DIAGRAM IS NOT TO SCALE


SHEET 1 of 5				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-48	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 138.0		DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.4 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,435.28		EASTING (CCS NAD 27 Z 5): 7,615,915.90		DATE STARTED: 5/3/2006	
						DATE COMPLETED: 5/4/2006	
DRILLING METHOD: Rotosonic				DRILLING EQUIPMENT:			
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California				LOGGED BY: K. Ebel			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
5			0	SM	<b>SILTY SAND (SM)</b> - yellowish brn (10YR5/4), 65% vf to f sand, 25% silt, 10% met gravel, poorly graded, subang to ang up to 4cm, very loose, dry  - some c sand, gravel increases to 15%  - 40% gravel  - some <3cm silt nodules, well graded, increased silt, 50% sand, 35% fines, 15% gravel  - brn (10YR4/3), 65%sand, 10% fines, 25% gravel, increased gravel and c sand, mostly subang, loose, dry	Hand auger to ~6'	
10			10		Drilling Hard		
15					Drilling Hard		
20			10	SM	- becomes moist, dk yellow brn (10YR3/4), 75% sand, 15% fines, 10% silt  - (10YR4/4)  - increasing gravel up to 6cm, subrnd, met, 50% sand, 10% fines, 40% gravel		
25							
30			10		<b>SILTY SAND W/ GRAVEL (SM)</b> - dr yellowish brn (10YR4/4), 40% vf to c sand, 30% silt, 30% gravel, subang up to 4cm, dk met sand and gravel, hard, moist  <b>SANDY SILT W/ GRAVEL (ML)</b> - dk yellow brn (10YR4/3), 35% vf to c sand, 50% met fines (50% clay & 50% silt), 15% gravel ,subang up to 2cm, m density, moist  <b>SILTY SAND W/ GRAVEL (SM)</b> - dr yellowish brn (10YR4/4), 40% vf to c sand, 30% silt, 30% gravel, subang up to 4cm, dk met sand and gravel, hard, moist		
35					- large 10cm cobble, mm, lightly weathered		



SHEET 2 of 5				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-48	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 138.0		DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.4 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,435.28		EASTING (CCS NAD 27 Z 5): 7,615,915.90		DATE STARTED: 5/3/2006	
						DATE COMPLETED: 5/4/2006	
DRILLING METHOD: Rotosonic				DRILLING EQUIPMENT:			
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California				LOGGED BY: K. Ebel			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
40			5	SM	<b>WELL GRADED SAND (SM)</b> - 75% mostly m to c sand, 10% fines, 15% gravel, subang up to 3cm, dark met, loose, moist  - more fines, 60% sand, 25% fines, 15% gravel	Drilling Hard     Drilling Hard - top of old alluvium ?	
45			6	SM	<b>SAND w/ SILT and GRAVEL (SM)</b> - reddish brn (5YR4/3), 45% m to c sand, 20% fines, 35% gravel, subang up to 4cm, mm, m density, wet  - gravel fines, 75% sand, 15% fines, 10% gravel  - clay nodules		
50			8	GM	<b>GRAVEL w/ SILT and SAND</b> dk reddish brn (5YR3/4), 25% well graded f to c sand, 30% fines, 45% subang gravel up to 9cm, fine silt, loose, dry  <b>SILT w/ SAND and GRAVEL (ML)</b> - dr reddish brn (5YR3/3), 30% f to c poorly graded sand, 45% fines, 25% weathered gravel, subrnd to subang up to 3cm, loose, moist - 25% sand, 65% fines, 10% gravel, very wet - sandy lenses, 60% sand, 30% fines, 10% gravel - 30% gravel, 30% sand, 40% fines - large mm cobble, all highly weathered		
55					<b>SANDY SILTY GRAVEL (GM)</b> - dr reddish brn (5YR3/4), 30% f to c well graded subrnd to subang sand, 20% fines, 50% weathered gravel, subrnd to subang up to 10mm		
60			5				
65			5	GM	- increased gravel and silt, 15% sand, 25% silt, 60% gravel  - large conglomerate cobbles, no met		
70			5				



**CH2MHILL**

SHEET 3 of 5				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-48			
SOIL BORING LOG									
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 138.0		DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ			
SURFACE ELEVATION: 484.4 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,435.28		EASTING (CCS NAD 27 Z 5): 7,615,915.90		DATE STARTED: 5/3/2006			
						DATE COMPLETED: 5/4/2006			
DRILLING METHOD: Rotasonic				DRILLING EQUIPMENT:					
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California				LOGGED BY: K. Ebel					
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS			
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.			
75			5	GM	<b>SANDY SILTY GRAVEL (GM)</b> - dr reddish brn (5YR3/4), 30% f to c well graded subrnd to subang sand, 20% fines, 50% weathered gravel, subrnd to subang up to 10mm  - less gravel, slightly moist, dense, fines are about 35% clay, gravel up to 5cm, 30% sand, 35% fines, 35% gravel				
80					<b>SILTY SANDY GRAVEL (GW)</b> - reddish brn (5YR4/4), 30% m sand, 20% fines, 50% gravel, subrnd to subang up to 4cm, mm & conglomerate clasts, loose, dry				
85			10						
90				SM	<b>SILTY SAND (SM)</b> - dr reddish (5YR3/3), 75% m subrnd sand, 20% fines, 5% gravel, subrnd to subang up to 8cm, trace clay, saturated  - sand and gravel coarsening with depth, 50% sand, 20% fines, 30% gravel				
95			10		<b>SANDY SILT W/ GRAVEL (ML)</b> - dk reddish brn (5YR3/3), 30% vf to c sand, 60% met fines, 10% gravel ,subrnd up to 4cm, m density, wet  - much siltier, 10% sand, 85% fines, 5% gravel - dr brn (7.5YR3/4), loose but dry gravel up to 6cm, 25% sand, 45% fines, 30% gravel  - reddish brn (5YR4/4)				
100				GM	<b>SANDY SILTY GRAVEL (GM)</b> - brn (7.5YR4/4), 35% f to c sand, 35% fines, 40% gravel, subrnd to subang up to 9cm, mm, loose, dry  - coarsening of sand and gravel - brn (7.5YR4/4)				
105			10						


**CH2MHILL**

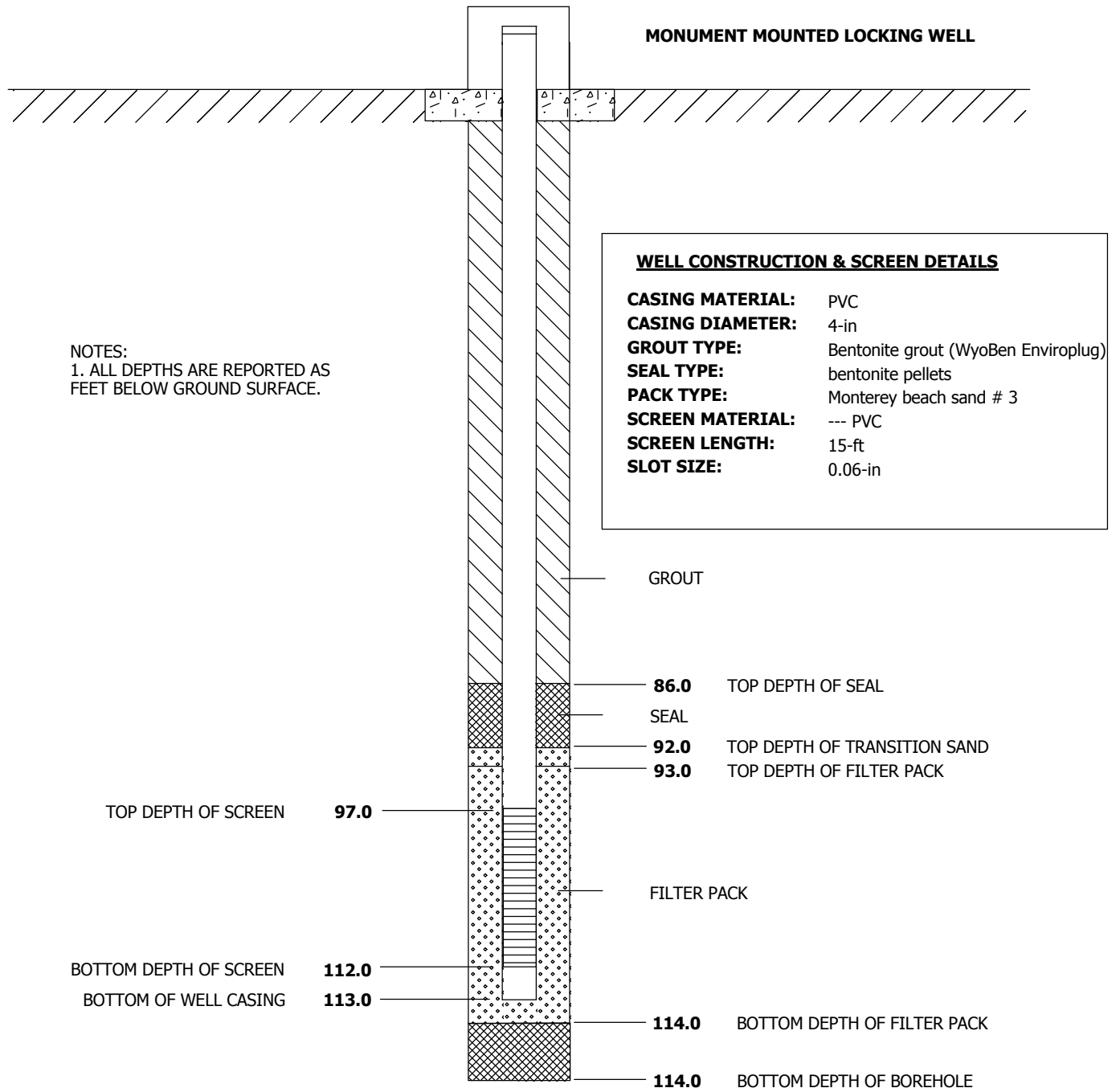
SHEET 4 of 5				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-48	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 138.0		DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.4 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,435.28		EASTING (CCS NAD 27 Z 5): 7,615,915.90		DATE STARTED: 5/3/2006	
						DATE COMPLETED: 5/4/2006	
DRILLING METHOD: Rotosonic				DRILLING EQUIPMENT:			
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California				LOGGED BY: K. Ebel			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION  SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
					SANDY SILTY GRAVEL (GM) - brn (7.5YR4/4), 35% f to c sand, 35% fines, 40% gravel, subrnd to subang up to 9cm, mm, loose, dry	Drill Rate = 1' / min	
110			10	ML	SILT w/ GRAVEL (ML)		
115					SILTY SANDY GRAVEL (GM)		
120			10	GM		Hard Drilling = 3' / min	
125							
130			1	GM	SILTY GRAVEL w/ SAND (GM)	Hard Drilling - Lost core from 127' to 137'	
135							
					SILTY SANDY GRAVEL (GM) - core sized conglom clasts - gravel fining	Very Hard Drilling = 0.7' / min, chattering	

SHEET 5 of 5				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-48	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 138.0		DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.4 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,435.28		EASTING (CCS NAD 27 Z 5): 7,615,915.90		DATE STARTED: 5/3/2006	
						DATE COMPLETED: 5/4/2006	
DRILLING METHOD: Rotosonic				DRILLING EQUIPMENT:			
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California				LOGGED BY: K. Ebel			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
			10	GM	<b>SILTY SANDY GRAVEL (GM)</b>  - core sized conglomerate clasts - moist core, subangular gravel, 15% sand, 35% fines, 50% gravel  - dry core, subangular gravel, 15% sand, 35% fines, 50% gravel - 20% sand, 30% fines, 50% gravel	Drilling easier = 1.5' / min	
			8				
				BR	<b>MIOCENE CONGLOMERATE (BR)</b> - gravel coarsening up to 9cm		
					<i>Boring Terminated at 155 ft</i>  <b>ABBREVIATIONS</b> <i>cc = continuous core run</i> <i>brn = brown</i> <i>lt = light</i> <i>dk = dark</i> <i>vf = very fine-grained</i> <i>f = fine-grained</i> <i>m = medium-grained</i> <i>c = coarse-grained</i> <i>vc = very coarse-grained</i> <i>ang = angular</i> <i>subang = subangular</i> <i>subrnd = subrounded</i> <i>rnd = rounded</i> <i>br = bedrock formation</i> <i>ss = sandstone</i> <i>conglom = conglomerate</i> <i>comptd = compacted</i> <i>qtz = quartz</i>		


**CH2MHILL**

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 326128.01.16.EN	<b>PROJECT:</b> IMPM Drill Program	<b>WELL NO:</b> <i><b>MW-51</b></i>
<b>LOCATION:</b> PG&E Compressor Station - Flood Plain, Topock, California		
<b>DRILLING CONTRACTOR:</b> Prosonic	<b>DRILLING START DATE:</b> 4/8/2006	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END DATE:</b> 4/13/2006	
<b>LOGGER:</b> Rob Tweidt / Arlin Brewster	<b>WELL COMPLETION DATE:</b> 4/13/2006	
<b>TOP OF WELL CASING (NGVD 29):</b> ---	<b>NORTHING COORDINATE (CCS DAND 27, ZONE 5):</b> 2101900.11	
<b>GROUND SURFACE ELEVATION (NGVD 29):</b> 496.81	<b>EASTING COORDINATE (CCS NAD 27 ZONE 5):</b> 7615807.51	





WELL DIAGRAM IS NOT TO SCALE

SHEET 1 of 4				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-51	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 114.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 496.8 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,900.11		EASTING (CCS NAD 27 Z 5): 7,615,807.51		DATE STARTED: 3/31/2004	DATE COMPLETED:
DRILLING METHOD:				DRILLING EQUIPMENT:			
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California				LOGGED BY: R. Tweidt / A. Brewster			
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
5				SM	<b>SILTY SAND w/ GRAVEL (SM)</b> - dk yellowish brn (10YR4/4), 20% well graded subang to subrnd met gravel up to 14cm, 50% sand, 30% fines, slightly moist  - increased gravel, 40% gravel up to 7cm, 30% sand, 30% fines  - 20% gravel up to 5cm, 50% sand, 30% fines  - increased gravel content, 40% gravel up to 7cm, 30% sand, 30% fines - 25% gravel up to 5cm, 45% sand, 30% fines - increased gravel content, 40% gravel up to 7cm, 20% sand, 40% fines, 60/40 met to sed rock ratio		
10			0				
15							
20			10				
25				ML	<b>SILT (ML)</b> - dk greyish brn (10YR4/2), 10% well graded subang to subrnd gravel up to 5cm, 10% sand, 10% fines, gravel mostly met, slightly moist  <b>SILT w/ SAND and GRAVEL (ML)</b> - dr yellowish brn (10YR4/4), 20% well graded subang gravel up to 6cm, 20% sand, 60% fines, mostly met gravel, slightly moist		
30			8				
35							



SHEET 2 of 4				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-51	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 114.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 496.8 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,900.11		EASTING (CCS NAD 27 Z 5): 7,615,807.51		DATE STARTED: 3/31/2004	
DATE COMPLETED:		DRILLING METHOD:					
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California						LOGGED BY: R. Tweidt / A. Brewster	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
40				ML	<b>SILT w/ SAND and GRAVEL (ML)</b> - dr yellowish brn (10YR4/4), 20% well graded subang gravel up to 6cm, 20% sand, 60% fines, mostly met gravel, slightly moist  - 25% gravel up to 7cm, 15% sand, 60% fines  - increased moisture  - 25% gravel up to 6cm, 15% sand, 60% fines		
45			10				
50			10				
55				SP	- 20% gravel up to 7cm, 20% sand, 60% fines   - 20% gravel up to 5cm, 15% sand, 65% fines		
60			10		<b>SAND (SP)</b> - dk brn (7.5YR 3/4), 5% f gravel, poorly sorted, subang to subrnd up to 12 cm, 85% sand, 10% fines, wet   - 10% gravel up to 8cm, 80% sand, 10% fines		
65							
70							


**CH2MHILL**

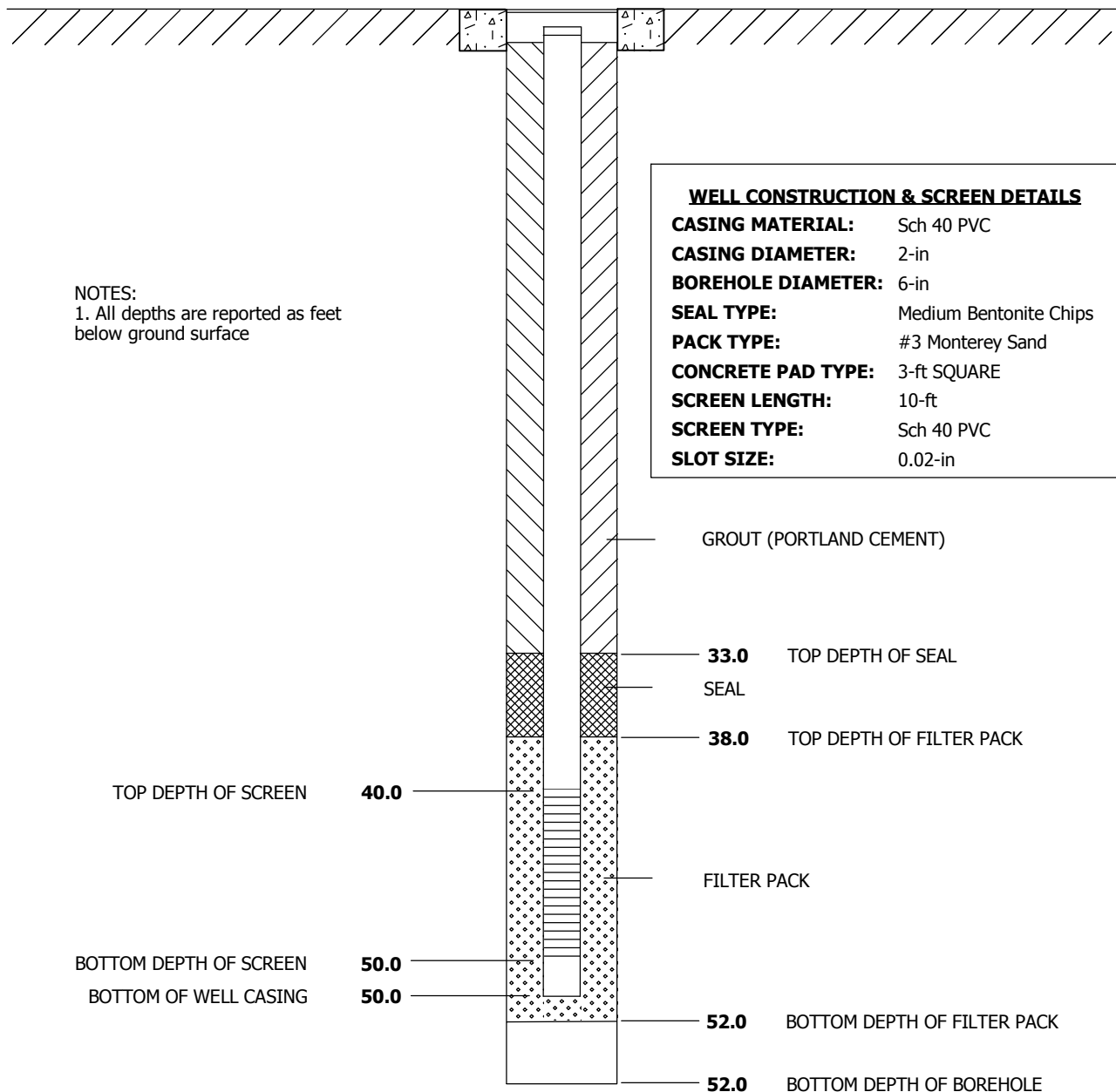
SHEET 3 of 4				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-51	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 114.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 496.8 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,900.11		EASTING (CCS NAD 27 Z 5): 7,615,807.51		DATE STARTED: 3/31/2004	DATE COMPLETED:
DRILLING METHOD:						DRILLING EQUIPMENT:	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California						LOGGED BY: R. Tweidt / A. Brewster	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
75			6	SP/SM	SAND (SP/SM) - dk greyish brn (10YR4/2), 0% gravel, 90% subang to subrnd sand, 10% fines, poorly graded, wet		
80			7	SM	SAND (SM) - brn (10YR4/3), 5% subang gravel up to 5cm, 75% sand, 20% fines, mostly met gravel, poorly graded, moist  - 15% gravel up to 10cm, 70% sand, 15% fines		
85							
90			10		SILT (ML) dk brn (7.5YR3/4), 10% ang to subang gravel up to 5cm, 15% sand, 75% fines, mostly met gravel, slightly moist		
95							
100				ML	- 20% gravel up to 10cm, 10% sand, 70% fines		
			10				
105					- 10% gravel up to 4cm, 15% sand, 75% fines  - 10% gravel up to 5cm, 15% sand, 75% fines		
							

SHEET 4 of 4				PROJECT NUMBER: 326128.01.16.EN		BORING NUMBER: MW-51	
SOIL BORING LOG							
PROJECT NAME: IMPM Drill Program				HOLE DEPTH (ft): 114.0		DRILLING CONTRACTOR:	
SURFACE ELEVATION: 496.8 ft. MSL		NORTHING (CCS NAD 27 Z 5): 2,101,900.11		EASTING (CCS NAD 27 Z 5): 7,615,807.51		DATE STARTED: 3/31/2004	
DATE COMPLETED:		DRILLING METHOD:					
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California						LOGGED BY: R. Tweidt / A. Brewster	
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS	
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)			DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.	
110					SILT (ML) dk brn (7.5YR3/4), 10% ang to subang gravel up to 5cm, 15% sand, 75% fines, mostly met gravel, slightly moist		
				ML	SANDY SILT (ML) - dk reddish brn (2.5YR 53/3), 10% ang to subang gravel up to 4cm, 40% sand, 50% fines, mostly met gravel, well graded, saturated		
			7	ML	SILT (ML) - dk reddish brn (2.5YR3/3), 20% gravel, 20% sand, 60% fines, presence of highly weathered clasts to clay		
				BR	MIOCENE CONGLOMERATE (BR)		
					Boring Terminated at 114 ft		
					<b>ABBREVIATIONS</b> cc = continuous core run brn = brown lt = light dk = dark vf = very fine-grained f = fine-grained m = medium-grained c = coarse-grained vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz		

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i><b>MW-57-050</b></i>
<b>LOCATION:</b> Site B		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 1/21/2009	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 1/21/2009	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 1/21/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 508.97 ft AMSL	<b>GENERAL REMARKS:</b> Alias during field work: MW-57S	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100906.35		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616384.35		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



<b>PROJECT NUMBER:</b> <b>382653.FP.04.FW</b>	<b>BORING NUMBER:</b> <b>MW-57</b>
SHEET 1 OF 11	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock - ERGI	LOCATION : Site B (2100899.6 N, 7616389.4 E)
ELEVATION : 509.0 ft	DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 52 ft BGS	START : 1/14/2009      END : 1/20/2009      LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPROX. 32 IN BGS				START : 1/14/2009		END : 1/20/2009		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		COMPLETE		ML	<b>Sandy Silt With Gravel (ML)</b> 0.0-3.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 30% sand, 50% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 10 mm		Boring initially drilled to 70' bgs using Rotosonic tools up to 10-in in diameter. Permanent 5-in PVC conductor casing installed from ground surface to 70' bgs (portland cement grout). Boring drilled from 70' bgs to total depth of 192' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter)		
3.0				GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm				
4.0	10:10								
5									
8.0	11:00								
9.0	14:00 (FD)								
10									
15									
18.0									
19.0	11:10								
20									



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 2 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE					
	COMPLETE			GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
25							
30							
35							
40							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 3 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
45	COMPLETE			GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
50				Tmc	<b>Conglomerate (Tmc)</b> 46.0-145.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are yellowish red (5YR 4/6), dry, matrix-supported conglomerate with no dominant clast mineralogy		
55							
60							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 4 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

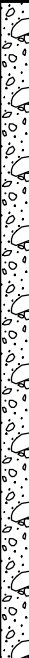
ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPENDIX 32 R BGS				START: 1/14/2009		END: 1/20/2009		LOGGER: A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION						
65		COMPLETE		Tmc	<b>Conglomerate (Tmc)</b> 46.0-145.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are yellowish red (5YR 4/6), dry, matrix-supported conglomerate with no dominant clast mineralogy				
70	70.0				Begin rock coring from 70.0 ft bgs See the next page for the rock core log.		Boring by Rotosonic completed 1/14/09. Install permanent 5-in diameter PVC conductor casing (portland cement grout). Begin rotary core drilling at 70.0' bgs.		
75									
80									





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)


ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPROX. 32 ft BGS		START : 1/14/2009		END : 1/20/2009		LOGGERS: J. L. Brown, Jr. (Normal)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
70.0	R1 5.3 ft 0%	0	NR		No Recovery 70-75.3'		
75	75.3	100	0		Conglomerate (Tmc) 75.3-145.5' - light brown, (5YR 5/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), unweathered, matrix-supported, massive	R1 = 23.0 min	
			0				
			0				
			0				
			0				
			0				
			0				
			0				
80	R2 9.5 ft 103%	100	0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
85	84.8	100	0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
90	R3 10 ft 100%	100	0		Added Approx. 50 gallons of water		



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 6 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

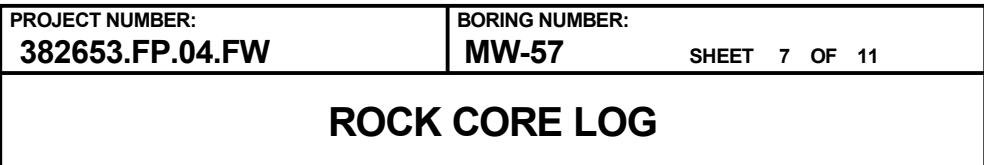
WATER LEVELS : Approx. 52 ft BGS

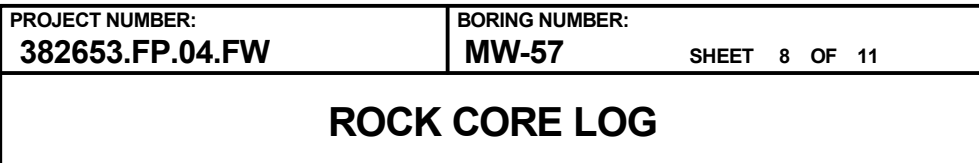
START : 1/14/2009

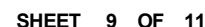
END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.000' SURFACE		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
95	94.8		0		<b>Conglomerate (Tmc)</b> 75.3-145.5' - light brown, (5YR 5/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), unweathered, matrix-supported, massive	Added approx. 25 gallons of water. R3 = 10.0 min	
			0				
			0				
			0				
			0				
			0	98.5, 99.0' - Joint, 35 deg, rough, undulating, reddish staining, tight	98.5-98.7' - slightly weathered		
			0				
			0				
			0				
			0				
100	R4 10 ft 100%	70	1				
			1				
			0				
			0				
			0				
			>10	103.0-105.0' - Multiple breaks, difficult to ascertain if jointed or caused by drilling.			
			>10				
105	104.8		0			R4 = 10.5 min	
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
110	R5 10 ft 100%	97	0				







DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
155	154.9		0	153.5, 154.5' - Mechanical break, 35 deg, undulating to planar, brownish with black staining, no infill, slickensided, tight 154.6-155.6' - Fracture zone, healed fractures with random orientation		Conglomerate (Tmc) 145.5-153.1' - moderate reddish orange, (10R 6/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), completely weathered, matrix-supported, foliated  Metaconglomerate (Tmc) 153.1-154.6' - dark yellowish orange, (10YR 6/6), strong (R4), unweathered, massive, moderate HCl reaction, conglomerate matrix has been largely replaced with minerals that have a moderate reaction with HCl, however relict conglomerate structure is apparent.  Altered Metadiorite (pTbr) 154.6-155.6' - moderate yellowish brown, (10YR 5/4), largely felsic mineralogy, medium grained, strong (R4), unweathered, no HCL reaction, portions of this interval exhibit mylonitic texture  Metadiorite (pTbr) 155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated  166.8-167.0' - slightly weathered	R9 = 17.5 min
			0				
			0				
			0				
			0				
160	159.7	58	>10	158.2' - Joint, 60 deg dip along multiple planes, rough, undulating, < 1 mm calcite infilling covering 50% of one plane, yellowish staining, tightness uncertain  160.9-164.2' - Fracture zone, reddish staining, yellow staining from 162.3-164.2'		General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling. R10 = 23.0 min	
			0				
			0				
			1				
			0				
165	164.4	51	0	166.1' - Mechanical break, near 90 deg, calcite infilling, calcite healed fracture, most likely induced by drilling  167.7-170.0' - Mechanical break (6), 35 deg and 45 deg, calcite infilling, along calcite healed fractures, likely induced by drilling		R11 = 13.3 min	
			>10				
			>10				
			>10				
			0				
170	169.0	53	0			R12 = 19.3 min	
			0				
			1				
			0				
			0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 10 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPROX. 32 ft BGS				START : 1/14/2009		END : 1/20/2009		LOGGERS : J. C. BROWER, (NORMAN)		
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY	COMMENTS		
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS		SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS						
175	R13 4.8 ft 100%	69	0	172.2-173.8' - Fracture zone, reddish staining		<b>Metadiorite (pTbr)</b> 155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated	Last 1.5' = 2-3x faster drill rate			
			0							
			>10							
	R14 173.8 0.5 ft 100%	0	>10	R13 = 25.3 min						
			R15 3.4 ft 100%	71				1	R14 = 7.5 min	
								0	@ 175' bgs: drill rate increases	
	1									
	177.7	1	R15 = 17.0 min							
	180	R16 4.2 ft 100%	100	0						
				1						
1										
181.9		1	R16 = 15.5 min							
		R17 10 ft 100%		92	1					
0										
0										
185	R17 10 ft 100%	92		0						
			0							
			0							
			0							
			1							
190	R17 10 ft 100%	92	0							
			0							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 11 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

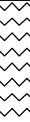
ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL (ft) BELOW SURFACE		CORE RUN LENGTH AND RECOVERY (%)		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
191.9			0				<b>Metadiorite (pTbr)</b> 155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated	R17 = 35.5 min
			0					
195							End Drilling on 1/20/2009 Total Borehole Depth: 191.9 ft bgs	
200								
205								
210								

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i><b>MW-57-070</b></i>
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**LOCATION:** Site B

**DRILLING CONTRACTOR:** Boart Longyear (D. Roberts)

**DRILLING START:** 1/28/2009

**DRILLING METHOD:** Rotosonic

**DRILLING END:** 1/28/2009

**LOGGER:** A. Brewster (Northstar)

**WELL COMPLETION DATE:** 1/28/2009

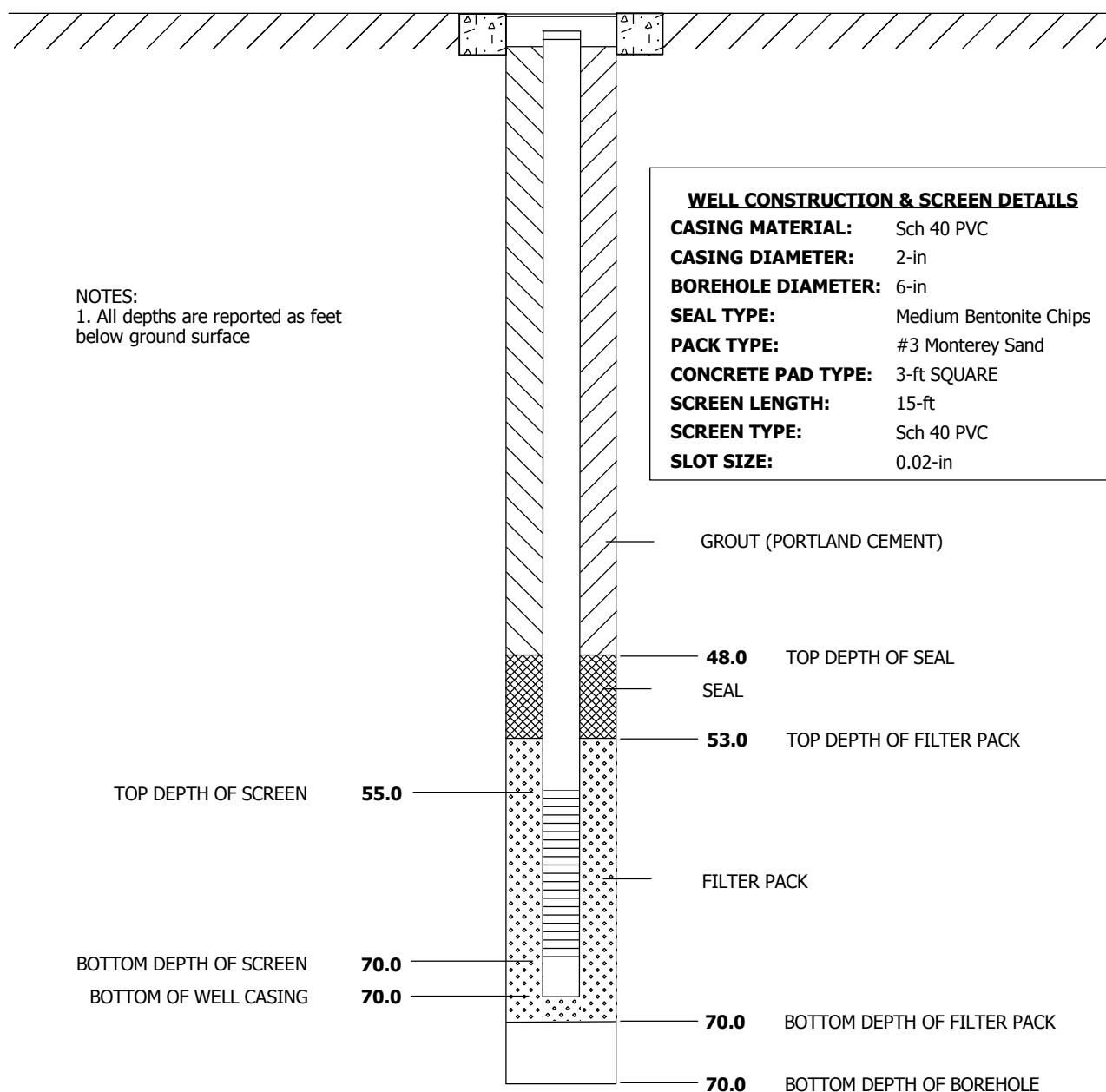
**GROUND SURFACE ELEVATION (NAVD 88):** 508.97 ft AMSL

**GENERAL REMARKS:** Alias during field work: MW-57M

**NORTHING (CCS NAD 83 Z 5):**  
2100893.58

**EASTING (CCS NAD 83 Z 5):**  
7616394.98

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



# SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

**DRILLING EQUIPMENT AND METHOD :** Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPROX. 32' BGS			START : 1/14/2009		END : 1/20/2009		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY		SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)		RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY			DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
LAB SAMPLE								
COMPLETE		ML		Sandy Silt With Gravel (ML) 0.0-3.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 30% sand, 50% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 10 mm		Boring initially drilled to 70' bgs using Rotasonic tools up to 10-in in diameter. Permanent 5-in PVC conductor casing installed from ground surface to 70' bgs (portland cement grout). Boring drilled from 70' bgs to total depth of 192' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter)		
3.0		10:10		Silty Gravel (GM) 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm				
4.0								
5								
8.0		11:00, 14:00 (FD)						
9.0								
10								
15								
18.0		11:10						
19.0								
20								



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 2 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE					
	COMPLETE			GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
25							
30							
35							
40							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 3 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
45	COMPLETE			GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
50				Tmc	<b>Conglomerate (Tmc)</b> 46.0-145.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are yellowish red (5YR 4/6), dry, matrix-supported conglomerate with no dominant clast mineralogy		
55							
60							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 4 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

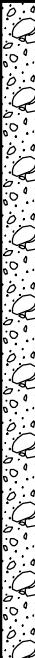
ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPROX. 32 ft BGS				START : 1/14/2009		END : 1/20/2009		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION						
65		COMPLETE		Tmc	<b>Conglomerate (Tmc)</b> 46.0-145.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are yellowish red (5YR 4/6), dry, matrix-supported conglomerate with no dominant clast mineralogy				
70	70.0				Begin rock coring from 70.0 ft bgs See the next page for the rock core log.		Boring by Rotosonic completed 1/14/09. Install permanent 5-in diameter PVC conductor casing (portland cement grout). Begin rotary core drilling at 70.0' bgs.		
75									
80									



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)


ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPROX. 32 ft BGS		START : 1/14/2009		END : 1/20/2009		LOGGERS: J. L. Brown, Jr. (Normal)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
70.0	R1 5.3 ft 0%	0	NR		No Recovery 70-75.3'		
75	75.3	100	0		Conglomerate (Tmc) 75.3-145.5' - light brown, (5YR 5/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), unweathered, matrix-supported, massive	R1 = 23.0 min	
			0				
			0				
			0				
			0				
			0				
			0				
			0				
80	R2 9.5 ft 103%	100	0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
85	84.8	100	0	Added Approx. 50 gallons of water			
			0				
			0				
			0				
			0				
			0				
			0				
			0				
90	R3 10 ft 100%	100	0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 6 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

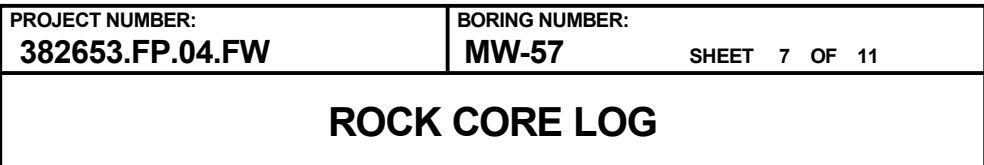
WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

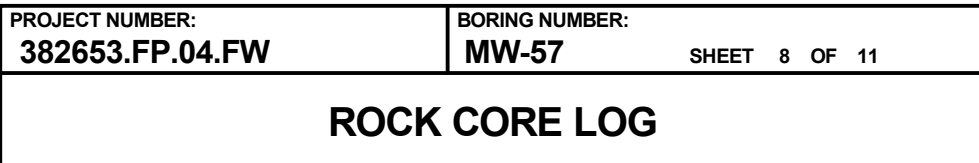
LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.000' SURFACE		START: 1/14/2009		END: 1/20/2009		LOGGERS: (NAME)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
95	94.8		0			<b>Conglomerate (Tmc)</b> 75.3-145.5' - light brown, (5YR 5/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), unweathered, matrix-supported, massive	
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LOGGER : A. Brewster (Northstar)

[illegible]





# ROCK CORE LOG

PROJECT : PG&amp;E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

**CORING EQUIPMENT AND METHOD :** Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)





ORIENTATION : Vertical

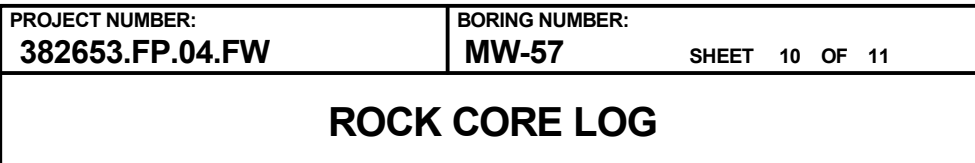
WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPROX. SEI R BGS		START: 1/14/2009		END: 1/20/2009		LOGGER: J.C. Browder (Normal)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
155	154.9	58	0		<b>Conglomerate (Tmc)</b> 145.5-153.1' - moderate reddish orange, (10R 6/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), completely weathered, matrix-supported, foliated	R9 = 17.5 min	
			0				
			0				
			0				
			0				
160	159.7	51	>10		<b>Metaconglomerate (Tmc)</b> 153.1-154.6' - dark yellowish orange, (10YR 6/6), strong (R4), unweathered, massive, moderate HCl reaction, conglomerate matrix has been largely replaced with minerals that have a moderate reaction with HCl, however relict conglomerate structure is apparent.  <b>Altered Metadiorite (pTbr)</b> 154.6-155.6' - moderate yellowish brown, (10YR 5/4), largely felsic mineralogy, medium grained, strong (R4), unweathered, no HCL reaction, portions of this interval exhibit mylonitic texture  <b>Metadiorite (pTbr)</b> 155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated		General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling. R10 = 23.0 min
			0				
			0				
			1				
			0				
165	164.4	53	0		160.9-164.2' - Fracture zone, reddish staining, yellow staining from 162.3-164.2'	R11 = 13.3 min	
			>10				
			>10				
			>10				
			>10				
170	169.0		0		166.1' - Mechanical break, near 90 deg, calcite infilling, calcite healed fracture, most likely induced by drilling  167.7-170.0' - Mechanical break (6), 35 deg and 45 deg, calcite infilling, along calcite healed fractures, likely induced by drilling  166.8-167.0' - slightly weathered	R12 = 19.3 min	
			0				
			0				
			1				
			0				





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 11 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

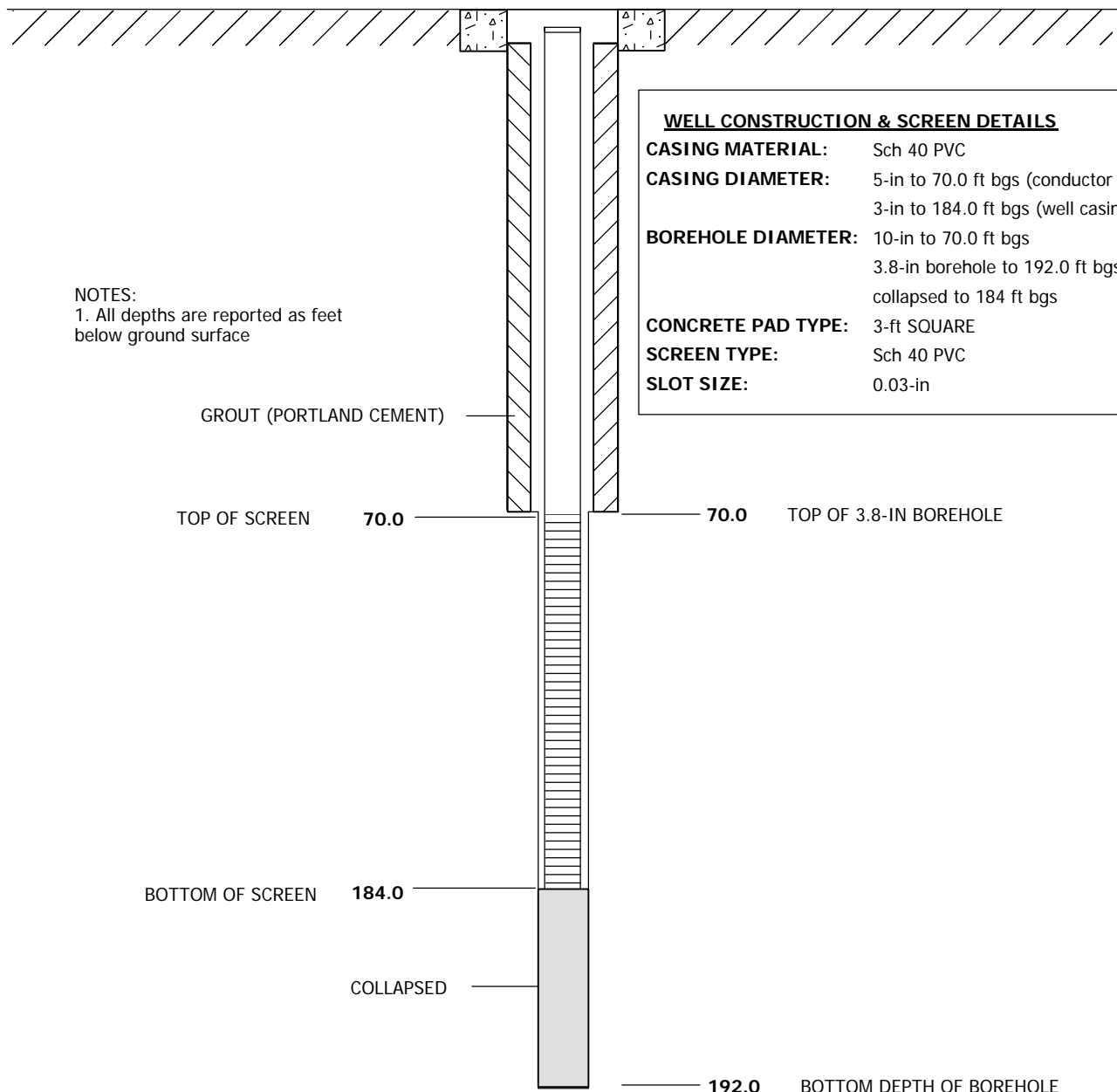
LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	DESCRIPTION			
			DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
191.9		0		Metadiorite (pTbr)	155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated	R17 = 35.5 min
		0			End Drilling on 1/20/2009 Total Borehole Depth: 191.9 ft bgs	
195						
200						
205						
210						

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i>MW-57-185</i>
<b>LOCATION:</b> Site B		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 1/14/2009	
<b>DRILLING METHOD:</b> Rotosonic / Rotary Core (HQ)	<b>DRILLING END:</b> 1/20/2009	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 2/16/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 508.97 ft AMSL	<b>GENERAL REMARKS:</b> Alias during field work: MW-57BR	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100899.56		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616389.44		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)




WELL DIAGRAM IS NOT TO SCALE



<b>PROJECT NUMBER:</b> <b>382653.FP.04.FW</b>	<b>BORING NUMBER:</b> <b>MW-57</b>
SHEET 1 OF 11	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock - ERGI	LOCATION : Site B (2100899.6 N, 7616389.4 E)
ELEVATION : 509.0 ft	DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 52 ft BGS	START : 1/14/2009      END : 1/20/2009      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	LAB SAMPLE					
	COMPLETE		ML	<b>Sandy Silt With Gravel (ML)</b> 0.0-3.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 30% sand, 50% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 10 mm		Boring initially drilled to 70' bgs using Rotosonic tools up to 10-in in diameter. Permanent 5-in PVC conductor casing installed from ground surface to 70' bgs (portland cement grout). Boring drilled from 70' bgs to total depth of 192' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter)
3.0		10:10	GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
4.0						
5						
8.0		11:00, 14:00 (FD)				
9.0						
10						
15						
18.0		11:10				
19.0						
20						



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 2 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE					
	COMPLETE			GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
25							
30							
35							
40							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 3 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
45	COMPLETE			GM	<b>Silty Gravel (GM)</b> 3.0-46.0' - dark brown, (7.5YR 3/3), dry, loose, 40% gravel, 20% sand, 40% fines, angular gravel, poorly graded, no dominant mineralogy, matrix-supported, max clast size = 100 mm		
50				Tmc	<b>Conglomerate (Tmc)</b> 46.0-145.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are yellowish red (5YR 4/6), dry, matrix-supported conglomerate with no dominant clast mineralogy		
55							
60							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 4 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
RECOVERY (in)							
LAB SAMPLE							
65		COMPLETE		Tmc	<b>Conglomerate (Tmc)</b> 46.0-145.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are yellowish red (5YR 4/6), dry, matrix-supported conglomerate with no dominant clast mineralogy		
70	70.0				Begin rock coring from 70.0 ft bgs See the next page for the rock core log.		Boring by Rotosonic completed 1/14/09. Install permanent 5-in diameter PVC conductor casing (portland cement grout). Begin rotary core drilling at 70.0' bgs.
75							
80							





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)


ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPROX. 32 ft BGS		START : 1/14/2009		END : 1/20/2009		LOGGERS: J. L. Brown, Jr. (Normal)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
70.0	R1 5.3 ft 0%	0	NR		No Recovery 70-75.3'		
75	75.3	100	0		Conglomerate (Tmc) 75.3-145.5' - light brown, (5YR 5/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), unweathered, matrix-supported, massive	R1 = 23.0 min	
	0						
	0						
	0						
	0						
	0						
	0						
	0						
80	R2 9.5 ft 103%	100	0			Added Approx. 50 gallons of water	
	0						
	0						
	0						
	0						
	0						
	0						
	0						
85	84.8	100	0				
	0						
	0						
	0						
	0						
	R3 10 ft 100%	100	0				
90							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 6 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

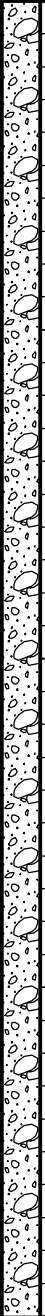
ORIENTATION : Vertical

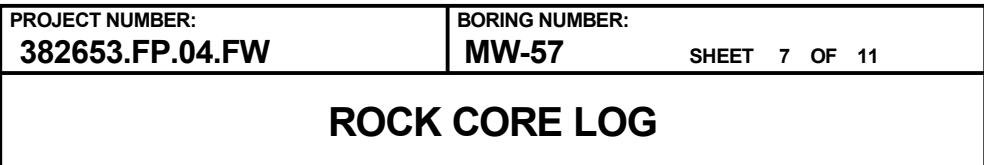
WATER LEVELS : Approx. 52 ft BGS

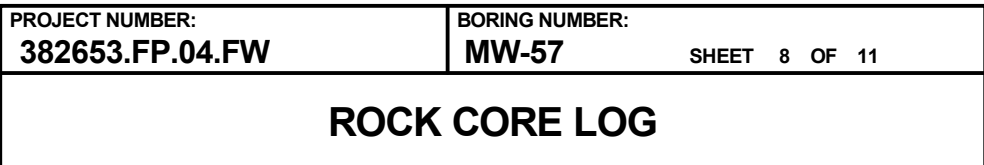
START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: APPROX. 32 ft BGS		START : 1/14/2009		END : 1/20/2009		LOGGER: J. L. Brown, (Normal)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
95	94.8		0			<b>Conglomerate (Tmc)</b> 75.3-145.5' - light brown, (5YR 5/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), unweathered, matrix-supported, massive	Added approx. 25 gallons of water. R3 = 10.0 min
		0					
		0					
		0					
		0					
		0					
		0					
		0					
		0					
		0					
100	R4 10 ft 100%	70	1	98.5, 99.0' - Joint, 35 deg, rough, undulating, reddish staining, tight		98.5-98.7' - slightly weathered	
			1				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
105	104.8		>10	103.0-105.0' - Multiple breaks, difficult to ascertain if jointed or caused by drilling.			R4 = 10.5 min
		>10					
		0					
		0					
		0					
		0					
		0					
		0					
		0					
		0					
110	R5 10 ft 100%	97	0				
			0				
			0				
			0				
			0				
			0				





# ROCK CORE LOG

PROJECT : PG&amp;E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

**CORING EQUIPMENT AND METHOD :** Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)




ORIENTATION : Vertical

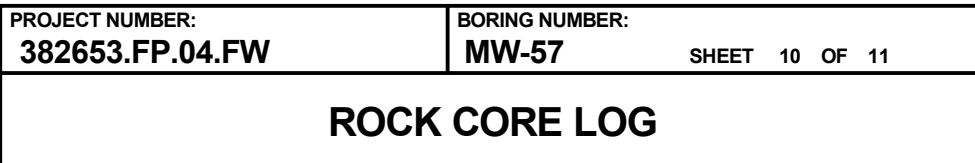
WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPROX. SEI BGS		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
155	154.9	58	0	153.5, 154.5' - Mechanical break, 35 deg, undulating to planar, brownish with black staining, no infill, slickensided, tight 154.6-155.6' - Fracture zone, healed fractures with random orientation		<b>Conglomerate (Tmc)</b> 145.5-153.1' - moderate reddish orange, (10R 6/6), no dominant clast mineralogy, fine to coarse grained, medium strong (R3), completely weathered, matrix-supported, foliated  <b>Metaconglomerate (Tmc)</b> 153.1-154.6' - dark yellowish orange, (10YR 6/6), strong (R4), unweathered, massive, moderate HCl reaction, conglomerate matrix has been largely replaced with minerals that have a moderate reaction with HCl, however relict conglomerate structure is apparent.  <b>Altered Metadiorite (pTbr)</b> 154.6-155.6' - moderate yellowish brown, (10YR 5/4), largely felsic mineralogy, medium grained, strong (R4), unweathered, no HCL reaction, portions of this interval exhibit mylonitic texture  <b>Metadiorite (pTbr)</b> 155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated	R9 = 17.5 min
			0				
			0				
			0				
			0				
160	159.7	51	>10	158.2' - Joint, 60 deg dip along multiple planes, rough, undulating, < 1 mm calcite infilling covering 50% of one plane, yellowish staining, tightness uncertain  160.9-164.2' - Fracture zone, reddish staining, yellow staining from 162.3-164.2'			General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling. R10 = 23.0 min
			0				
			>10				
			>10				
			>10				
165	164.4	53	0	166.1' - Mechanical break, near 90 deg, calcite infilling, calcite healed fracture, most likely induced by drilling  167.7-170.0' - Mechanical break (6), 35 deg and 45 deg, calcite infilling, along calcite healed fractures, likely induced by drilling		166.8-167.0' - slightly weathered	R11 = 13.3 min
			0				
			1				
			0				
			0				
170	169.0		0				R12 = 19.3 min





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-57**

SHEET 11 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site B (2100899.6 N, 7616389.4 E)

ELEVATION : 509.0 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 52 ft BGS

START : 1/14/2009

END : 1/20/2009

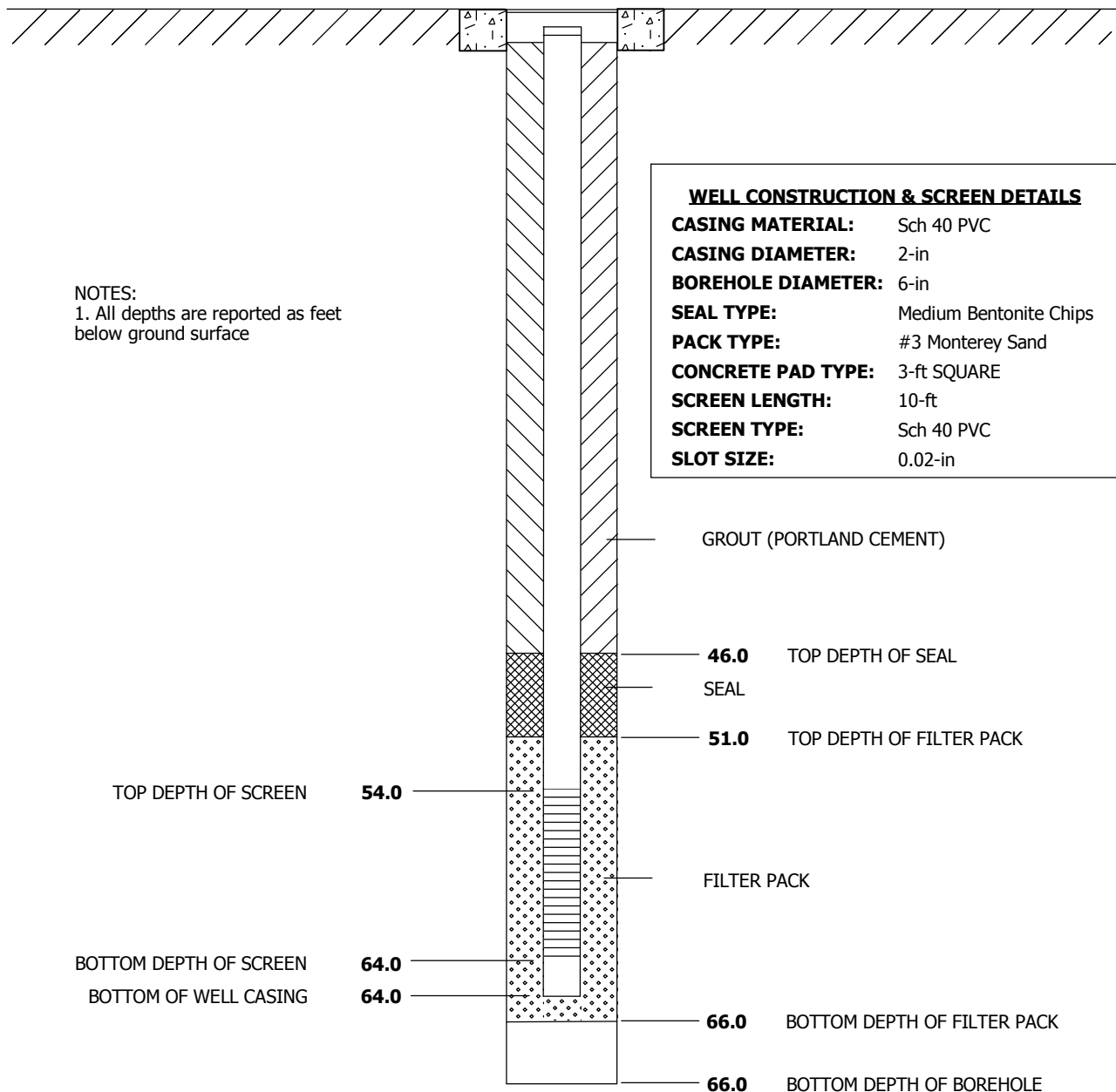
LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	DESCRIPTION			
			DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
191.9		0		Metadiorite (pTbr)	155.6-191.9' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine to medium grained, strong (R4), unweathered, massive to foliated	R17 = 35.5 min
		0				
195					End Drilling on 1/20/2009 Total Borehole Depth: 191.9 ft bgs	
200						
205						
210						

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i><b>MW-58-065</b></i>
<b>LOCATION:</b> Site A		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 2/11/2009	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 2/12/2009	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 2/12/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 521.41 ft AMSL	<b>GENERAL REMARKS:</b> Alias during field work: MW-58S	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100607.15		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616136.25		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 1 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools


ORIENTATION : Vertical

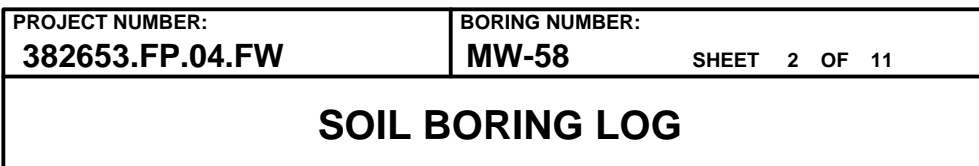
WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

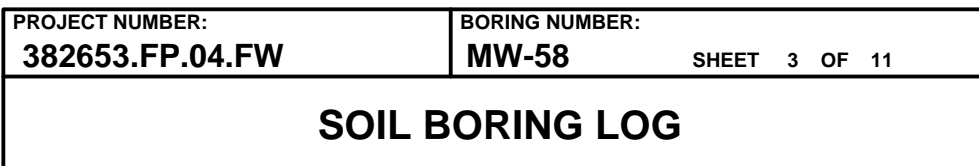
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
1.5 2.0	COMPLETE	14:00	ML	<b>Silt With Sand(ML)</b> 0.0-2.0' - brown, (7.5YR 4/4), dry, loose, 0% gravel, 20% sand, 80% fines, sand is angular to subangular, poorly graded, no dominant mineralogy		Boring initially drilled to 65.5' bgs using Rotosonic tools up to 10-in in diameter. Permanent 6-in PVC conductor casing installed from ground surface to 65.5' bgs (portland cement grout). Boring drilled from 65.5' bgs to an initial total depth of 115' bgs using diamond bit rotary core tools (HQ- size, 3.8-in diameter). Following testing, boring was deepened to a total depth of 206' bgs using rotary core tools.	
				<b>Silty Gravel With Sand(GM)</b> 2.0-17.0' - brown, (7.5YR 4/3), dry, loose, 40% gravel, 30% sand, 30% fines, gravel is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 90 mm.			
				<b>Silty Sand With Gravel(SM)</b> 16.0-51.0' - brown, (7.5YR 4/3), dry, loose, 15% gravel, 60% sand, 25% fines, gravel is angular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 100 mm			
19.0 20.0		14:50					



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
COMPLETE				SM	<b>Silty Sand With Gravel(SM)</b> 16.0-51.0' - brown, (7.5YR 4/3), dry, loose, 15% gravel, 60% sand, 25% fines, gravel is angular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 100 mm		
25							
29.0							
30.0		15:10					
35							
39.0							
40.0		16:30					



LOCATION : Site A (2100612.1 N, 7616131.8 E)

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

ORIENTATION : Vertical

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
45		COMPLETE		SM	<b>Silty Sand With Gravel(SM)</b> 16.0-51.0' - brown, (7.5YR 4/3), dry, loose, 15% gravel, 60% sand, 25% fines, gravel is angular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 100 mm		
	49.0						
	50.0		17:10				
55				ML	<b>Silt (ML)</b> 51.0-53.0' - dark brown, (7.5YR 3/2), dry, stiff, 0% gravel, 0% sand, 100% fines, no apparent structure, max clast size = 20 mm. Occurrence of lenses of white clayey silt up to 10 mm thick, cohesive.		
60				SP	<b>Poorly Graded Sand With Gravel(SP)</b> 53.0-60.0' - dark yellowish brown, (10YR 4/6), dry, loose to medium dense, 30% gravel, 65% sand, 5% fines, sand is fine to medium grained, subangular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 30 mm.		Total depth of Rotosonic boring is 65.5 ft bgs. Install permanent 6-in conductor casing (portland cement grout). See rock core log for 60.0-65.5 lithologic description.
	59.0						
	60.0		17:30				
					Begin rock coring from 65.5 ft bgs See the next page for the rock core log.		



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 4 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
60.0						<b>Metadiorite(pTbr)</b> 60.0-62.0' - Metadiorite. Highly weathered.	
65						<b>Metadiorite(pTbr)</b> 62.0-65.5' - Metadiorite. Rock is competent, but shattered and partially pulverized by Rotasonic drilling method.	
65.5	R1 3 ft 100%	>10		65.5-70.0' - core recovered, but largely broken by drilling.		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	65.5': Begin rotary core drilling General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling.
68.5	R2 1 ft 100%		13				
69.5	R3 0.5 ft 100%		0	68.5' - Joint, 50 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
70							
70.0			0				
			1				
			0	70.9' - Joint, 30 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			3	72.2' - Joint, 35 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			1	72.7' - Joint (2), 40 deg and 60 deg, rough, undulating, < 1 mm calcite infilling, yellowish staining on 40 deg face, tight			
			0	73.9' - Joint, 40 deg, rough, undulating, yellowish silty infill (< 1 mm) and < 1 mm calcite infilling, yellowish staining, tight			
75							
75.5			3	75.2' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			0	75.7, 76.0' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			1	77.2' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			2	78.3' - Joint, 40 deg, rough, stepped, no staining, tight			
			2	78.8' - Joint, 60 deg, rough, undulating, no staining, tight			
80	R5 8.5 ft 100%		67				R1 = 11.5 min R2 = 13.2 min R3 = 8.0 min  R4 = 23.3 min



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58** SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
85	R6 1.5 ft 100%	80	1	79.3, 79.6' - Joint, 40 deg, rough, undulating, no staining, tight	[Symbolic Log]	<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R5 = 39.2 min
			>10	80.4' - Joint, 15 deg, rough, undulating, some red staining, tight			
			2	81.1' - Joint, 15 deg, rough, undulating, < 0.5 mm calcite infilling, no staining, tight			
			1	81.4-82.1' - Fracture zone, rough, undulating, < 1 mm calcite infilling, no staining, tight, 60 deg dip at 82.1'			
	R7 4.4 ft 100%	32	1	82.5-84.0' - Joint, near 90 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight			
			1	84.9' - Joint, 25 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			R6 = 4.5 min
			2	85.3, 85.5' - Joint, 40 deg, rough, stepped, < 0.5 mm calcite infilling, no staining, tight			
			>10	86' - Joint, 10 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			R7 = 19.6 min
			>10	86.4' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, yellowish staining, tight, 86.4-88.9' multiple fractures, rough, undulating, minor calcite growth (< 1 mm), some yellowish staining, tight. 60 deg dip at 88.9'.			
			>10				
90	R8 4.5 ft 100%	51	>10	90.3' - Joint, 30 deg, rough, undulating, no staining, tight			R8 = 30.5 min
			2	90.5-90.9' - Fracture zone, rough, undulating, no staining, tight, 60 deg dip at 90.9'			
			2	90.9' - Joint, 60 deg, rough, undulating, reddish staining, tight			
			>10	91.5' - Joint, 30 deg, rough, undulating, reddish staining, tight			
	R9 1 ft 100%	33	>10	92.4' - Joint, 10 deg, rough, undulating, calcite infilling, no staining, tight			
			>10	92.8' - Joint, 40 deg, rough, undulating, reddish staining, tight			
			>10	93.4-93.9' - Fracture zone, rough, undulating, brownish-grey microcrystalline infill (< 1 mm), reddish-yellow staining, tight, no reaction to HCl			R9 = 4.5 min
			>10	94.6-97.8' - Multiple healed fractures, rough, undulating, > 3 mm black infill, some rust-colored staining, tight.			
			>10	96.1' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			>10	97.0, 97.9' - Joint, 60 deg, rough, undulating, no staining, tight			
95	R10 4.6 ft 100%	17	>10	97.9-100.0' - Fracture zone, rough, undulating, < 1 mm black infill, reddish staining			R10 = 23.3 min
			>10				
100	100.0						





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 7 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
125	R13 10.8 ft 100%	100	1	120.7' - Joint, 35 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R13 = 25.1 min
			0				
			0				
			2	123.4, 123.5' - Joint, 35 deg and 45 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			1	124.5' - Joint, 70 deg, rough, undulating, < 1 mm calcite infilling, no staining, moderately tight			
			0				
130	R14 6.5 ft 100%	65	0			130.2-132.5' - slightly weathered	R14 = 20.3 min
			1	127.2' - Joint, 65 deg, rough, undulating, < 2.5-inch dark reddish brown (10R 3/4) consolidated fine sediment infilling, no staining, tight			
			0				
			0				
			>10	130.2-132.5' - Fracture zone, rough, undulating to stepped, < 2 mm calcite infilling, reddish staining, no dominant orientation			
			>10				
135	R15 3.7 ft 100%	100	>10				R15 = 14.5 min
			0				
			0				
			1	135.7' - Joint, 15 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			0				
			0				
140			0				
			0				
			0				
			0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58** SHEET 8 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

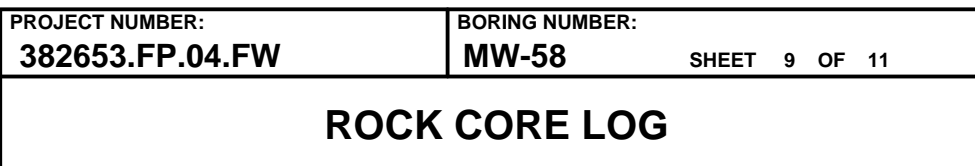
START : 1/29/2009

END : 3/27/2009


LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
145	R16 10.2 ft 100%	100	0			<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R16 = 33.0 min
			0				
			0				
			1				
			1	143.9, 144.6' - Joint, 40 deg, rough, undulating to stepped, < 5 mm calcite infilling, no staining, moderately tight			
			3	145.1, 145.3, 145.5' - Joint, 40 deg, rough, undulating, < 5 mm calcite infilling, reddish staining, tight to moderately tight			
146.4			0				
			1	147.4' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			2	148.1, 148.3, 149.6' - Joint, 65 deg, rough, undulating, < 5 mm calcite infilling, reddish staining, tight			
150			1				
	R17 9.8 ft 100%	90	1	150.1, 152.9, 153.4, 154.5' - Joint, 25, 25, and 65 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			R17 = 37.8 min
			0				
			1				
			1				
155			1				
			1	155.0, 156.1, 156.4, 156.7' - Joint, 30 deg, rough, undulating, < 1 mm calcite infilling, dark red to black staining, tight			
156.2			3				
			0				
			1	158.5' - Joint, 85 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			
160			0				





LOGGER : A. Brewster (Northstar)

WATER LEVEL: Approx. 66 ft BGS		START: 1/29/2009		END: 3/27/2009		LOGGER: R. Brewster (Normal)					
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS					
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.				
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS						
165	R18 10 ft 100%	80	0		<b>Metadiorite (pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R18 = 39.0 min					
			0								
			0								
			0								
			>10								
			>10								
166.2	R19 7 ft 100%	57	>10				164.5-166.7' - Fracture zone, rough, undulating, < 1 mm calcite infilling, reddish staining, no dominant orientation, moderately tight	171.7-172.2' - medium to coarse grained 172.2-177.4' - yellowish gray, (5Y 8/1), largely felsic mineralogy, fine grained, unweathered	R19 = 38.0 min		
>10											
1											
>10											
1											
1											
>10											
173.2			R20 2 ft 100%	40	>10	177.4-179.4' - light grey (N7), largely felsic mineralogy, coarse grained, unweathered				R20 = 11.3 min	
>10											
175.2	R21 2 ft 100%	20			>10						R21 = 12.2 min
>10											
177.2	R22 4.3 ft 100%	81	>10	178.1, 178.3, 178.7' - Joint, 45, 45, 85 deg, rough, undulating, < 1 mm fine-grained white sediment/silt (no reaction to HCl) infilling, no staining, moderately tight	179.4' - fine grained						
3											
1											
180											



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 10 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.00 ft		APPLIC: 66 R-000		START: 1/29/2009		END: 1/27/2009		LOGGERS: J. Brown, (R. N. Star)			
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY		COMMENTS			
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.				
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS							
185	181.5		1	179.7, 180.7' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated  182.3-183.2' - coarse grained  184.5-185.0' - increase in felsic minerals  187.0-195.2' - medium grained	R22 = 24.0 min				
	R23 4.5 ft 100%	>10	181.2-181.5' - Fracture zone, rough, undulating, reddish staining, no dominant orientation, tight								
		0									
		0									
		3	184.0, 184.1, 184.5' - Joint, 60 deg, rough, undulating, < 3 mm white silt/clay infilling (no HCl reaction, greasy when wet), no staining, tight								
	186.0		1	185.6, 186.8, 186.9' - Joint, 25, 25, and 55 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight					R23 = 17.8 min		
	R24 6.5 ft 100%	2									
		>10	187.2-187.9' - Fracture zone, rough, undulating, < 1 mm calcite infilling, reddish staining, no dominant orientation, moderately tight								
		3	188.3, 2 at 188.7' - Joint, 60, 85, and 85 deg, rough, undulating, < 1 mm calcite infilling, rusty staining, tight								
		2	189.1, 189.6, 190.3' - Joint, 75, 15, and 75 deg, rough, undulating, < 2 mm calcite infilling, rusty staining, moderately tight								
1											
192.5			>10	191.5-192.5' - Fracture zone, rough, undulating, rusty staining, no dominant orientation, tight		R24 = 39.0 min					
R25 3.5 ft 100%	1	193.3, 194.1, 194.3, 194.7' - Joint, 25 deg, rough to smooth, undulating, rusty staining, tight									
	3										
	>10	195.0-198.8' - Fracture zone, rough, undulating, reddish staining, no dominant orientation, tight									
196.0		>10			195.2-197.3' - yellowish grey (5Y 8/1), largely felsic minerals, fine grained, unweathered		R25 = 13.0 min				
R26 2.6 ft 100%	>10										
	>10										
	>10	198.1, 199.4, 199.7' - Joint, 30 deg, rough, stepped to undulating, < 1 mm calcite infilling, reddish staining, tight									
198.6		>10							R26 = 17.7 min		
		3									
200											



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58** SHEET 11 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

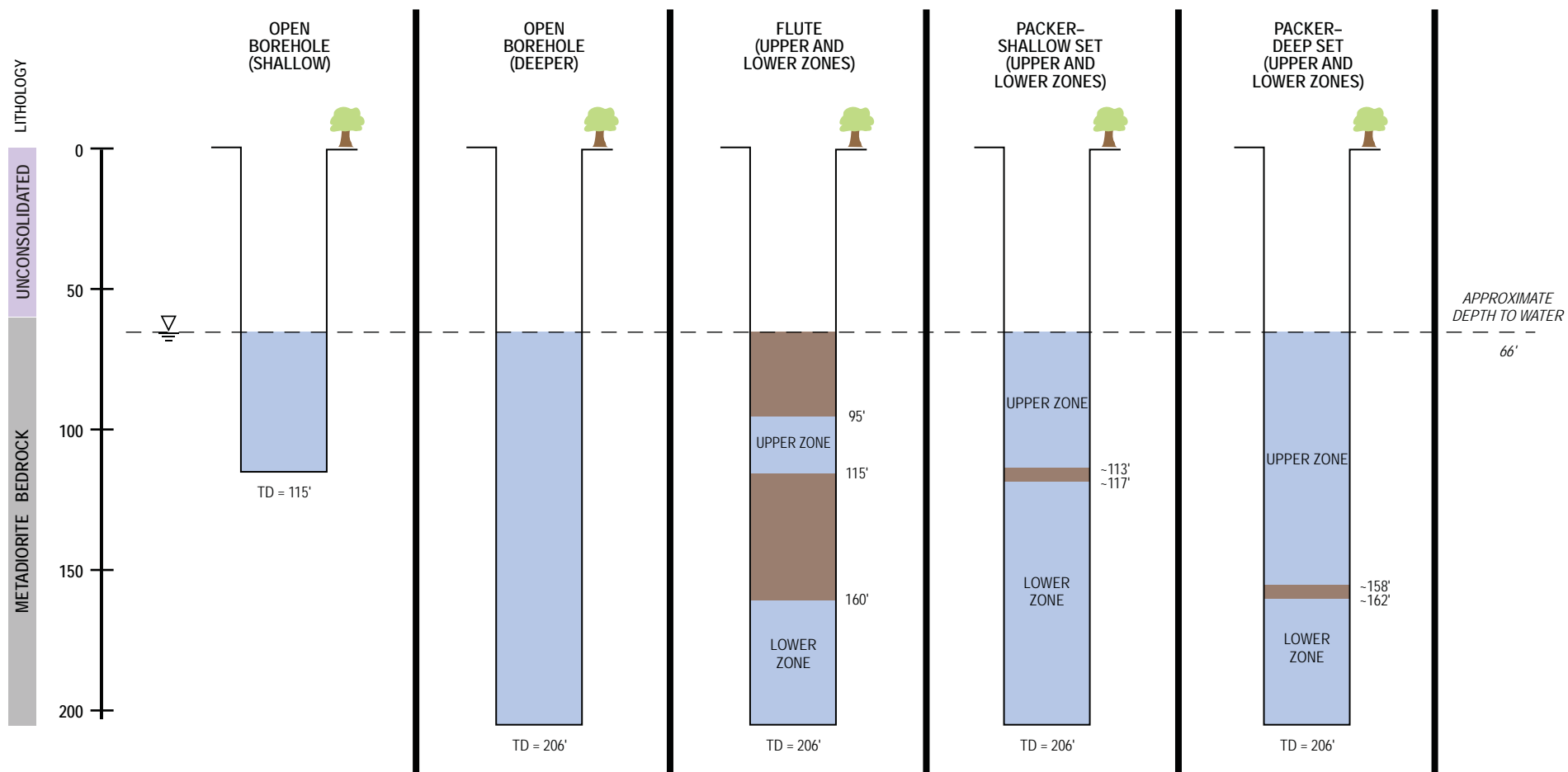
WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: Approx. 66 ft bgs		START : 1/29/2009		END : 3/27/2009		LOGGERS : A. Brewster (Northstar)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
203.0  							



#### LEGEND

- Portion of borehole exposed during sample collection
- Portion of borehole sealed during sample collection

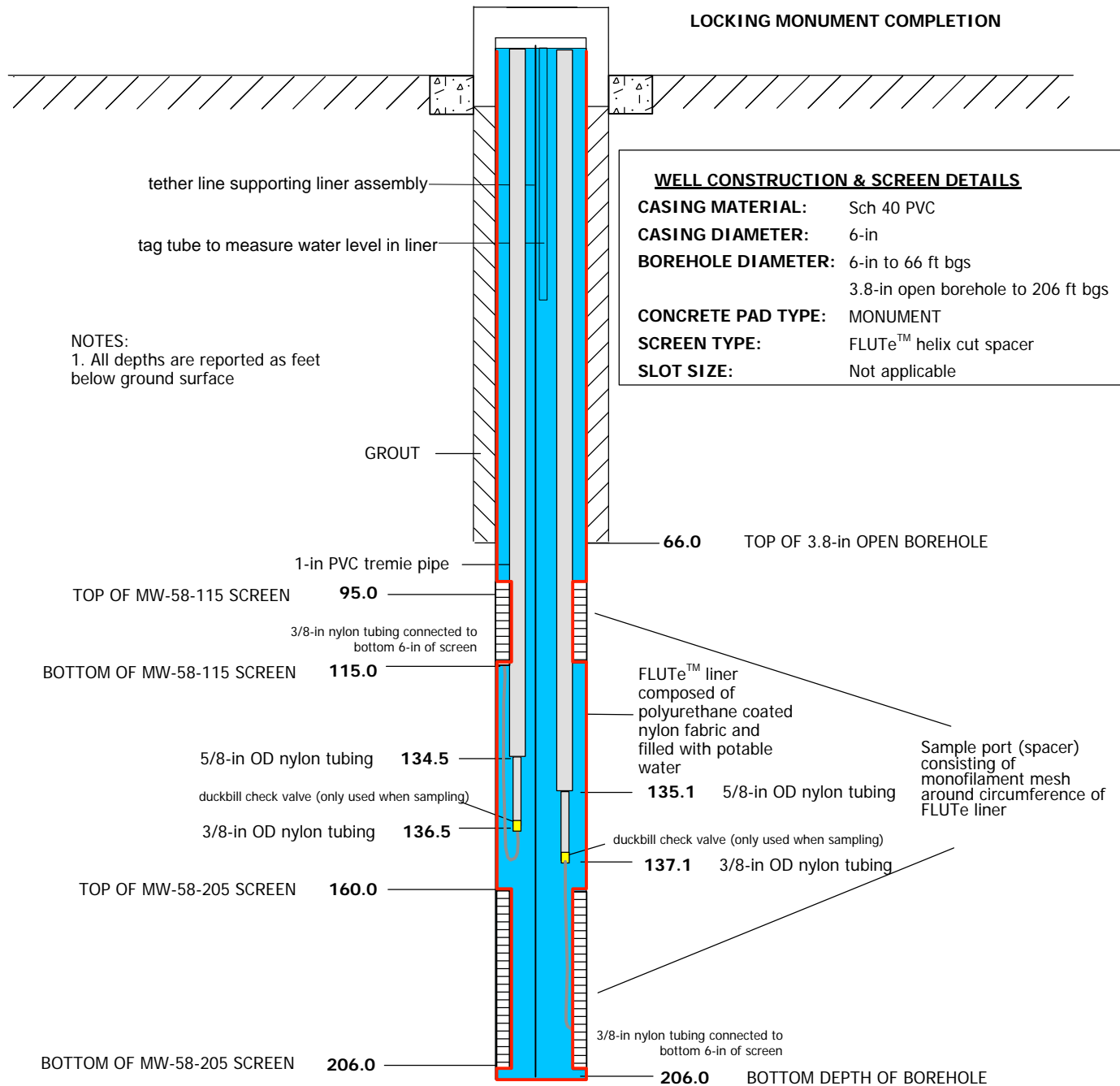
#### NOTES:


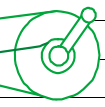
- Scale is approximate.
- All depths presented as feet below ground surface.

MW-58BR Sampling Configurations  
PG&E Topock Compressor Station  
Needles, California

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO's:</b> <i>MW-58-115</i> <i>MW-58-205</i>
<b>LOCATION:</b> Site A		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 1/29/2009	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 2/12/2009	
<b>LOGGER:</b> A. Brewster (Northstar) and I. Wood	<b>WELL COMPLETION DATE:</b> 7/8/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 521.78 ft AMSL	<b>GENERAL REMARKS:</b> 4-inch diameter, 2-port Guelph Water FLUTE™ multi-level system with helical screens installed into open 3.8-inch HQ borehole	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100612.06		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616131.80		



 <b>Flexible Liner Underground Technologies, Ltd. L.C.</b>			
		<i>For a medley of innovative designs</i>	
		6 Easy St., Santa Fe, NM 87506 505-455-1300, <a href="http://www.flut.com">www.flut.com</a>	
<b>As-Built Information</b>		<b>Job #</b>	968-1
<b>General:</b>			
<b>Job Description:</b>		206' 4"dia. 2 Port Guelph Water FLUTe	
<b>Customer:</b>		CH2M Hill	
<b>Location:</b>		155 Grand Ave. Suite 1000 Oakland, CA 94612	
<b>Well Designation:</b>		MW-58BR	
<b>Hole Depth:</b>		206'	
<b>Water Table:</b>		67'	
<b>Drilling Method:</b>		N/A	
<b>Casing Information:</b>		N/A	
<b>Installation Method:</b>		Water eversion	
<b>Bubbler / Tag:</b>		67'	
<b>Liner:</b>			
<b>Material:</b>		210d Orange d/c 2 sleeve	
<b>Diameter:</b>		4"	
<b>Material Above Casing:</b>		3'	
<b>Uneverted Material:</b>		4'	
<b>Rough Fabrication Legnth:</b>		216'	
<b>Termination:</b>		End Seal Knot	
<b>Knot Diameter Allowance:</b>		2"	
<b>Markings on Liner:</b>		Ink stamp indicating FLUTe TOC & FLUTe Job# 968-1	
<b>Spacer Design:</b>		2 Material helix cut spacer Design (orange mesh) and Mylar	
	<b>Spacer #</b>	<b>Spacer Bottom [ft]</b>	<b>Spacer Top [ft]</b>
	1	115'	95'
	2	206'	160'

<b>Tubing &amp; Ports:</b>							
<b>Tubing In Bundle:</b>		NYLON					
<b>Tubing In Sleeves:</b>		NYLON					
<b>Bubbler Details:</b>		1/4 NYLON					
<b>Port Design:</b>		Superthane feed thru					
<b>Port Locations:</b>		6" @ bottom of spacer					
<b>Vent Design:</b>		1/4 Superthane feed thru w/ 3/8 tygon tubing connected to duct					
<b>Vent Location:</b>		210'					
<b>Pump Assembly:</b>							
<b>Port #:</b>	<b>Transducer Serial #:</b>	<b>Transducer Pressure Rating [psi]:</b>	<b>Diaphragm Depth [ft. btoc]</b>	<b>Cable Serial #:</b>	<b>Cable Length [ft.]</b>	<b>5/8 x 3/8</b>	<b>3/8 x 1/4</b>
1						134'.5"	136'.5"
2						135'	137'

<b>Other Info:</b>							
<b>Transducer Type:</b>		N/A					
<b>Kellum Design:</b>		1" Friction Kellum wrap Below Unions 1" Webbing with blue high					
<b>Kellum Locations:</b>		1st kellum @ 18' btoc: others every 40 there after					
<b>Tether:</b>		1/4"					
<b>Marking on Tubing:</b>		Port #'s and color code					
<b>Marking on Cables:</b>		Port #'S					
<b>Bundle Sheating:</b>		White 2.25" starting @ 134'					
<b>Marks on Bundle:</b>		E.P. markings @ every 40'					
<b>Pump Tube:</b>		216'					
<b>Reel / Packaging:</b>		SF FLUTe					
<b>Casing Adapter Info:</b>		ABQ FLUTe					
<b>Wellhead Info:</b>		ABQ FLUTe					
<b>Vent Tube:</b>		n/a					
<b>Clamps:</b>		ABQ FLUTe					
<b>Shipped Via:</b>		ABQ FLUTe					
<b>Other Notes:</b>		Port # 1 Protrudes @ 134'.5" Top Of Tube @ 131" W/ red cap:					
		Port # 2 Protrudes @ 135' Top Of Tube @ 133' W/ red cap:					





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 1 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools


ORIENTATION : Vertical

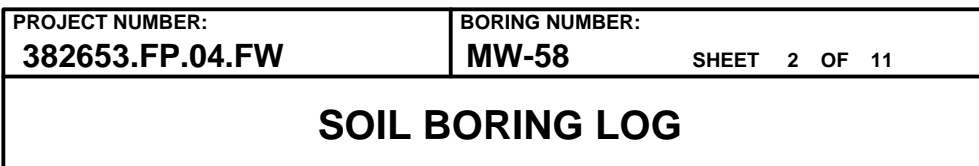
WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
1.5 2.0	COMPLETE	14:00	ML	<b>Silt With Sand(ML)</b> 0.0-2.0' - brown, (7.5YR 4/4), dry, loose, 0% gravel, 20% sand, 80% fines, sand is angular to subangular, poorly graded, no dominant mineralogy		Boring initially drilled to 65.5' bgs using Rotosonic tools up to 10-in in diameter. Permanent 6-in PVC conductor casing installed from ground surface to 65.5' bgs (portland cement grout). Boring drilled from 65.5' bgs to an initial total depth of 115' bgs using diamond bit rotary core tools (HQ- size, 3.8-in diameter). Following testing, boring was deepened to a total depth of 206' bgs using rotary core tools.	
				<b>Silty Gravel With Sand(GM)</b> 2.0-17.0' - brown, (7.5YR 4/3), dry, loose, 40% gravel, 30% sand, 30% fines, gravel is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 90 mm.			
				<b>Silty Sand With Gravel(SM)</b> 16.0-51.0' - brown, (7.5YR 4/3), dry, loose, 15% gravel, 60% sand, 25% fines, gravel is angular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 100 mm			
19.0 20.0		14:50					



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
		COMPLETE		SM	<b>Silty Sand With Gravel(SM)</b> 16.0-51.0' - brown, (7.5YR 4/3), dry, loose, 15% gravel, 60% sand, 25% fines, gravel is angular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 100 mm		
25							
	29.0						
30	30.0	15:10					
35							
	39.0						
40	40.0	16:30					



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58** SHEET 3 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: APPROX. 56 RDS			START: 7/29/2009		END: 8/27/2009		LOGGERS: J.A. Browster (Rothstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY				
45		COMPLETE	SM	<b>Silty Sand With Gravel(SM)</b> 16.0-51.0' - brown, (7.5YR 4/3), dry, loose, 15% gravel, 60% sand, 25% fines, gravel is angular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 100 mm				
50	49.0 50.0	17:10						
			ML	<b>Silt (ML)</b> 51.0-53.0' - dark brown, (7.5YR 3/2), dry, stiff, 0% gravel, 0% sand, 100% fines, no apparent structure, max clast size = 20 mm. Occurrence of lenses of white clayey silt up to 10 mm thick, cohesive.				
55			SP	<b>Poorly Graded Sand With Gravel(SP)</b> 53.0-60.0' - dark yellowish brown, (10YR 4/6), dry, loose to medium dense, 30% gravel, 65% sand, 5% fines, sand is fine to medium grained, subangular to subrounded, poorly graded, no dominant mineralogy, matrix supported, max clast size = 30 mm.				
60	59.0 60.0	17:30						
				Begin rock coring from 65.5 ft bgs See the next page for the rock core log.			Total depth of Rotosonic boring is 65.5 ft bgs. Install permanent 6-in conductor casing (portland cement grout). See rock core log for 60.0-65.5 lithologic description.	



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 4 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
60.0						<b>Metadiorite(pTbr)</b> 60.0-62.0' - Metadiorite. Highly weathered.	
65						<b>Metadiorite(pTbr)</b> 62.0-65.5' - Metadiorite. Rock is competent, but shattered and partially pulverized by Rotasonic drilling method.	
65.5	R1 3 ft 100%	13	>10	65.5-70.0' - core recovered, but largely broken by drilling.		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	65.5': Begin rotary core drilling General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling.
68.5	R2 1 ft 100%	0	1	68.5' - Joint, 50 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
69.5	R3 0.5 ft 100%	0	>10				
70							
70.0							
			1				
			0	70.9' - Joint, 30 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			3	72.2' - Joint, 35 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			1	72.7' - Joint (2), 40 deg and 60 deg, rough, undulating, < 1 mm calcite infilling, yellowish staining on 40 deg face, tight			
			0	73.9' - Joint, 40 deg, rough, undulating, yellowish silty infill (< 1 mm) and < 1 mm calcite infilling, yellowish staining, tight			
75			3	75.2' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			0	75.7, 76.0' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			1	77.2' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			2	78.3' - Joint, 40 deg, rough, stepped, no staining, tight			
			2	78.8' - Joint, 60 deg, rough, undulating, no staining, tight			
80	R5 8.5 ft 100%	67					R4 = 23.3 min



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58** SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
85	R6 1.5 ft 100%	80	1	79.3, 79.6' - Joint, 40 deg, rough, undulating, no staining, tight		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R5 = 39.2 min  R6 = 4.5 min  R7 = 19.6 min  R8 = 30.5 min R9 = 4.5 min  R10 = 23.3 min
			>10	80.4' - Joint, 15 deg, rough, undulating, some red staining, tight			
			2	81.1' - Joint, 15 deg, rough, undulating, < 0.5 mm calcite infilling, no staining, tight			
			1	81.4-82.1' - Fracture zone, rough, undulating, < 1 mm calcite infilling, no staining, tight, 60 deg dip at 82.1'			
	R7 4.4 ft 100%	32	1	82.5-84.0' - Joint, near 90 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight			
			1	84.9' - Joint, 25 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			2	85.3, 85.5' - Joint, 40 deg, rough, stepped, < 0.5 mm calcite infilling, no staining, tight			
			>10	86' - Joint, 10 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			>10	86.4' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, yellowish staining, tight, 86.4-88.9' multiple fractures, rough, undulating, minor calcite growth (< 1 mm), some yellowish staining, tight. 60 deg dip at 88.9'.			
			>10				
90	R8 4.5 ft 100%	51	>10	90.3' - Joint, 30 deg, rough, undulating, no staining, tight			
			2	90.5-90.9' - Fracture zone, rough, undulating, no staining, tight, 60 deg dip at 90.9'			
			2	90.9' - Joint, 60 deg, rough, undulating, reddish staining, tight			
			>10	91.5' - Joint, 30 deg, rough, undulating, reddish staining, tight			
	R9 1 ft 100%	33	>10	92.4' - Joint, 10 deg, rough, undulating, calcite infilling, no staining, tight			
			>10	92.8' - Joint, 40 deg, rough, undulating, reddish staining, tight			
			>10	93.4-93.9' - Fracture zone, rough, undulating, brownish-grey microcrystalline infill (< 1 mm), reddish-yellow staining, tight, no reaction to HCl			
			>10	94.6-97.8' - Multiple healed fractures, rough, undulating, > 3 mm black infill, some rust-colored staining, tight.			
			>10	96.1' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			>10	97.0, 97.9' - Joint, 60 deg, rough, undulating, no staining, tight			
95	R10 4.6 ft 100%	17	>10	97.9-100.0' - Fracture zone, rough, undulating, < 1 mm black infill, reddish staining			
			>10				
100	100.0						



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 6 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.10 ft		DATE: 06/01/2009		START: 11/29/2009		END: 10/27/2009		LOGGERS: J. BROWN (R.N.M.S.)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS		
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
105	R11 5.5 ft 100%	100	1	100.4' - Joint, 40 deg, rough, undulating, no staining, tight		<b>Metadiorite (pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R11 = 21.9 min		
			0						
			0						
			2	103.1' - Joint, 20 deg, rough, undulating, < 0.5 mm calcite infilling, no staining, tight					
			1	103.9' - Joint, 40 deg, rough, undulating, < 0.5 mm calcite infilling, no staining, tight					
0	104.2' - Joint, 40 deg, rough, undulating, < 0.5 mm calcite infilling, some red staining, tight								
1	106.4' - Joint, 40 deg, rough, undulating, no staining, tight								
0									
>10	108.3-108.7' - Fracture zone, rough, undulating, no staining, tight								
0									
110	R12 9.7 ft 100%	79	0						
			0						
			1	111.1' - Joint, 30 deg, rough, undulating, no staining, tight					
			0						
			1	113' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight					
115	R12 9.7 ft 100%	79	2	114.1' - Joint, 40 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight					R12 = 36.7 min
			1	114.7' - Joint, 15 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight					
			1	115.3, 116.7, 116.8' - Joint, 35 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight					
			2						
			0						
120	R12 9.7 ft 100%	79	1	118.5' - Joint, 55 deg, rough, undulating, < 5 mm calcite infilling, no staining, tight			Drilling to 115.2 ft bgs ends on 2/4/2009, following testing, drilling resumes on 3/25/2009.		
			0						



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 7 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
125	R13 10.8 ft 100%	100	1	120.7' - Joint, 35 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R13 = 25.1 min
			0				
			0				
			2	123.4, 123.5' - Joint, 35 deg and 45 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			1	124.5' - Joint, 70 deg, rough, undulating, < 1 mm calcite infilling, no staining, moderately tight			
			0				
130	R14 6.5 ft 100%	65	0			130.2-132.5' - slightly weathered	R14 = 20.3 min
			1	127.2' - Joint, 65 deg, rough, undulating, < 2.5-inch dark reddish brown (10R 3/4) consolidated fine sediment infilling, no staining, tight			
			0				
			0				
			>10	130.2-132.5' - Fracture zone, rough, undulating to stepped, < 2 mm calcite infilling, reddish staining, no dominant orientation			
			>10				
135	R15 3.7 ft 100%	100	>10				R15 = 14.5 min
			0				
			0				
			1	135.7' - Joint, 15 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			0				
			0				
140			0				
			0				
			0				
			0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58** SHEET 8 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
145	R16 10.2 ft 100%	100	0			<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R16 = 33.0 min
			0				
			0				
			1				
			1	143.9, 144.6' - Joint, 40 deg, rough, undulating to stepped, < 5 mm calcite infilling, no staining, moderately tight			
			3	145.1, 145.3, 145.5' - Joint, 40 deg, rough, undulating, < 5 mm calcite infilling, reddish staining, tight to moderately tight			
146.4			0				
			1	147.4' - Joint, 40 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
			2	148.1, 148.3, 149.6' - Joint, 65 deg, rough, undulating, < 5 mm calcite infilling, reddish staining, tight			
150			1				
	R17 9.8 ft 100%	90	1	150.1, 152.9, 153.4, 154.5' - Joint, 25, 25, and 65 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			R17 = 37.8 min
			0				
			1				
			1				
155			1				
			1	155.0, 156.1, 156.4, 156.7' - Joint, 30 deg, rough, undulating, < 1 mm calcite infilling, dark red to black staining, tight			
156.2			3				
			0				
			1	158.5' - Joint, 85 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			
160			0				







PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-58**

SHEET 10 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site A (2100612.1 N, 7616131.8 E)

ELEVATION : 521.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

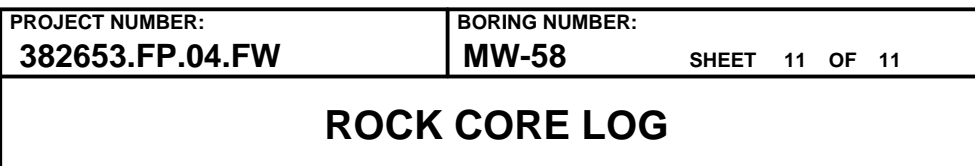
WATER LEVELS : Approx. 66 ft BGS

START : 1/29/2009

END : 3/27/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.00 ft		APPLIC: 66 R-000		START: 1/29/2009		END: 1/27/2009		LOGGERS: J. Brown, (R.N. Star)		
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY		COMMENTS		
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS						
185	181.5		1	179.7, 180.7' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight		<b>Metadiorite(pTbr)</b> 65.5-206.0' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated  182.3-183.2' - coarse grained	R22 = 24.0 min			
	R23 4.5 ft 100%	>10	181.2-181.5' - Fracture zone, rough, undulating, reddish staining, no dominant orientation, tight							
		0								
		0								
		3	184.0, 184.1, 184.5' - Joint, 60 deg, rough, undulating, < 3 mm white silt/clay infilling (no HCl reaction, greasy when wet), no staining, tight							
	186.0		1	185.6, 186.8, 186.9' - Joint, 25, 25, and 55 deg, rough, undulating, < 2 mm calcite infilling, no staining, tight					184.5-185.0' - increase in felsic minerals	R23 = 17.8 min
	R24 6.5 ft 100%	2								
		>10	187.2-187.9' - Fracture zone, rough, undulating, < 1 mm calcite infilling, reddish staining, no dominant orientation, moderately tight							
		3	188.3, 2 at 188.7' - Joint, 60, 85, and 85 deg, rough, undulating, < 1 mm calcite infilling, rusty staining, tight							
		2	189.1, 189.6, 190.3' - Joint, 75, 15, and 75 deg, rough, undulating, < 2 mm calcite infilling, rusty staining, moderately tight							
1										
>10		191.5-192.5' - Fracture zone, rough, undulating, rusty staining, no dominant orientation, tight								
192.5		>10			187.0-195.2' - medium grained	R24 = 39.0 min				
R25 3.5 ft 100%	1	193.3, 194.1, 194.3, 194.7' - Joint, 25 deg, rough to smooth, undulating, rusty staining, tight								
	3									
	>10	195.0-198.8' - Fracture zone, rough, undulating, reddish staining, no dominant orientation, tight								
196.0		>10					195.2-197.3' - yellowish grey (5Y 8/1), largely felsic minerals, fine grained, unweathered	R25 = 13.0 min		
R26 2.6 ft 100%	>10									
	>10									
198.6		>10	198.1, 199.4, 199.7' - Joint, 30 deg, rough, stepped to undulating, < 1 mm calcite infilling, reddish staining, tight						R26 = 17.7 min	
		3								
200										



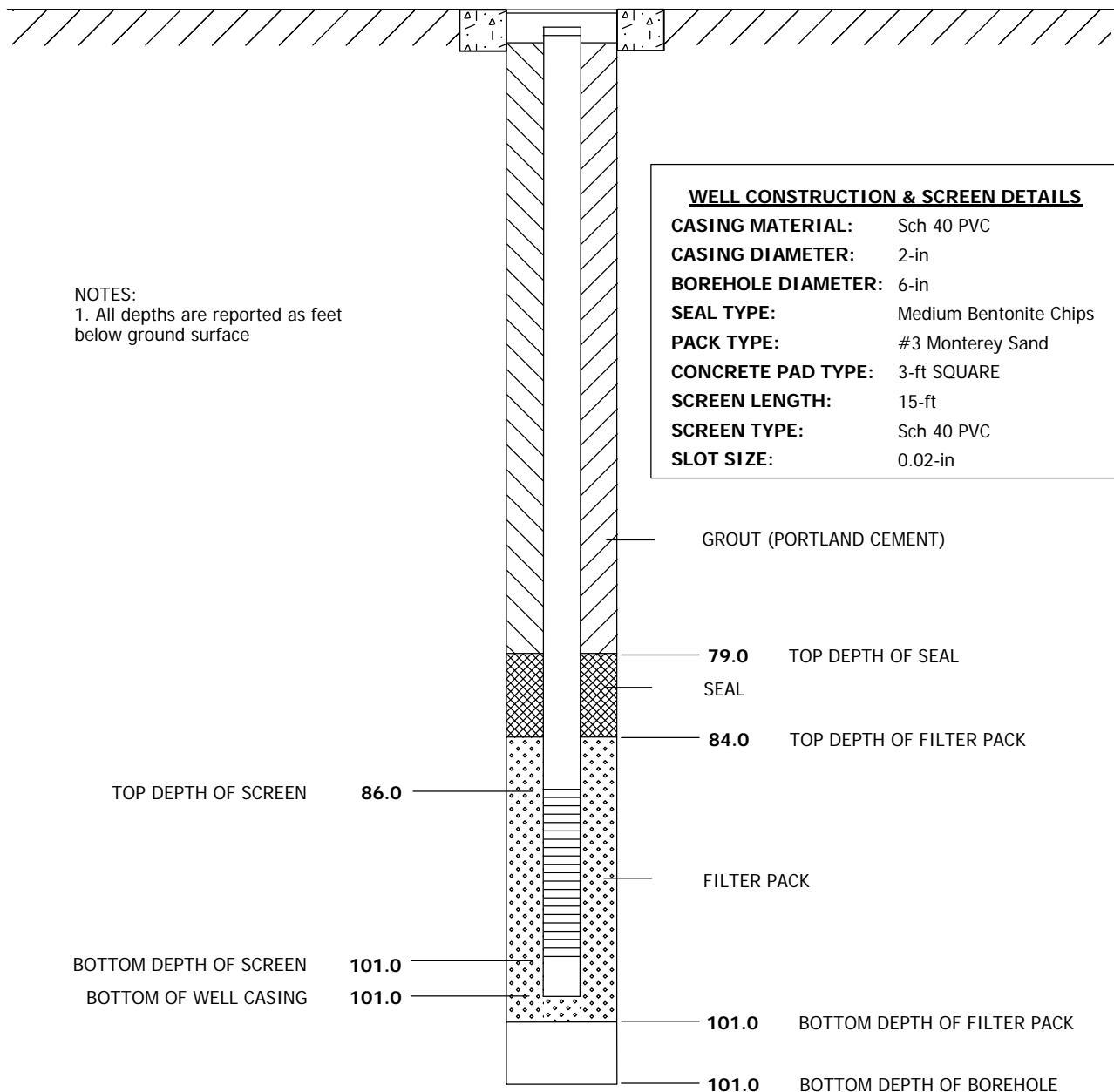
LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)		CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
			R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
						DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
205		R27 4.4 ft 100%	39	3		<b>Metadiorite(pTbr)</b> 199.1-206.0' - greenish gray, (5GY 6/1), intermediate (dioritic) mineralogy, medium grained, strong (R4), unweathered, massive to foliated	R27 = 27.0 min	
			0					
	203.0		>10	200.1, 200.6, 200.9' - Joint, 60, 30, and 30 deg, rough, undulating to stepped, < 1 mm calcite infilling, reddish staining, moderately tight				
			>10	202.0-206.0' - Fracture zone, rough, undulating to stepped, < 3 mm calcite infilling, reddish staining, moderately tight				
		R28 3 ft 100%	17	>10				
				>10				
				>10				
		206.0				End Drilling on 3/27/2009 Total Borehole Depth: 206.0 ft bgs		
210								
215								
220								

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i>MW-59-100</i>
<b>LOCATION:</b> Site G		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 2/25/2009	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 2/26/2009	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 2/26/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 538.94 ft AMSL	<b>GENERAL REMARKS:</b> Alias during field work: MW-59	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100851.96		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616081.90		

## 12-IN DIAMETER MONUMENT CASING



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-59**

SHEET 1 OF 6

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site G (2100852.0 N, 7616081.9 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 84 ft BGS

START : 2/25/2009

END : 2/26/2009


LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
LAB SAMPLE							
5	COMPLETE			<b>Silty Sand (SM)</b> 0-82.0' - brown, (10YR 4/3), dry, loose, 10% gravel, 75% sand, 15% fines, angular to subangular, poor to moderate grading, matrix supported, max clast size = 80 mm.		Target depth of boring is 15 feet past static water level.	
				3.5-18.5' - yellowish brown, (10YR 5/4)			
10				SM			
15							
20					18.5-71.0' brown, (10YR 4/3)		



<b>PROJECT NUMBER:</b> <b>382653.FP.04.FW</b>	<b>BORING NUMBER:</b> <b>MW-59</b>
SHEET 2 OF 6	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock - ERGI	LOCATION : Site G (2100852.0 N, 7616081.9 E)
ELEVATION : 538.9 ft	DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 84 ft BGS	START : 2/25/2009      END : 2/26/2009      LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPENDIX 64 R.D.S.				START : 2/20/2009		END : 2/20/2009		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
INTERVAL (ft)		RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
		LAB SAMPLE							
		COMPLETE		SM	<b>Silty Sand (SM)</b> 0-82.0' - brown from 18.5', (10YR 4/3), dry, loose, 10% gravel, 75% sand, 15% fines, angular to subangular, poor to moderate grading, matrix supported, max clast size = 80 mm.				
25									
30									
35									
40									



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-59**

SHEET 3 OF 6

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site G (2100852.0 N, 7616081.9 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools


ORIENTATION : Vertical

WATER LEVELS : Approx. 84 ft BGS

START : 2/25/2009

END : 2/26/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: TYPICAL: 0.4 ft BGS		START: 2/20/2009		END: 2/20/2009		ESSER: A. Browster (Horizontal)	
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
RECOVERY (in)		LAB SAMPLE					
COMPLETE							
45		SM	<b>Silty Sand (SM)</b> 0-82.0' - brown from 18.5', (10YR 4/3), dry, loose, 10% gravel, 75% sand, 15% fines, angular to subangular, poor to moderate grading, matrix supported, max clast size = 80 mm.				
50							
</							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-59**

SHEET 4 OF 6

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site G (2100852.0 N, 7616081.9 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 84 ft BGS

START : 2/25/2009

END : 2/26/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: TOP OF SPRING				START: 2/20/2009		END: 2/20/2009		ESSER: A. Brower (Horizontal)	
DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
INTERVAL (ft)		RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
LAB SAMPLE									
65		COMPLETE		SM	<b>Silty Sand (SM)</b> 0-82.0' - brown from 18.5', (10YR 4/3), dry, loose, 10% gravel, 75% sand, 15% fines, angular to subangular, poor to moderate grading, matrix supported, max clast size = 80 mm.				
70					71.0-82.0' brown, (7.5YR 4/3)				
75									
80									





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-59**

SHEET 5 OF 6

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site G (2100852.0 N, 7616081.9 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 84 ft BGS

START : 2/25/2009

END : 2/26/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
		COMPLETE		SM	<b>Silty Sand (SM)</b> 0-82.0' - brown from 71.0', (7.5YR 4/3), dry, loose, 10% gravel, 75% sand, 15% fines, angular to subangular, poor to moderate grading, matrix supported, max clast size = 80 mm.			
85				SP	<b>Poorly Graded Sand With Gravel (SP)</b> 82.0-101.0' - dark brown, (10YR 3/3), dry, loose to medium dense, 40% gravel, 60% sand, 0% fines, subangular to subrounded, poorly graded, matrix supported, max clast size = 50 mm. 83.0' - moist 84.0' - saturated			
90								
			</					



<b>PROJECT NUMBER:</b> <b>382653.FP.04.FW</b>	<b>BORING NUMBER:</b> <b>MW-59</b>
SHEET 6 OF 6	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock - ERGI	LOCATION : Site G (2100852.0 N, 7616081.9 E)
ELEVATION : 538.9 ft	DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 84 ft BGS	START : 2/25/2009      END : 2/26/2009      LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPENDIX 64 R BGS				START : 2/20/2009		END : 2/20/2009		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION						
	LAB SAMPLE								
	COMPLETE			SP	<b>Poorly Graded Sand With Gravel (SP)</b> 82.0-101.0' - mixture of very dark greyish brown, (10YR 3/2), and dark reddish brown, (5YR 3/4), from 97.0', loose to medium dense, 40% gravel, 60% sand, 0% fines, subangular to subrounded, poorly graded, saturated from 84.0', matrix supported, max clast size = 50 mm. End Drilling on 2/26/2009 Total Borehole Depth: 101.0 ft bgs				
105									
110									
115									
120									

# WELL COMPLETION DIAGRAM

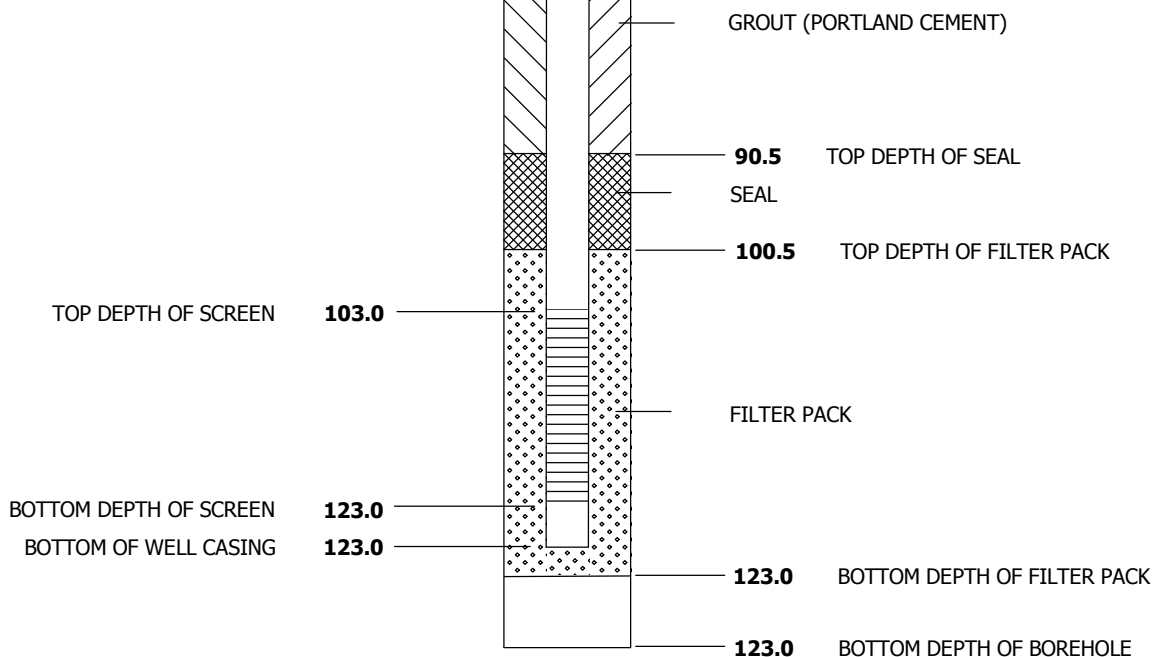
<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i><b>MW-60-125</b></i>
<b>LOCATION:</b> Site F		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 2/27/2009	
<b>DRILLING METHOD:</b> Rotary Core (HQ) - Rotasonic overdrill	<b>DRILLING END:</b> 3/3/2009	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 3/3/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 555.78 ft AMSL	<b>GENERAL REMARKS:</b> Alias during field work: MW-60	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100491.63		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616434.82		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)

NOTES:  
1. All depths are reported as feet below ground surface

### WELL CONSTRUCTION & SCREEN DETAILS

<b>CASING MATERIAL:</b>	Sch 40 PVC
<b>CASING DIAMETER:</b>	2-in
<b>BOREHOLE DIAMETER:</b>	6-in
<b>SEAL TYPE:</b>	Medium Bentonite Chips
<b>PACK TYPE:</b>	#3 Monterey Sand
<b>CONCRETE PAD TYPE:</b>	3-ft SQUARE
<b>SCREEN LENGTH:</b>	20-ft
<b>SCREEN TYPE:</b>	Sch 40 PVC
<b>SLOT SIZE:</b>	0.02-in



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-60**

SHEET 1 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools


ORIENTATION : Vertical

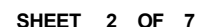
WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS : APPROX. 90 ft BGS		START : 2/27/2009		END : 3/3/2009		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)		LAB SAMPLE				
5	COMPLETE			SM	<b>Silty Sand (SM)</b> 0.0-9.0' - dark yellowish brown, (10YR 4/4), dry, loose, 15% gravel, 60% sand, 25% fines, angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 60 mm.		Boring initially drilled to 86.5' bgs using Rotosonic tools up to 6-in in diameter. 6-in conductor casing then used as a temporary conductor casing to facilitate rotary core drilling. Boring drilled from 86.5' bgs to a total depth of 123.0' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter), and then overdrilled to total depth using 6-in Rotosonic tools.
10				pTbr	<b>Metadiorite (pTbr)</b> 9.0-86.5' - bedrock is consolidated. Drilling method pulverizes most of the core. Intact portions of core are described, as appropriate.		
15					16.0-26.0'- greyish green (5G 5/2), fine grained, some calcite infill (1 mm max) and reddish staining observed on fracture surfaces		
20							

[illegible]



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-60**

SHEET 3 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS: TOP OF SOIL LOG		START: 2/27/2009		END: 3/30/2009		ESSER: A. Browder (Horizontal)	
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
				RECOVERY (in)			
				LAB SAMPLE			



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-60**

SHEET 4 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools


ORIENTATION : Vertical

WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.00 ft. COR. 0.00				START: 12/27/2009		END: 1/30/2010		LOGGERS: A. Browder (Horizontal)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
65		COMPLETE		pTbr	<b>Metadiorite (pTbr)</b> 36.0-73.0'- dusky green (5G 3/2), fine grained, no infill, very little reddish staining on fracture surfaces		73.0-86.5'- Nearly 100% of core recovered is intact.		
70									
75									
80					73.0-86.5'- dusky green (5G 3/2) rock mass with very light grey (N8) mottling, medium grained, calcite infill and reddish staining on fracture surfaces				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-60**

SHEET 5 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools


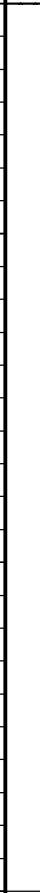
ORIENTATION : Vertical

WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

WATER LEVELS / DEPTH: SOIL LOG		START: 2/27/2009		END: 3/31/2009		LOGGERS: A. Browder, R. Hunsley	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)	LAB SAMPLE					
85	86.5	COMPLETE		pTbr	73.0-86.5'- dusky green (5G 3/2) rock mass with very light grey (N8) mottling, medium grained, calcite infill and reddish staining on fracture surfaces		Total depth of initial Rotosonic boring is 86.5 ft bgs. Begin rotary core drilling.
90					Begin rock coring from 86.5 ft bgs See the next page for the rock core log.		
95							
100							





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-60**

SHEET 6 OF 7

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
86.5	R1 3 ft 100%	0	>10	86.5-89.5' - Fracture zone, rough, undulating, < 1 mm calcite infilling, reddish staining, no dominant orientation		<b>Metadiorite (pTbr)</b> 86.5-123.0' - dusky green, (5G 3/2), intermediate (dioritic) mineralogy, medium grained, unweathered, massive to foliated	General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling. R1 = 23.0 min
89.5			>10				
			>10				
90			>10	89.5-96.5' - Fracture zone, 30 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			
			2				
			2				
	R2 7 ft 100%	53	3				
			2				
95			>10				
			>10				
96.5			0			92.0' - fine grained	R2 = 36.0 min
			1	97' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight			
			0				
			1				
100			1	100' - Joint, 60 deg, rough, undulating, < 1 mm calcite infilling, no staining, tight			
	R3 9.9 ft 100%	48	2	100.5-105.0' - Fracture zone, 30 deg and 60 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, rusty staining at 102.5' and 103.6', tight.			
			1				
			1				
105			1				
			0				
106.4						104.5' - medium grained	R3 = 50.0 min



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-60**

SHEET 7 OF 7

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site F (2100491.6 N, 7616434.8 E)

ELEVATION : 555.8 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 98 ft BGS

START : 2/27/2009

END : 3/3/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
110	R4 6 ft 100%	90	1	107.5' - Joint, 70 deg, rough, undulating, < 1 mm calcite infilling, reddish staining, tight		<b>Metadiorite (pTbr)</b> 86.5-123.0' - dusky green, (5G 3/2), intermediate (dioritic) mineralogy, medium grained, unweathered, massive to foliated	
			1				
			0				
			0			110.5' - coarse grained	
			0				
			0				
112.4			1	112.0-115.0' - Fracture zone or mechanical break, 30 deg and 60 deg, < 1 mm calcite infilling, rusty-reddish staining, tight, likely mechanical breaks along healed joints		112.0' - fine grained	R4 = 33.0 min
	R5 3.6 ft 100%	0	1				
			1			113.5' - yellow-orange staining	
115			1				
			>10	115.0-116.0' - Fracture zone, rough, undulating, no staining, no dominant orientation			
116.0			1	116.0-123.0' - Fracture zone, 30 deg, rough, undulating, < 0.05 mm calcite infilling, no staining, tight			R5 = 45.0 min
	R6 7 ft 100%	77	1				
			1				
			2				
120			1				
			0				
			1			121.0-122.0' - yellow-orange staining	
			1				R6 = 31.0 min
123.0							
						End Drilling on 3/3/2009 Total Borehole Depth: 123.0 ft bgs	
125							

# WELL COMPLETION DIAGRAM

**PROJECT NO:** 417981.ER.02.FW

**PROJECT:** ER-TCS Groundwater Investigation

**WELL NO:** ***MW-60BR-245***

**LOCATION:** Site F

**DRILLING CONTRACTOR:** Boart Longyear (R. Sawrey)

**DRILLING START:** 6/28/2011

**DRILLING METHOD:** Rotosonic/Wireline Rotary Core

**DRILLING END:** 7/28/2011

**LOGGER:** C. Keller (Northstar)

**WELL COMPLETION DATE:** 7/28/2011

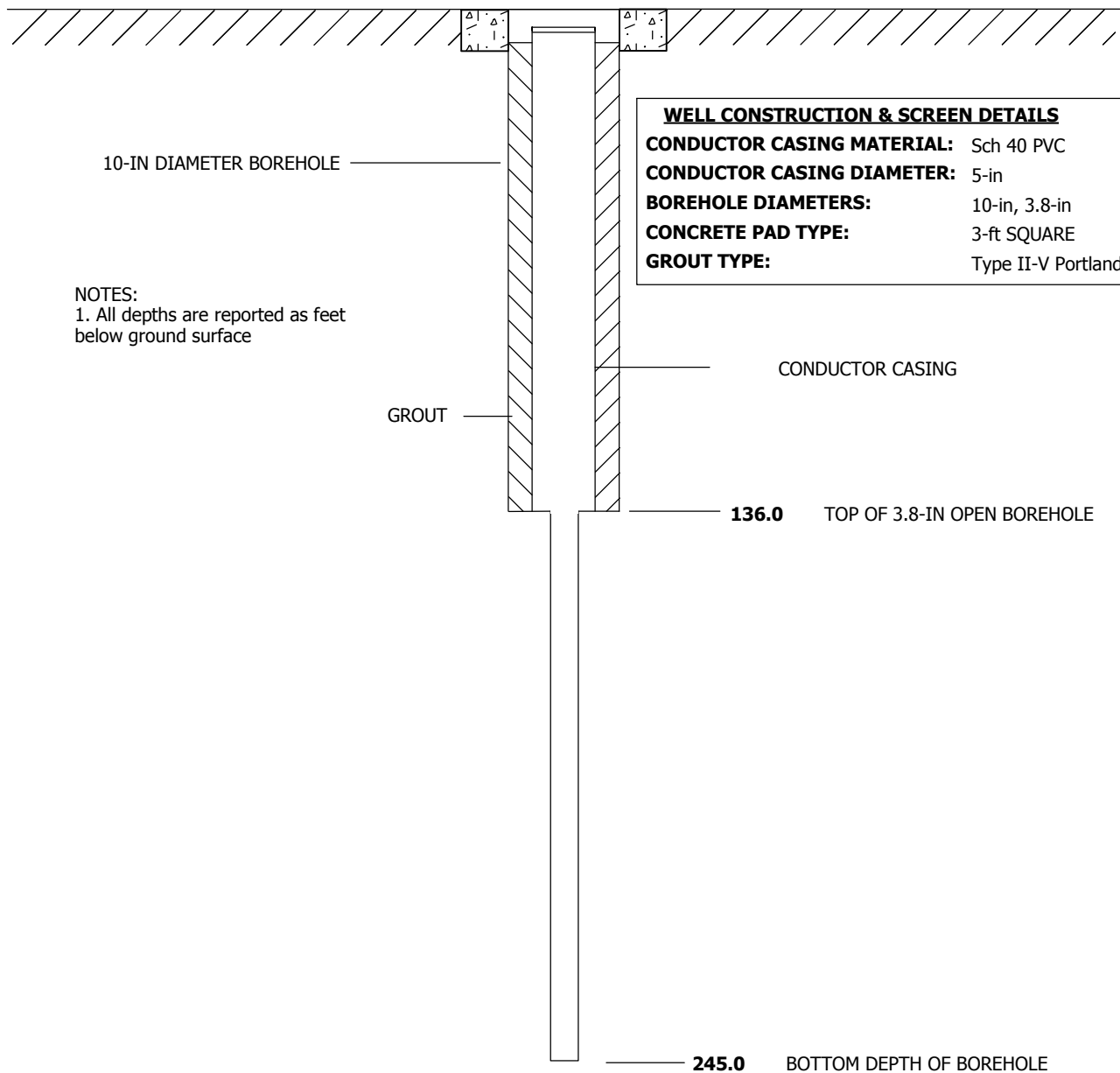
**GROUND SURFACE ELEVATION (NAVD 88):** 555.9 ft AMSL

**GENERAL REMARKS:** Open 3.8" diameter borehole from 136 to 245 feet bgs. Centralizers at 10, 30, 50, 70, 90, and 110 ft bgs.

**NORTHING (CCS NAD 83 Z 5):**  
2100495.02

**EASTING (CCS NAD 83 Z 5):**  
7616444.42

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-60**

SHEET 1 OF 6

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site F (2100495.0 N, 7616444.4 E)

ELEVATION : 555.9 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 99 ft BGS

START : 6/24/2011

END : 7/28/2011

LOGGER : C. Kreller (Northstar)

WATER LEVELS: APPROX. 99 ft BGS		START: 9/24/2011		END: 7/29/2011		LOGGERS: J. Kiefer (Northstar)	
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
140	137.0	33	5	137' - Grout material		<b>Metadiorite</b> dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphibole, phaneritic, fresh, hard, no foliation, highly fractured and healed with chlorite cement, massive.	Run 1: 10 minutes 0 sec
	R1 3 ft 100%		2	137.1' - Mechanical fracture			
	2		137.4, 137.6' - Joint, 65 deg and 30 deg, smooth, undulating, iron staining, narrow, no calcite infill				
	140.0	16	2	138.1, 138.8' - Joint, 40 deg and 80 deg, smooth, undulating, iron staining, narrow, no calcite infill			
			2	138.9' - Mechanical break			
			2	139.1, 139.5' - Joint, 80 deg and 70 deg, smooth, undulating, iron staining, tight at 139.1', narrow at 139.5, no calcite infill			
			>10	140.0-141.0' - predominantly mechanical fractures			
			>10	141' - multiple fractures, iron staining			
			>10				
			>10	144' - Joint, 20 deg, smooth, undulating, iron staining, no calcite infill, narrow			
145	73	1	145.0-147.0' - Mechanical fractures predominant				
		>10					
		2	147.1, 147.4' - Joint, 70 deg and 30 deg, smooth, undulating, <2 mm calcite infilling, no iron staining, tight				
		5	148.3, 148.5' - Joint, 60 deg and 80 deg, smooth, undulating, minor iron staining, narrow				
		0					
		0					
150	70	2	150' - Predominantly mechanical fractures				
		1	151' - Predominantly mechanical fractures				
		2	152' - Mechanical fractures				
		0					
		0					
		0					
155	155.0		3	155.5, 155.7, 155.8' - Joint (3), 30, 90, and 60 deg, smooth, undulating, iron staining, tight			
			1	156.7' - Joint, 50 deg, smooth, undulating, iron staining, tight			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-60** SHEET 2 OF 6

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site F (2100495.0 N, 7616444.4 E)

ELEVATION : 555.9 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 99 ft BGS

START : 6/24/2011

END : 7/28/2011

LOGGER : C. Kreller (Northstar)

DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
160	R5 5 ft 100%	80	2	157.2, 157.9' - Joint, 10 deg and 10 deg, rough, undulating, iron staining, narrow	<b>Metadiorite</b> dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphibole, phaneritic, fresh, hard, no foliation, highly fractured and healed with chlorite cement, massive.	Run 5: 15 min 20 sec	
			1	158.9' - Joint, 50 deg, smooth, undulating, iron staining, tight			
			0				
165	R6 5 ft 100%	100	1	160.5' - Joint, 40 deg, rough, undulating, <2mm calcite infilling, iron staining, tight			Run 6: 15 min 0 sec
			1	161.7' - Mechanical fracture			Run 6: 15 min 0 sec
			1	162.8' - Joint, 40 deg, smooth, undulating, iron staining, tight			
			1	163.7' - Joint, 20 deg, smooth, undulating, iron staining, tight			
			0				
170	R7 5 ft 100%	86	2	165.3, 165.7, 165.8' - Joint (3), 50, 60, and 60 deg, rough, undulating, iron staining, narrow			Run 7: 17 min 52 sec
			0				
			1	167.1' - Joint, horizontal, smooth, undulating, iron staining, moderately narrow			
			1	167.8' - Joint, 10 deg, smooth, undulating, iron staining, tight			
				168.8' - Joint, 20 deg, smooth, undulating, minor iron staining, moderately narrow			Run 7: 17 min 52 sec
			0				
175	R8 5 ft 100%	86	1	170.8' - Joint, 40 deg, smooth, undulating, iron staining, narrow, no calcite infill			Run 8: 60 min 0 sec, water pump issues on rig.
			1	171.7' - Mechanical fracture			
			1	172.6' - Mechanical fracture			
			1	173.8' - Joint, 20 deg, smooth, undulating, minor iron staining, narrow			Run 8: 60 min 0 sec, water pump issues on rig.
			0				
			0				Run 9: 20 min 10 sec
			2				



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-60** SHEET 3 OF 6

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site F (2100495.0 N, 7616444.4 E)

ELEVATION : 555.9 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 99 ft BGS

START : 6/24/2011

END : 7/28/2011

LOGGER : C. Kreller (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
180	R9 5 ft 100%	93	1	176.2, 176.7' - Joint, 20 deg and 30 deg, rough, minor iron staining, stepped, narrow, no calcite infill		<b>Metadiorite</b> dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphibole, phaneritic, fresh, hard, no foliation, highly fractured and healed with chlorite cement, massive.	Run 9: 20 min 10 sec
			1	177.9' - Mechanical fracture			
			1	178.8' - Joint, 30 deg, rough, undulating, iron staining, moderately narrow			
			1	179.3, 179.6' - Joint, 35 deg, smooth, undulating, no iron staining, tight, no calcite infill			Run 10: 17 min 37 sec
185	R10 5 ft 100%	91	1	180.4' - Joint, 60 deg, smooth, undulating, minor iron staining, tight, no calcite infill			Run 10: 17 min 37 sec
			1	181.3' - Mechanical fracture along a plane of weakness, <2mm calcite infilling			
			1	182' - Mechanical fracture along a plane of weakness, <2mm calcite infilling			
			1	183.5' - Mechanical fracture			
190	R11 5 ft 100%	60	0				Run 11: 15 min 31 sec
			2	185.5' - Joint, 50 deg, smooth, undulating, slight iron staining, tight			
			6	185.9' - Joint, 50 deg, smooth, undulating, slight iron staining, narrow, chlorite present			
			2	186.4-186.9' - Joint, 50 deg, smooth, undulating, slight iron staining, narrow to tight. Some mechanical fracturing associated with retrieving core out of barrel, chlorite present			
			1	187.4' - Joint, 45 deg, smooth, undulating, slight iron staining, tight			Run 11: 15 min 31 sec
			0	187.9' - Joint, 60 deg, smooth, undulating, slight iron staining, tight, chlorite present			
			0	188.5' - Joint, 25 deg, smooth, undulating, slight iron staining, tight, chlorite present			Run 12: 29 min 30 sec
195	R12 5 ft 100%	78	1	190.8' - Joint, 35 deg, smooth, undulating, iron staining, tight			
			1	191.9' - Mechanical fracture			
			0				Run 12: 29 min 30 sec
			3	193.1' - Joint, 30 deg, smooth, undulating, iron staining, tight			
			2	193.5' - Mechanical fracture			
			2	193.9' - Joint, 30 deg, smooth, undulating, iron staining, tight			
			1	194.3' - Mechanical fracture along a plane of weakness, <2mm calcite infilling			Run 13: 23 min 30 sec
			1	194.5' - Joint, 35 deg, smooth, undulating, slight iron staining, tight			
			0	195.4' - Joint, 60 deg, smooth, undulating, slight iron staining, tight			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-60**

SHEET 4 OF 6

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site F (2100495.0 N, 7616444.4 E)

ELEVATION : 555.9 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 99 ft BGS

START : 6/24/2011

END : 7/28/2011

LOGGER : C. Kreller (Northstar)

WATER LEVELS : APPROX. 99 ft BGS		START : 6/24/2011		END : 7/26/2011		LOGGERS : J. Reiser (Northstar)		
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.	
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
200	R13 5 ft 100%	92	1	196.8' - Mechanical fracture		<b>Metadiorite</b> dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphibole, phaneritic, fresh, hard, no foliation, highly fractured and healed with chlorite cement, massive.	Run 13: 23 min 30 sec	
			0	197.9' - Mechanical fracture, calcite present (<2mm)				
			1	199.5' - Joint, 20 deg, smooth, undulating, slight iron staining, no calcite present				
	R14 5 ft 100%	90	1					Run 14: 39 min 38 sec
			1	200.9' - Mechanical fracture				Run 14: 39 min 38 sec
			1	201.9' - Mechanical fracture				
			1	202.6' - Mechanical fracture				
			2	203.2' - Mechanical fracture				
			1	203.8' - Mechanical fracture				
			1	204.4' - Mechanical fracture				
205	R15 5 ft 100%	93	0			Run 15: unknown		
			2	206' - Mechanical fracture				
			0	206.9' - Mechanical fracture				
			2	208' - Mechanical fracture				
			0	208.6' - Mechanical fracture		Run 15: unknown		
			0					
210	R16 5 ft 100%	93	2	210.4' - Mechanical fracture along a preferential plane, <2mm calcite infilling		Run 16: 15 min 0 sec		
			0	210.9' - Mechanical fracture along a preferential plane, <2mm calcite infilling				
			2	212' - Mechanical fracture along a preferential plane, <2mm calcite infilling				
			0	212.9' - Mechanical fracture		Run 16: 15 min 0 sec		
			0	214.3' - Mechanical fracture				
			0	214.7' - Mechanical fracture				
			1	215.1' - Mechanical fracture along a preferential plane, <2mm calcite infilling		Run 17: 12 min 29 sec		
			0					



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-60**

SHEET 5 OF 6

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site F (2100495.0 N, 7616444.4 E)

ELEVATION : 555.9 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 99 ft BGS

START : 6/24/2011

END : 7/28/2011

LOGGER : C. Kreller (Northstar)

WATER LEVEL: 7.40 BGS				START: 02/26/17		END: 7/26/2017		LOGGERS: J. F. GRIFFIN (Principal)			
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY		COMMENTS		
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS							
220	R17 5 ft 100%	88	1	217.5' - Joint, 30 deg, smooth, undulating, <2mm calcite infilling, no iron staining, tight			Metadiorite dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphibole, phaneritic, fresh, hard, no foliation, highly fractured and healed with chlorite cement, massive.	Run 17: 12 min 29 sec			
			1	218.7' - Mechanical fracture							
			1	219.4' - Mechanical fracture							
225	R18 5 ft 100%	95	0							Run 18: 17 min 10 sec	
			1	221.3' - Mechanical fracture					Run 18: 17 min 10 sec		
			1	222' - Mechanical fracture							
			1	223.5' - Mechanical fracture along a plane of weakness, <2mm calcite infilling							
			1	224.3' - Mechanical fracture along a plane of weakness, <2mm calcite infilling							
230	R19 5 ft 100%	100	0							Run 19: 21 min 30 sec	
			0								
			1	227.3' - Mechanical fracture							
			1	228.8' - Mechanical fracture					Run 19: 21 min 30 sec		
			0								
235	R20 5 ft 100%	70	2	230.0-230.7' - Joint, 45 deg, smooth, undulating, <2mm calcite infilling, iron staining, narrow			230.0-230.7' - cemented, breccia zone.	Run 20: 20 min 6 sec, increase in water production (230-231' bgs)			
			2	230.9' - Joint, 45 deg, smooth, undulating, <2mm calcite infilling, iron staining, tight							
			1	231.2, 231.4' - Mechanical fracture along a preferential plane, iron staining, <2mm calcite infilling							
			1	232.4' - Joint, 15 deg, smooth, undulating, <2mm calcite infilling, iron staining, narrow				Run 20: 20 min 6 sec			
			1	233.4' - Joint, 20 deg, smooth, undulating, <2mm calcite infilling, iron staining, narrow							
			0								
			0					Run 21: 12 min 20 sec			
			1								





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-60** SHEET 6 OF 6

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site F (2100495.0 N, 7616444.4 E)

ELEVATION : 555.9 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 99 ft BGS

START : 6/24/2011

END : 7/28/2011

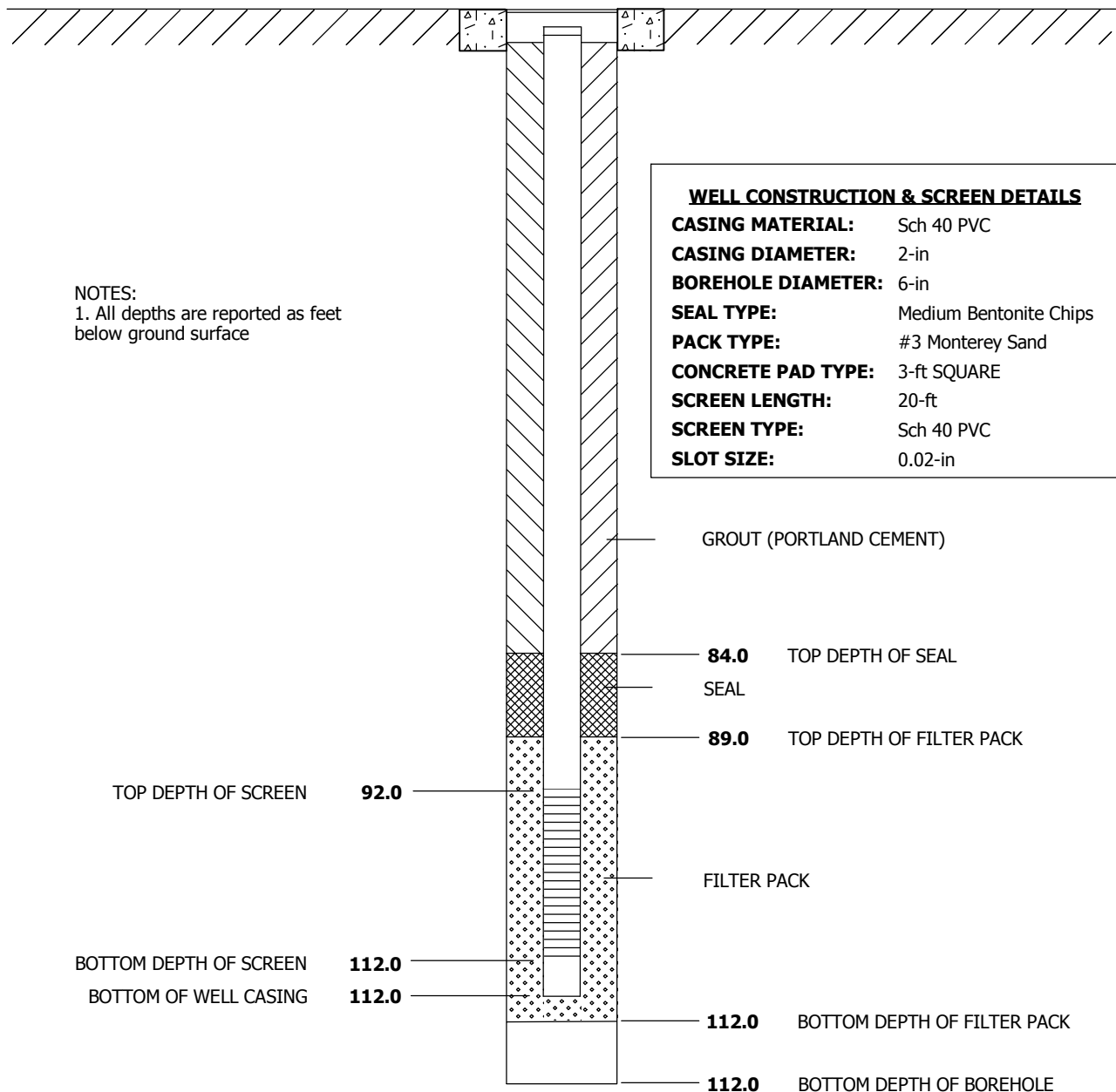
LOGGER : C. Kreller (Northstar)

WATER LEVELS : APPROX. 99 ft bgs		START : 6/24/2011		END : 7/28/2011		LOGGERS : J. Reiser (Northstar)		
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS		SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.	
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
240	R21 5 ft 100%	78	1	236.4' - Mechanical fracture along a plane of weakness, <2mm calcite infilling		<b>Metadiorite</b> dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphibole, phaneritic, fresh, hard, no foliation, highly fractured and healed with chlorite cement, massive.	Run 21: 12 min 20 sec	
			1	237.1' - Joint, 30 deg, smooth, undulating, <2mm calcite infilling, minor iron staining, presence of copper colored infill in the joint, tight				
			>10	238.8' - Joint, 25 deg, smooth, undulating, <2mm calcite infilling, tight 239.4' - Highly fractured zone				
	R22 5 ft 100%		0	240.1' - Mechanical fracture along a preferential plane, <2mm calcite infilling				Run 22: 29 min 51 sec
			0	240.8' - Joint, 40 deg, smooth, undulating, <2mm calcite infilling, no iron staining				Run 22: 29 min 51 sec
			2	242.2' - Joint, 50 deg, rough, undulating, <2mm calcite infilling, minor iron staining				Increase drill rate
			>10	242.4' - Mechanical fracture				
			>10	243' - Joint, 45 deg, smooth, undulating, <2mm calcite infilling, minor iron staining				
			0					
	245	245.0						
250								

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i><b>MW-61-110</b></i>
<b>LOCATION:</b> Site C		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 3/4/2009	
<b>DRILLING METHOD:</b> Rotary Core (HQ) - Rotosonic overdrill	<b>DRILLING END:</b> 3/13/2009	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 3/13/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 544.12 ft AMSL	<b>GENERAL REMARKS:</b> Alias during field work: MW-61	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100713.02		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616591.04		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-61**

SHEET 1 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site C (2100713.0 N, 7616591.0 E)

ELEVATION : 544.1 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 87 ft BGS

START : 3/4/2009

END : 3/12/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
RECOVERY (in)							
LAB SAMPLE							
5	COMPLETE			SM	<b>Silty Sand With Gravel (SM)</b> 0.0-14.0' - dark brown, (7.5YR 3/3), dry, loose, 30% gravel, 50% sand, 20% fines, sand is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 40 mm		Boring initially drilled to 68.0' bgs using Rotosonic tools up to 6-in in diameter. 6-in Rotosonic casing then used as a temporary conductor casing to facilitate the rotary core drilling. Boring drilled from 68.0' bgs to a total depth of 112.4' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter) and then overdrilled to total depth using 6-in Rotosonic tools.
15				SP-SM	<b>Poorly Graded Sand With Silt And Gravel (SP-SM)</b> 14.0-63.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 70% sand, 10% fines, sand is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 50 mm		
20							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-61**

SHEET 2 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site C (2100713.0 N, 7616591.0 E)

ELEVATION : 544.1 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools


ORIENTATION : Vertical

WATER LEVELS : Approx. 87 ft BGS

START : 3/4/2009

END : 3/12/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
LAB SAMPLE							
COMPLETE				SP-SM	<b>Poorly Graded Sand With Silt And Gravel (SP-SM)</b> 14.0-63.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 70% sand, 10% fines, sand is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 50 mm		
25							
30							
35							
40							

# SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site C (2100713.0 N, 7616591.0 E)

ELEVATION : 544.1 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 87 ft BGS

START : 3/4/2009

END : 3/12/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
<div style="display: flex; justify-content: space-between;"> <span>45</span> <span>50</span> <span>55</span> <span>60</span> </div>				SP-SM	<b>Poorly Graded Sand With Silt And Gravel (SP-SM)</b> 14.0-63.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 70% sand, 10% fines, sand is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 50 mm		
<div style="display: flex; justify-content: space-between;"> <span>45</span> <span>50</span> <span>55</span> <span>60</span> </div>							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-61**

SHEET 4 OF 7

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site C (2100713.0 N, 7616591.0 E)

ELEVATION : 544.1 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 87 ft BGS

START : 3/4/2009

END : 3/12/2009

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
RECOVERY (in)							
LAB SAMPLE							
		COMPLETE		SP-SM	<b>Poorly Graded Sand With Silt And Gravel (SP-SM)</b> 14.0-63.0' - dark brown, (7.5YR 3/3), dry, loose, 20% gravel, 70% sand, 10% fines, sand is angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 50 mm		Total depth of initial Rotosonic boring is 68.0 ft bgs. Begin rotary core drilling.
65				pTbr	<b>Metadiorite (pTbr)</b> 63.0-112.4' - bedrock is consolidated. Drilling method pulverizes most of the core.		
68.0							
70					Begin rock coring from 68.0 ft bgs See the next page for the rock core log.		
75							
80							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-61**

SHEET 5 OF 7

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site C (2100713.0 N, 7616591.0 E)

ELEVATION : 544.1 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 87 ft BTOC

START : 3/4/2009

END : 3/12/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	DESCRIPTION			
			DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
68.0	R1 7 ft 100%	53	0		<b>Metadiorite (pTbr)</b> 63.0-112.4' - dusky yellowish green, (10GY 3/2), intermediate (dioritic) mineralogy, fine grained, hard to very hard, unweathered, massive to foliated, pale greenish yellow (10YR 8/2) banding throughout	General Note: The metadiorite bedrock exhibits many small healed fractures (1-3 mm) of somewhat random orientation. These healed fractures create weaknesses in the rock. It can be difficult to determine if the metadiorite is jointed in-situ, or if the discontinuities are caused by the drilling method. Intervals with fracture per foot counts >10 are likely caused by drilling.  R1 = 17.0 min
70			>10			
			>10			
			0			
	R2 9.3 ft 100%	86	1		76.0' - yellow-orange staining	R2 = 33.0 min
			>10			
75			1			
			1			
	R3 6 ft 100%	57	1		81.0-94.5' - dusky yellow green, (5GY 5/2)	R2 = 33.0 min
			1			
80			1			
			>10			
	R3 6 ft 100%	57	>10		87.0' - yellow-orange staining	R2 = 33.0 min
			1			
			2			
85			1			



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-61**

SHEET 6 OF 7

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site C (2100713.0 N, 7616591.0 E)

ELEVATION : 544.1 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 87 ft BTOC

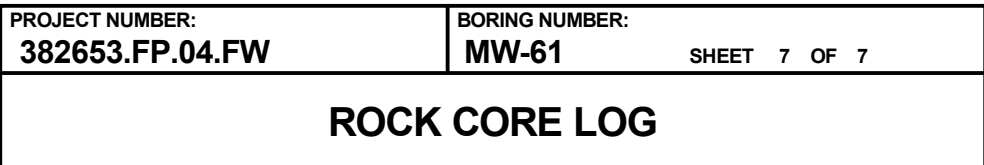
START : 3/4/2009

END : 3/12/2009

LOGGER : A. Brewster (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
90	90.3		0			<b>Metadiorite (pTbr)</b> 63.0-112.4' - dusky yellow green, (5GY 5/2), intermediate (dioritic) mineralogy, fine grained, hard to very hard, unweathered, massive to foliated, pale greenish yellow (10YR 8/2) banding throughout 89.0-94.5' - medium grained	R3 = 12.5 min
			0				
			1				
			1				
	R4 4.2 ft 100%	71	>10	90.9' - Joint, 20 deg, rough, undulating, < 1 mm calcite infilling, prominent reddish staining, tight		94.5-109.2' - dusky yellowish green, (10GY 3/2), fine grained	R4 = 11.8 min
			>10	91.9' - Joint, 80 deg, rough, undulating, calcite (< 3 mm) and dark greyish black material (< 1 mm), no staining, tight			
			>10	92.2-93.4' - Fracture zone, rough, undulating, primary calcite infill, secondary reddish staining, tertiary dark greyish-black infill, tight, no dominant orientation			
	94.5		2	94.2, 94.5, 95.6, 96.4' - Joint, rough, undulating, < 1 mm calcite infilling, reddish staining, 60, 30, 60, and 30 deg (respectively), tight			
			1				
			1				
			>10	97.0-97.7' - Fracture zone, no staining, < 1 mm dark greyish-black infill, tight, no dominant orientation			
			0				
	R5 10 ft 100%	90	1	99.4, 101.2, 101.8, 102.5, 103.3' - Joint, rough, undulating, < 1 mm calcite infilling, some reddish staining, 40, 40, 10, 40, and 60 deg (respectively), tight			
			0				
			2				
			1				
			1				
	104.5		0				R5 = 30.0 min
			1				
	R6 4.7 ft 100%	94	2	105.4, 106.2, 106.7' - Joint, 10 deg, rough, undulating, < 5 mm calcite infilling, some reddish staining, tight			
			0				





# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO:</b> <i><b>MW-62-065</b></i>
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**LOCATION:** Site E

**DRILLING CONTRACTOR:** Boart Longyear (D. Roberts)

**DRILLING START:** 3/14/2009

**DRILLING METHOD:** Rotary Core (HQ) - Rotosonic overdrill

**DRILLING END:** 3/18/2009

**LOGGER:** A. Brewster (Northstar)

**WELL COMPLETION DATE:** 3/18/2009

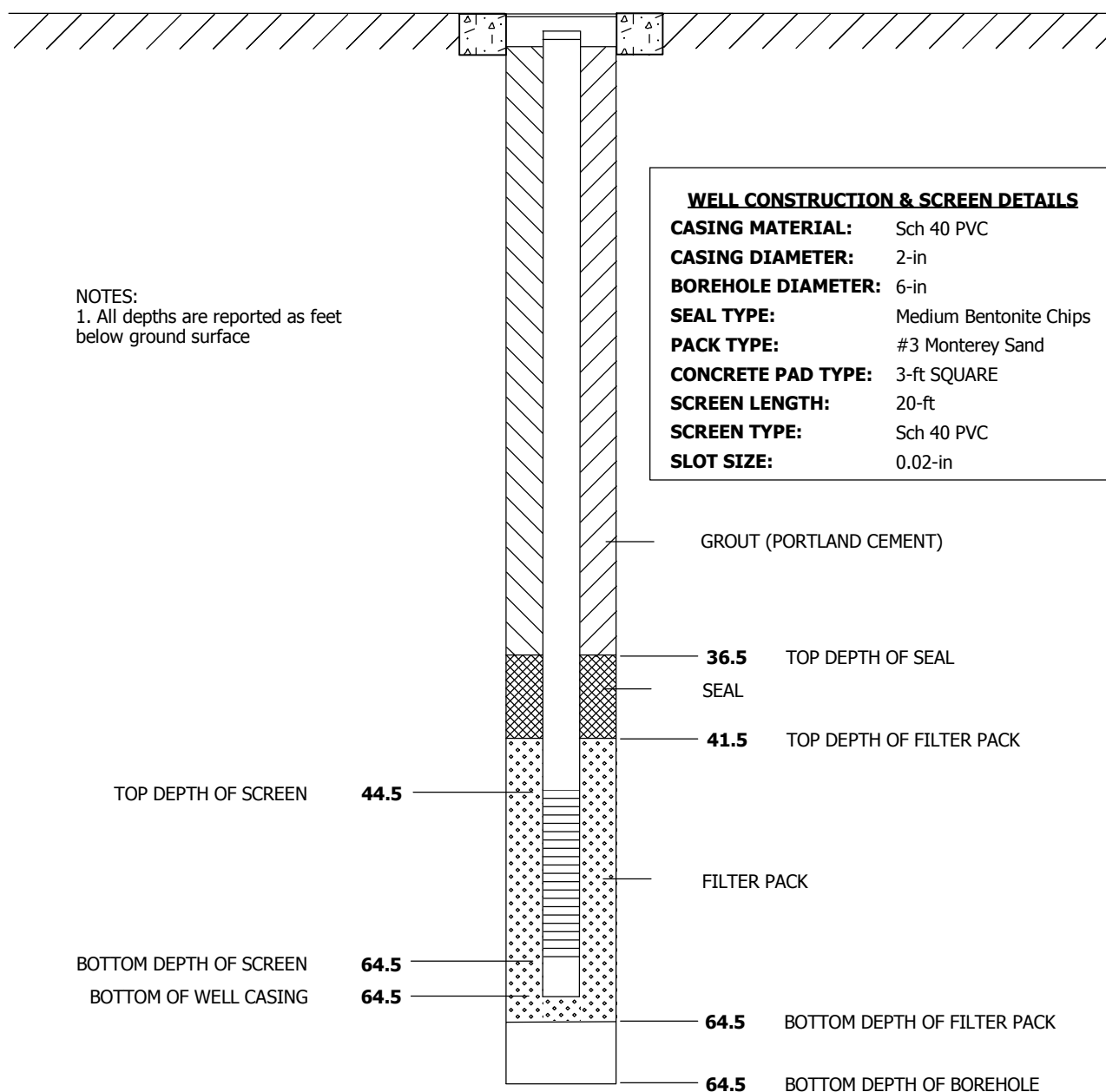
**GROUND SURFACE ELEVATION (NAVD 88):** 503.55 ft AMSL

**GENERAL REMARKS:** Alias during field work: MW-62

**NORTHING (CCS NAD 83 Z 5):**  
2101064.51

**EASTING (CCS NAD 83 Z 5):**  
7616560.96

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62**

SHEET 1 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools


ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009

LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
5	COMPLETE			SM	<b>Silty Sand (SM)</b> 0.0-4.5' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 80% sand, 15% fines, angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 30 mm		This log is the combination of two adjacent boreholes. Boring initially drilled to 21.0' bgs using Rotosonic tools up to 6-in in diameter. 6-in Rotosonic casing then used as temporary conductor casing to facilitate rotary core drilling. Boring drilled from 21.0' bgs to a total depth of 65.0' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter) and then overdrilled to total depth using 6-in Rotosonic tools. Adjacent borehole (approximately 10' southeast) was drilled to 75' bgs using Rotosonic tools up to 10-in diameter. Permanent 6-in PVC conductor casing installed from ground surface to 75' bgs (portland cement grout). Boring drilled from 75' bgs to a total depth of 191.5' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter).
				Tmc	<b>Conglomerate (Tmc)</b> 4.5-21.0' - reddish brown, (5YR 4/4), dry, consolidated, no dominant clast mineralogy. Drilling method pulverizes most of the core.		
10							
15							
20							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62**

SHEET 2 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

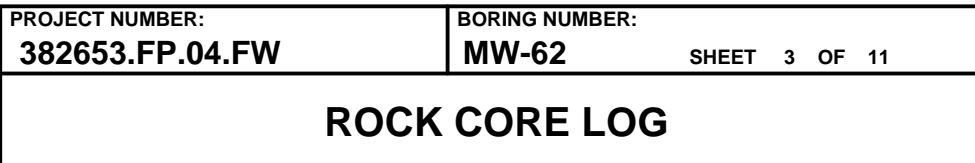
WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009

LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
21.0	COMPLETE		Tmc	Begin rock coring from 21.0 ft bgs See the next page for the rock core log.		Total depth of Rotosonic boring is 21.0 ft bgs. Begin rotary core drilling.	
25							
30							
35							
40							





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 4 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVEL: 7.70 ft RDS		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
45   <							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
62.8			1	61.6' - Joint, 45 deg, rough, undulating, no staining, tight		<b>Conglomerate(Tmc)</b> 21.0-64.5' - moderate reddish brown, (10R 4/6), no dominant clast mineralogy, strong (R4), hard, unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R6 = 26.9 min  R7 = 3.7 min
			0				
	R7 1.7 ft 100%	35	0				
64.5			0				
65	COMPLETE					<b>Conglomerate(Tmc)</b> 64.5-75.0' - Rotasonic drilling method pulverizes core.	
75						<b>Conglomerate(Tmc)</b> 75.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R1= 4.0 min
	R1 1 ft 0%						
76.0							
			0				
			0				
			0				
			0				
80			0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 6 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
85	R2 10 ft 65%	0	0			<b>Conglomerate(Tmc)</b> 75.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R2 = 80 min
86.0			NR				
90	R3 10 ft 40%	40	NR				
95			0				
			0				
			1				
96.0			0	94.6' - Joint, 30 deg, rough, planar, < 1 mm calcite infilling, reddish staining, tight			
			0				
			0				
100			0				
			1				R3 = 10 min





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 7 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
105	R4 10 ft 80%	60	1	100.7' - Joint, 50 deg, rough, undulating, reddish staining, tight		<b>Conglomerate(Tmc)</b> 75.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R4 = 20 min
			0	101.2' - Joint, 20 deg, rough, undulating, reddish staining, tight			
			0				
			0				
			0				
110			0				
			0				
			0				
			0				
			0				
115			0				R5 = 20 min
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
120			0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 8 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

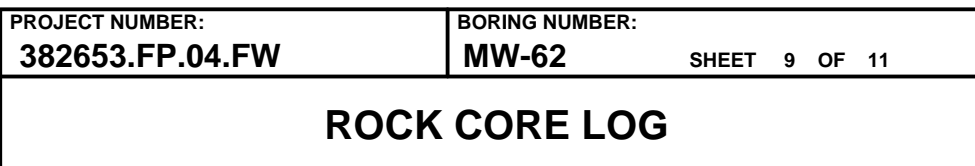
ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS







START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
125	R6 10 ft 100%	100	0			<b>Conglomerate(Tmc)</b> 76.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	
126.0			0				
			0				
			0				
			0				
			0				
130	R7 10 ft 80%	100	0			126.0' - moderate brown, (5YR 3/4), matrix supported, friable, moderately weathered	R6 = 20 min
			0				
			0				
			0				
135			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
140			0				R7 = 25 min
			0				



END : 4/22/2009      LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVELS: Approx. 47 ft BGS				START: 3/14/2009		END: 4/22/2009		LOGGER: A. Brewster/C. Kreier (Northstar)							
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY		COMMENTS								
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.								
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS										
145	R8 10 ft 100%	100	0		<b>Conglomerate(Tmc)</b> 76.0-191.5' - moderate brown, (5YR 3/4), from 126.0', no dominant clast mineralogy, matrix supported and friable from 126.0', moderately weathered from 126.0'										
		0													
		0													
		0													
		0													
	146.0	0	0					155.5' - moderate brown (5YR 4/4)	R8 = 20 min 146.0-156.0' add 300 gallons of water						
	0	0													
	0	0													
	0	0													
	0	0													
	0	0													
0	0														
0	0														
0	0														
0	0														
150	R9 10 ft 100%	100	0		155.5' - moderate brown (5YR 4/4)	R9 = 20 min									
		0	0												
		0	0												
		0	0												
155	R10 4 ft 100%	100	0					155.5' - moderate brown (5YR 4/4)	R9 = 20 min						
		0	0												
		0	0												
		0	0												
160	R11 1 ft 50%	100	0								155.5' - moderate brown (5YR 4/4)	R9 = 20 min			
		0	0												
161.0	50%	100	0											155.5' - moderate brown (5YR 4/4)	R9 = 20 min
		0	0												
					155.5' - moderate brown (5YR 4/4)	R9 = 20 min									



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 10 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVEL: 7.70 ft BGS		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
162.0  							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 11 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

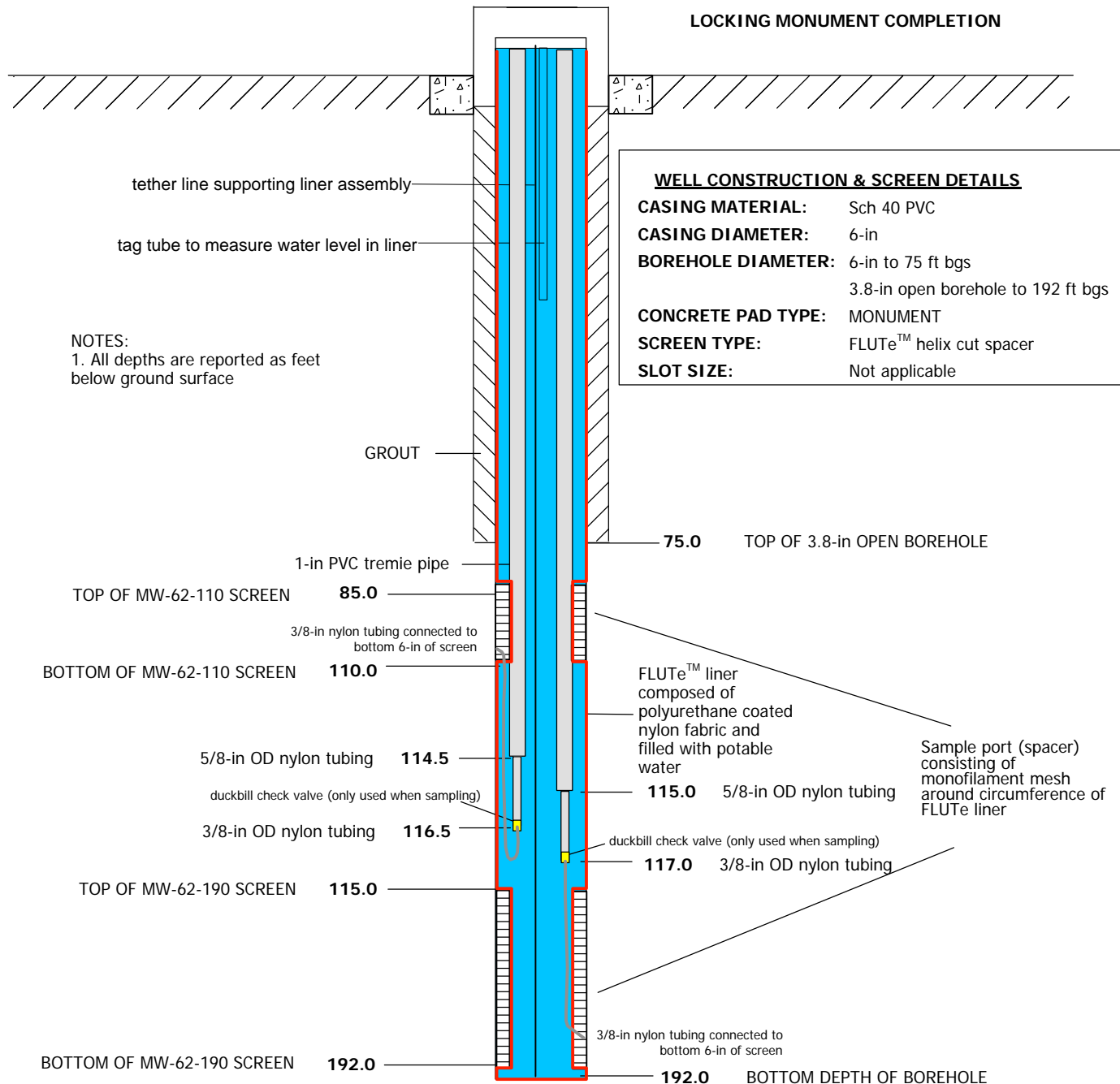
START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
185	R15 10 ft 100%	95	0			<b>Conglomerate(Tmc)</b> 76.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R15 = 20 min
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
186.0			0				
190	R16 5.5 ft 100%	100	0			<b>Conglomerate(Tmc)</b> 76.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R16 = 8 min
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
191.5			0				
						End Drilling on 4/22/2009 Total Borehole Depth: 191.5 ft bgs	
195							
200							

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 382653.FP.04.FW	<b>PROJECT:</b> PG&E Topock - ERGI	<b>WELL NO's:</b> <i>MW-62-110</i> <i>MW-62-190</i>
<b>LOCATION:</b> Site E		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (D. Roberts)	<b>DRILLING START:</b> 3/14/2009	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 3/18/2009	
<b>LOGGER:</b> A. Brewster (Northstar) and I. Wood	<b>WELL COMPLETION DATE:</b> 7/7/2009	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 504.05 ft AMSL	<b>GENERAL REMARKS:</b> 4-inch diameter, 2-port Guelph Water FLUTE™ multi-level system with helical screens installed into open 3.8-inch HQ borehole	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2101068.16		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616550.88		



WELL DIAGRAM IS NOT TO SCALE

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505-455-1300, www.flut.com

**As-Built Information****Job #**

968-2

**General:****Job Description:** 192' 4"dia. 2 Port Guelph Water FLUTe**Customer:** CH2M Hill**Location:** 155 Grand Ave. Suite 1000 Oakland, CA 94612**Well Designation:** MW-62BR**Hole Depth:** 192'**Water Table:** 47'**Drilling Method:** N/A**Casing Information:** N/A**Installation Method:** Water eversion**Bubbler / Tag:** 47'**Liner:****Material:** 210d Orange d/c 2 sleeve**Diameter:** 4"**Material Above Casing:** 3'**Uneverted Material:** 4'**Rough Fabrication Legnth:** 202'**Termination:** End Seal Knot**Knot Diameter Allowance:** 2"**Markings on Liner:** Ink stamp indicating FLUTe TOC & FLUTe Job# 968-2**Spacer Design:** 2 Material helix cut spacer Design (orange mesh) and Mylar**Spacer #****Spacer Bottom [ft]****Spacer Top [ft]**

1 110'

85'

2 192'

155'

Tubing & Ports:							
Tubing In Bundle:		NYLON					
Tubing In Sleeves:		NYLON					
Bubbler Details:		1/4 NYLON					
Port Design:		Superthane feed thru					
Port Locations:		6" @ bottom of spacer					
Vent Design:		1/4 Superthane feed thru w/ 3/8 tygon tubing connected to duct					
Vent Location:		202'					
Pump Assembly:							
Port #:	Transducer Serial #:	Transducer Pressure Rating [psi]:	Diaphragm Depth [ft. btoc]	Cable Serial #:	Cable Length [ft.]	5/8 x 3/8	3/8 x 1/4
1						114'.5"	116'.5"
2						115'	117'




<b>Other Info:</b>							
<b>Transducer Type:</b>		N/A					
<b>Kellum Design:</b>		1" Friction Kellum wrap Below Unions 1" Webbing with blue high					
<b>Kellum Locations:</b>		1st kellum @ 18' btoc: others every 40 there after					
<b>Tether:</b>		1/4"					
<b>Marking on Tubing:</b>		Port #'s and color code					
<b>Marking on Cables:</b>		Port #'S					
<b>Bundle Sheating:</b>		White 2.25" starting @ 1116'					
<b>Marks on Bundle:</b>		E.P. markings @ every 40'					
<b>Pump Tube:</b>		202'					
<b>Reel / Packaging:</b>		SF FLUTe					
<b>Casing Adapter Info:</b>		ABQ FLUTe					
<b>Wellhead Info:</b>		ABQ FLUTe					
<b>Vent Tube:</b>		n/a					
<b>Clamps:</b>		ABQ FLUTe					
<b>Shipped Via:</b>		ABQ FLUTe					
<b>Other Notes:</b>		Port # 1 Protrudes @ 114'.5" Top Of Tube @ 111" W/ red cap:					
		Port # 2 Protrudes @ 115' Top Of Tube @ 113' W/ red cap:					



<b>PROJECT NUMBER:</b> <b>382653.FP.04.FW</b>	<b>BORING NUMBER:</b> <b>MW-62</b>
SHEET 1 OF 11	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock - ERGI	LOCATION : Site E (2101068.3 N, 7616551.0 E)
ELEVATION : 503.6 ft	DRILLING CONTRACTOR : Boart Longyear (D. Roberts)
DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 47 ft BGS	START : 3/14/2009      END : 4/22/2009      LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH BELOW EXISTING GRADE (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	LAB SAMPLE					
5	COMPLETE		SM	<b>Silty Sand (SM)</b> 0.0-4.5' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 80% sand, 15% fines, angular to subangular, poorly graded, no dominant mineralogy, matrix supported, max clast size = 30 mm		This log is the combination of two adjacent boreholes. Boring initially drilled to 21.0' bgs using Rotosonic tools up to 6-in in diameter. 6-in Rotosonic casing then used as temporary conductor casing to facilitate rotary core drilling. Boring drilled from 21.0' bgs to a total depth of 65.0' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter) and then overdrilled to total depth using 6-in Rotosonic tools. Adjacent borehole (approximately 10' southeast) was drilled to 75' bgs using Rotosonic tools up to 10-in diameter. Permanent 6-in PVC conductor casing installed from ground surface to 75' bgs (portland cement grout). Boring drilled from 75' bgs to a total depth of 191.5' bgs using diamond bit rotary core tools (HQ-size, 3.8-in diameter).
			Tmc	<b>Conglomerate (Tmc)</b> 4.5-21.0' - reddish brown, (5YR 4/4), dry, consolidated, no dominant clast mineralogy. Drilling method pulverizes most of the core.		
10						
15						
20						



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62**

SHEET 2 OF 11

## SOIL BORING LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

DRILLING EQUIPMENT AND METHOD : Track-mounted Rig, Rotosonic drill head and tools

ORIENTATION : Vertical

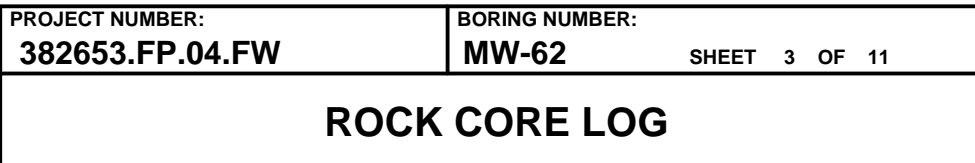
WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009

LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
21.0	COMPLETE		Tmc	Begin rock coring from 21.0 ft bgs See the next page for the rock core log.		Total depth of Rotosonic boring is 21.0 ft bgs. Begin rotary core drilling.	
25							
30							
35							
40							





PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 4 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVEL: 7.70 ft RDS		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
45   							



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 5 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
62.8			1	61.6' - Joint, 45 deg, rough, undulating, no staining, tight		<b>Conglomerate(Tmc)</b> 21.0-64.5' - moderate reddish brown, (10R 4/6), no dominant clast mineralogy, strong (R4), hard, unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R6 = 26.9 min  R7 = 3.7 min
			0				
	R7 1.7 ft 100%	35	0				
64.5			0				
65	COMPLETE					<b>Conglomerate(Tmc)</b> 64.5-75.0' - Rotasonic drilling method pulverizes core.	
75						<b>Conglomerate(Tmc)</b> 75.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R1= 4.0 min
	R1 1 ft 0%						
76.0			0				
			0				
			0				
			0				
80			0				
			0				



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 6 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
85	R2 10 ft 65%	0	0			<b>Conglomerate(Tmc)</b> 75.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R2 = 80 min
86.0			NR				
90	R3 10 ft 40%	40	NR				
95			0				
			0				
			1				
96.0			0	94.6' - Joint, 30 deg, rough, planar, < 1 mm calcite infilling, reddish staining, tight			
			0				
			0				
100			0				
			1				R3 = 10 min



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 7 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

ORIENTATION : Vertical

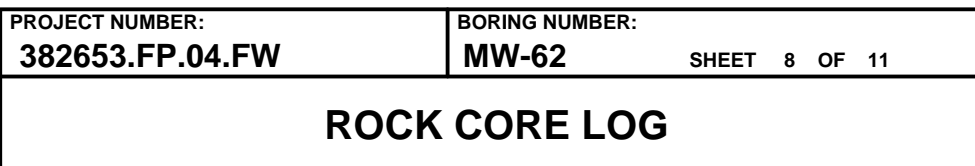
WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

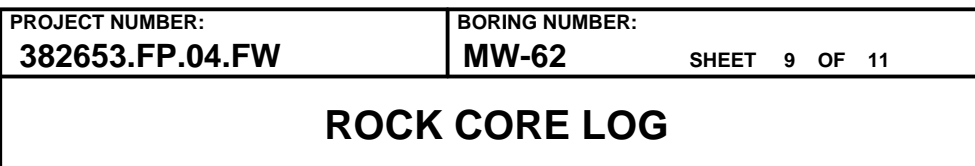
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
105	R4 10 ft 80%	60	1	100.7' - Joint, 50 deg, rough, undulating, reddish staining, tight		<b>Conglomerate(Tmc)</b> 75.0-191.5' - moderate brown, (5YR 4/4), no dominant clast mineralogy, strong (R4), unweathered, fine matrix, coarse sand to coarse gravel sized clasts, massive	R4 = 20 min
			0	101.2' - Joint, 20 deg, rough, undulating, reddish staining, tight			
			0				
			0				
			0				
			0				
110			0				
			0				
			0				
			0				
			0				
115			0				R5 = 20 min
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
120			0				
			0				





END : 4/22/2009    LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVELS : Approx. 47 ft BGS				START : 3/14/2009		END : 4/22/2009		LOGGER : A. Brewster/C. Kreier (Northstar)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS		SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
125  <									



END : 4/22/2009      LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVELS: Approx. 47 ft BGS				START: 3/14/2009		END: 4/22/2009		LOGGERS: A. Brewster/C. Krieger (Northstar)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY		COMMENTS		
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
145   									



PROJECT NUMBER:  
**382653.FP.04.FW**

BORING NUMBER:  
**MW-62** SHEET 10 OF 11

## ROCK CORE LOG

PROJECT : PG&E Topock - ERGI

LOCATION : Site E (2101068.3 N, 7616551.0 E)

ELEVATION : 503.6 ft

DRILLING CONTRACTOR : Boart Longyear (D. Roberts)

CORING EQUIPMENT AND METHOD : Track-mounted Rig, LF-70 Drill Head and HQ-sized tools (diamond bit)

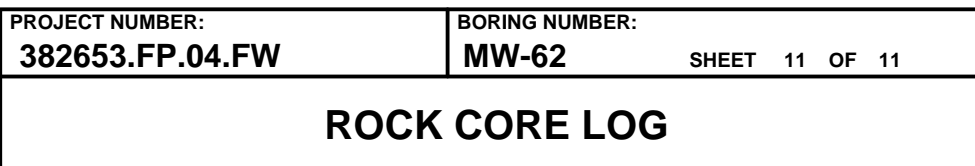
ORIENTATION : Vertical

WATER LEVELS : Approx. 47 ft BGS

START : 3/14/2009

END : 4/22/2009 LOGGER : A. Brewster/C. Kreller (Northstar)

DEPTH AND ELEVATION BELOW SURFACE (ft)		CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
			R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
						DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
165   								



END : 4/22/2009    LOGGER : A. Brewster/C. Kreller (Northstar)

WATER LEVELS : Approx. 47 ft bgs				START : 9/14/2009		END : 4/22/2009		LOGGER : A. Brewster/C. Kleier (Northstar)	
DEPTH AND ELEVATION BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS		
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
185   									

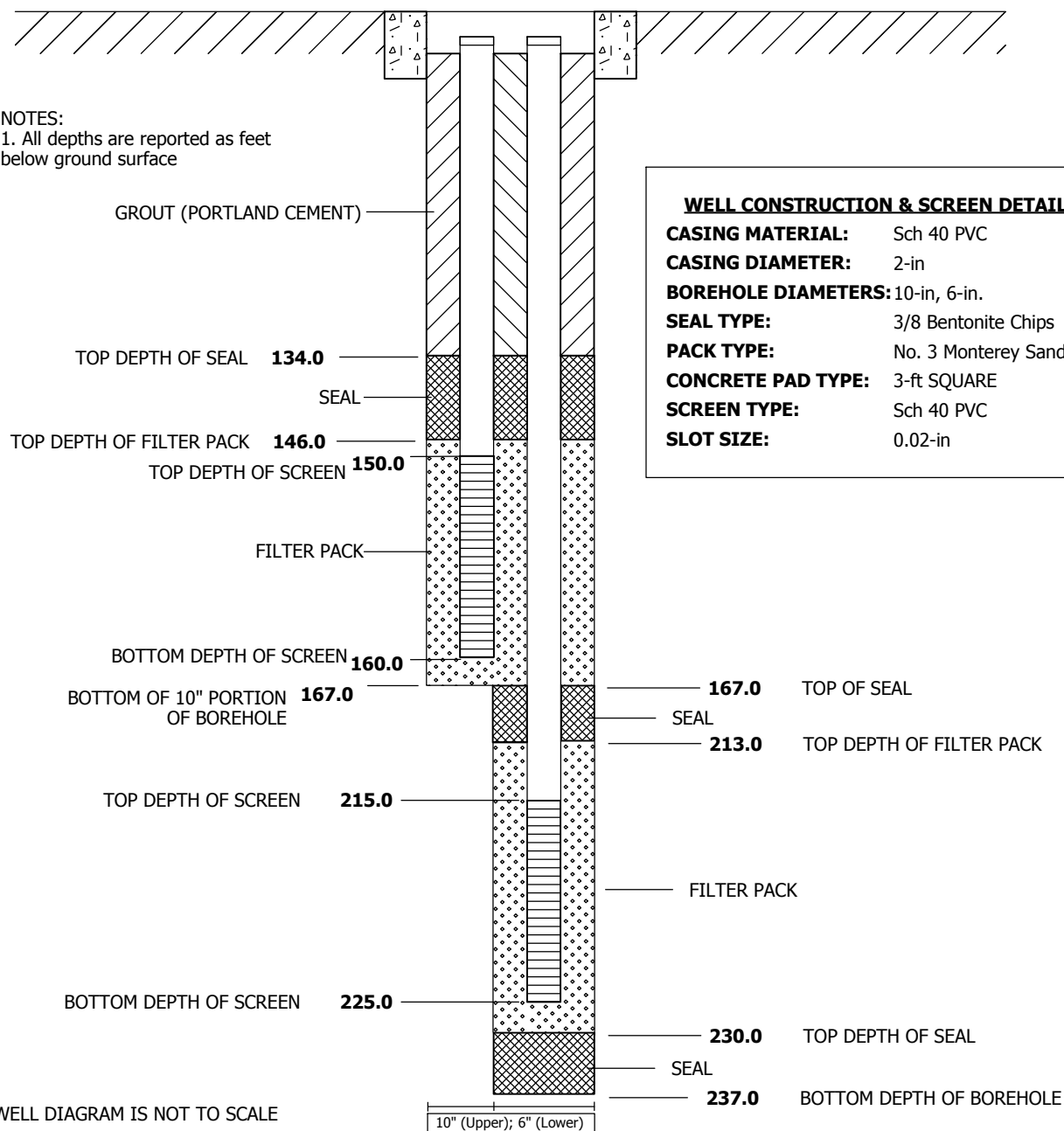
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-65-160</b></i> <i><b>MW-65-225</b></i>
<b>LOCATION:</b> Site 5		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 3/17/2011	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 4/4/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 4/7/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 597.0 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 5, 20, 35, 50, 65, 80, 95, 110, 125, 140, 165, 180, 195, and 210 ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100547.44		
<b>EASTING (CCS NAD 83 Z 5):</b> 7614934.72		

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)

**NOTES:**

1. All depths are reported as feet below ground surface



# SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Groundwater Investigation

LOCATION : Lower Bench of TCS (2100547.4 N, 7614934.7 E)

ELEVATION : 597.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350 with 6 barrels., Rotasonic



ORIENTATION : Vertical

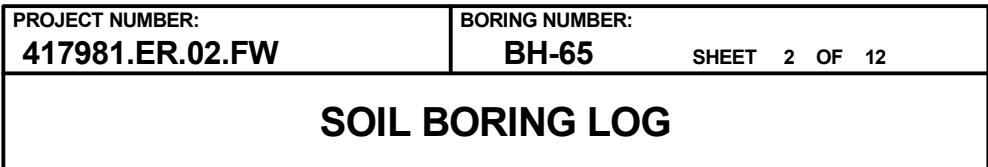
WATER LEVELS : Approx. 139 ft BGS

START : 3/17/2011

END : 3/23/2011

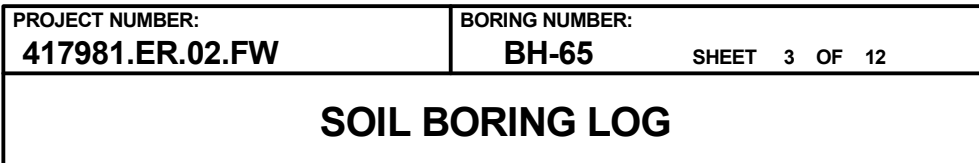
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5		COMPLETE		SW	<b>Well Graded Sand (SW)</b> 0.0-10.0' - dark yellowish brown, (10YR 4/4), dry, loose, 10% gravel, 85% sand, 5% fines, angular to subrounded, maximum clast diameter = 50mm.		Cleared to 10' bgs by hydro-vac rig (MPE)
	9.0 10.0		10001				Soil sample collected between 9.0 and 10.0 ft bgs.
15	14.0 15.0			SM	<b>Silty Sand (SM)</b> 10.0-87.0' - grayish brown, (2.5Y 5/2), dry, loose, 10% gravel, 60% sand, 30% fines, angular to subrounded, maximum clast diameter = 50mm.  17.0-20.0' - Color change to brown (7.5YR 4/3), change to 5% gravel, 65% sand, 30% fines, change to subrounded.		Soil sample collected between 14.0 and 15.0 ft bgs.
	19.0 20.0		10003				Soil sample collected between 19.0 and 20.0 ft bgs.



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)					SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
RECOVERY (in)		LAB SAMPLE					
25		COMPLETE		SM	<b>Silty Sand (SM)</b> 10.0-87.0' - grayish brown, (2.5Y 5/2), dry, loose, 10% gravel, 60% sand, 30% fines, angular to subrounded, maximum clast diameter = 50mm.		
	29.0 30.0		10004				
	35						
40	39.0 40.0		10005		34' - Change to 15% gravel, 55% sand, 30% fines, angularity change to subangular to subrounded.  35' - Change from loose to partially consolidated.		Soil sample collected between 39.0 and 40.0 ft bgs.









PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-65** SHEET 5 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Groundwater Investigation

LOCATION : Lower Bench of TCS (2100547.4 N, 7614934.7 E)

ELEVATION : 597.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350 with 6 barrels., Rotasonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 139 ft BGS

START : 3/17/2011

END : 3/23/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 139 ft bgs				START : 3/17/2011		END : 3/20/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION						
	LAB SAMPLE								
85	COMPLETE			SM	<b>Silty Sand (SM)</b> 10.0-87.0' - grayish brown, (2.5Y 5/2), dry, loose to partially consolidated, 15% gravel, 55% sand, 30% fines, subangular to subrounded, maximum clast diameter = 50mm, presence of highly weathered metadiorite fragments, red staining and/or deposits on gravel surfaces.				
90	89.0 90.0	10010		SW	<b>Well Graded Sand (SW)</b> 87.0-93.5' - dark yellowish brown, (10YR 4/4), dry, loose, angular to subangular, predominantly fine- to medium-grained quartz sand and metadiorite gravel, maximum clast size = 30mm.		Soil sample collected between 89.0 and 90.0 ft bgs.		
95				SM	<b>Silty Sand (SM)</b> 93.5-168.0' - grayish brown, (2.5Y 5/2), dry to slightly moist, loose to partially consolidated, 15% gravel, 55% sand, 30% fines, subangular to angular, presence of highly weathered metadiorite, maximum clast size = 50mm.				
100	99.0 100.0	10011					Soil sample collected between 99.0 and 100.0 ft bgs.		



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-65** SHEET 6 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Groundwater Investigation

LOCATION : Lower Bench of TCS (2100547.4 N, 7614934.7 E)

ELEVATION : 597.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350 with 6 barrels., Rotasonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 139 ft BGS

START : 3/17/2011

END : 3/23/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS / APPROX. 100 R.D.G.		START: 9/1/2011		END: 9/20/2011		EQUIP: J.A. Brown, (Nelson)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
105		COMPLETE		<b>Silty Sand (SM)</b> 93.5-168.0' - grayish brown, (2.5Y 5/2), dry to slightly moist, loose to partially consolidated, 15% gravel, 55% sand, 30% fines, subangular to angular, presence of highly weathered metadiorite, maximum clast size = 50mm.			
110	109.0 110.0		10012	SM		Soil sample collected between 109.0 and 110.0 ft bgs.	
115				115.0-120.0' - increase in proportion of miocene conglomerate fragments.			
120	119.0 120.0		10013			Soil sample collected between 119.0 and 120.0 ft bgs.	



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-65** SHEET 7 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Groundwater Investigation

LOCATION : Lower Bench of TCS (2100547.4 N, 7614934.7 E)

ELEVATION : 597.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350 with 6 barrels., Rotasonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 139 ft BGS

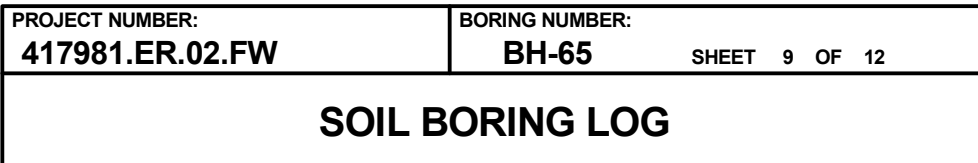
START : 3/17/2011

END : 3/23/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)	RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
						LAB SAMPLE
125	COMPLETE	SM	<b>Silty Sand (SM)</b> 93.5-168.0' - grayish brown, (2.5Y 5/2), dry to slightly moist, loose to partially consolidated, 15% gravel, 55% sand, 30% fines, subangular to angular, presence of highly weathered metadiorite, maximum clast size = 50mm.	Stop 3/18/2011 at 1530. Resume 3/19/2011 at 930.		
129.0 130.0	10014		Soil sample collected between 129.0 and 130.0 ft bgs.			
135				138' - Light green silt on surface fractures.		
139.0 140.0	10015		139' - Color change to brown (10YR 4/3), moist.	Soil sample collected between 139.0 and 140.0 ft bgs.		







PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-65** SHEET 10 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Groundwater Investigation

LOCATION : Lower Bench of TCS (2100547.4 N, 7614934.7 E)

ELEVATION : 597.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350 with 6 barrels., Rotasonic

ORIENTATION : Vertical

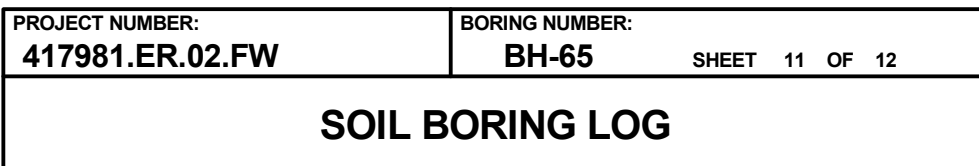
WATER LEVELS : Approx. 139 ft BGS

START : 3/17/2011


END : 3/23/2011

LOGGER : A. Brewster (Northstar)

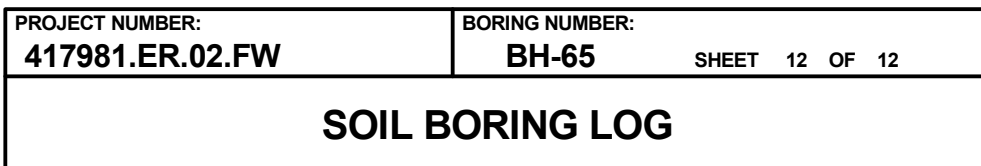
WATER LEVELS: Approx. 159 ft bgs			START: 3/17/2011		END: 3/20/2011		LOGGER: A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS		
INTERVAL (ft)	RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
	LAB SAMPLE							
185	187.0	COMPLETE	GW	<b>Well Graded Gravel (GW)</b> 168.0-228.0' - dark greyish brown, (2.5Y 5/2), saturated, loose to partially consolidated, 60% gravel, 30% sand, 10% fines, angular, presence of highly weathered metadiorite fragments (gravel), clast-supported, maximum clast size = 50 mm. Fragments display red staining/mineralization on most surfaces.   <				





LOGGER : A. Brewster (Northstar)

WATER LEVELS: Approx. 139 ft BGS				START: 3/17/2011		END: 3/20/2011		LOGGER: A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS		
		RECOVERY (in)					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		LAB SAMPLE							
205		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 168.0-228.0' - brown, (7.5YR 4/3), saturated, loose to partially consolidated, 60% gravel, 30% sand, 10% fines, angular, presence of highly weathered metadiorite fragments (gravel), clast-supported, maximum clast size = 50 mm. Fragments display red staining/mineralization on most surfaces.		Grab groundwater sample collected from borehole between 217.0 and 227.0 ft bgs.		
210									
215									
217.0									
220					213' - Color change to dark greyish brown (2.5Y 5/2) and change to 60% gravel, 30% sand, and 10% fines.  216' - Color change to very dark brown (10YR 3/2).				





LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
225				GW	<b>Well Graded Gravel (GW)</b> 168.0-228.0' - very dark brown, (10YR 3/2), saturated, loose to partially consolidated, 60% gravel, 30% sand, 10% fines, angular, presence of highly weathered metadiorite fragments (gravel), clast-supported, maximum clast size = 50 mm. Fragments display red staining/mineralization on most surfaces. Metadiorite boulders to 213 ft bgs. 222.0-224.5' - Metadiorite boulder.  224.5' - Color change to dark greyish brown (2.5Y 5/2).		Drill rate <1 in/min from 228.0-237.0'
227.0							
230				pTbr	<b>Metadiorite Bedrock (pTbr)</b> 228.0-237.0'  229.0-230.0' - Rock fragments covered with iron staining on all surfaces.  232.0-236.5' - Core difficult to recover, clasts in recovered core disintegrate into rock flour (ie, no gravel).  233.5' - Presence of calcite infill on rock surfaces.  236.5' - Interlocking metadiorite fragments.		Stop 03/22/2011 at 1645. Resume 03/23/2011 at 0830.
235							
240					End Drilling on 3/23/2011 Total Borehole Depth: 237.0 ft bgs		This borehole was converted into the following monitoring well(s): MW-65-160 and MW-65-225

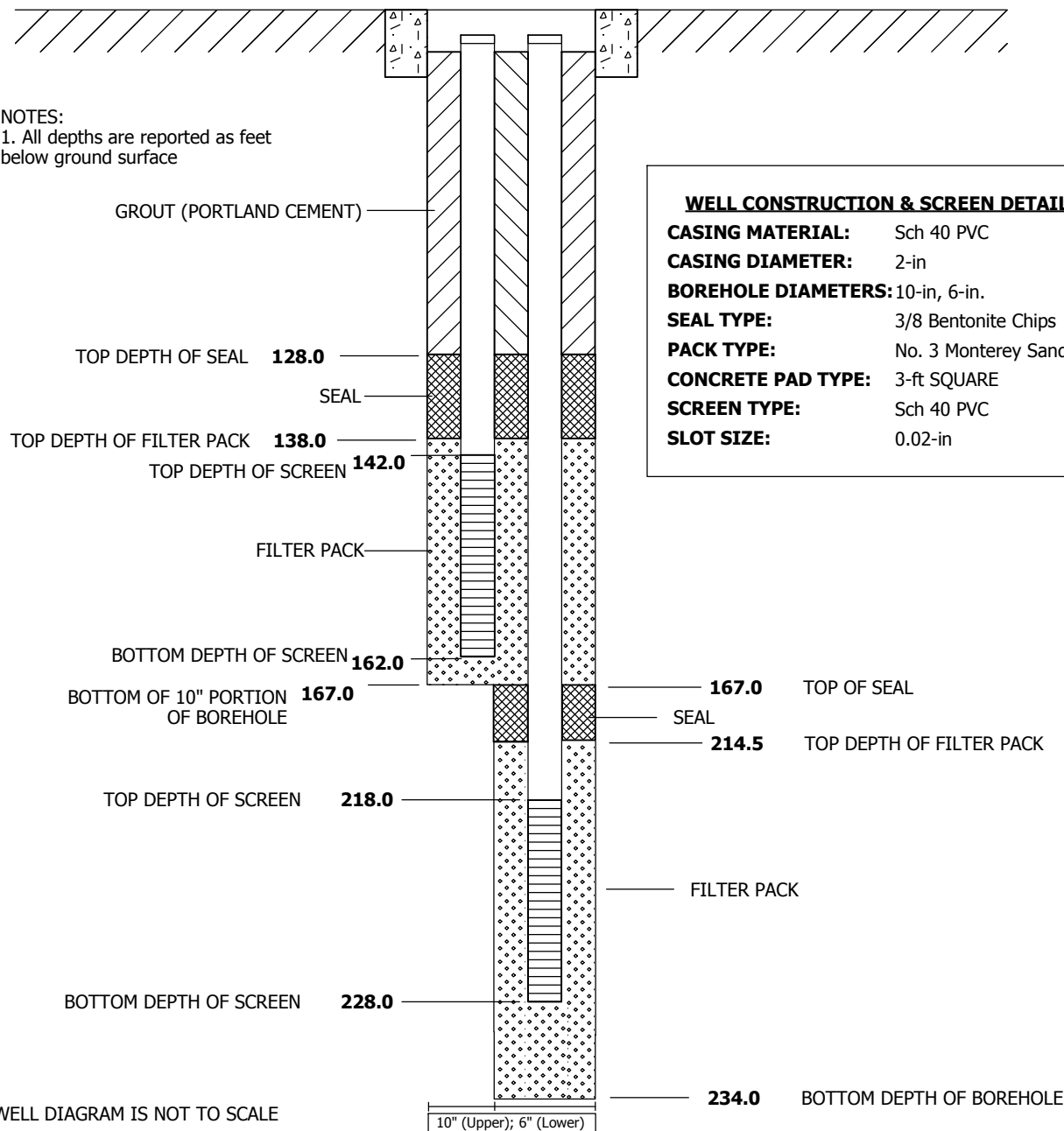
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-66-165</b></i> <i><b>MW-66-230</b></i>
<b>LOCATION:</b> Site 6		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 4/12/2011	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 4/20/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 4/20/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 586.6 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 15, 30, 45, 60, 75, 90, 105, 120, 135, 165, and 215 ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100957.66		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615153.76		

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)

### NOTES:

1. All depths are reported as feet below ground surface





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 1 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :





ORIENTATION : Vertical

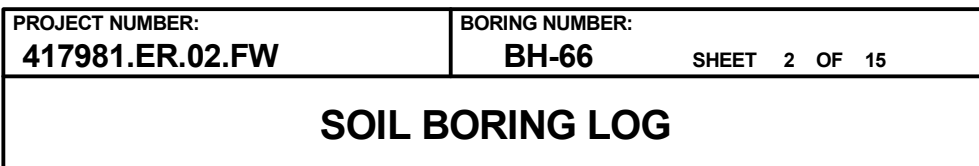
WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS: Approx. 15 ft bgs			START: 4/12/2011		END: 9/17/2011		LOGGER: A. Brewster (Northstar)			
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS				
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
5	0.0	COMPLETE	10101	Poorly Graded Sand (SP) 0.0-14.0' - yellowish brown, (10YR 5/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 0.0 and 1.0 ft bgs.				
	1.0					Soil sample collected between 2.0 and 3.0 ft bgs.				
	2.0		10102			Soil sample collected between 5.0 and 6.0 ft bgs.				
	3.0									
	5.0		10103							
	6.0									
	10									
	15		14.0			10104, 50003	SM		Soil sample collected between 14.0 and 15.0 ft bgs.	
	15.0					SP				
								Poorly Graded Sand (SP) 17.0-19.0' - yellowish brown, (10YR 5/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.		
20	19.0	10105	ML		Soil sample collected between 19.0 and 20.0 ft bgs.					
20.0										





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 3 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :


ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS / PRESS. / TEM. LOG		START: 4/12/2011		END: 4/13/2011		EQUIP: J. Brown (Nelson)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
45	COMPLETE		SM	<b>Silty Sand (SM)</b> 32.0-67.0' - yellowish brown, (10YR 5/4), dry, loose to partially consolidated, 10% gravel, 65% sand, 25% fines, angular to subangular, poorly graded, predominantly quartz.  46' - Change to 15% gravel, 60% sand, 25% fines.		Soil sample collected between 49.0 and 50.0 ft bgs.   <	



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 4 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :

ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft BGS				START : 4/12/2011		END : 9/17/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE							
65	COMPLETE			SM	<b>Silty Sand (SM)</b> 32.0-67.0' - yellowish brown, (10YR 5/4), dry, loose to partially consolidated, 10% gravel, 65% sand, 25% fines, angular to subangular, poorly graded, predominantly quartz.				
70	69.0 70.0		10110	SW	<b>Well Graded Sand (SW)</b> 67.0-83.0' - brown, (10YR 4/3), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, predominantly quartz.		Soil sample collected between 69.0 and 70.0 ft bgs.		
75					77' - Change to 5% gravel, 85% sand, 10% fines.				
80	79.0 80.0		10111				Soil sample collected between 79.0 and 80.0 ft bgs.		



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 5 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :

ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft BGS				START : 4/12/2011		END : 9/11/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
85	COMPLETE			SW	<b>Well Graded Sand (SW)</b> 67.0-83.0' - brown, (10YR 4/3), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, predominantly quartz.				
				SM	<b>Silty Sand (SM)</b> 83.0-87.0' - yellowish brown, (10YR 5/4), dry, partially consolidated, 10% gravel, 70% sand, 20% fines, angular to subangular, poorly graded, predominantly quartz. 83.0-84.0' - Metadiorite boulder.				
90	89.0 90.0			SW	<b>Well Graded Sand With Gravel (SW)</b> 87.0-132.0' - yellowish brown, (10YR 5/4), dry to moist, loose, 20% gravel, 75% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz and mixed gravel.			Soil sample collected between 89.0 and 90.0 ft bgs.	
		10112							
95									
100	99.0 100.0							Soil sample collected between 99.0 and 100.0 ft bgs.	



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 6 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :

ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)	RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
						LAB SAMPLE
	COMPLETE					
105			104.0-105.0' - Metadiorite boulder.			
110	109.0 110.0	10114	SW		Soil sample collected between 109.0 and 110.0 ft bgs.	
115						
			NR		Rig down at 1200. Drilling resumes at 0845.	
120	119.0 120.0	10115, 50004	<b>No Recovery (NR)</b> 117.0-119.0'  <b>Well Graded Sand With Gravel (SW)</b> 87.0-132.0' - yellowish brown, (10YR 5/4), dry to moist, loose, 20% gravel, 75% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz and mixed gravel.		Soil sample collected between 119.0 and 120.0 ft bgs.	





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 7 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :



ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
		RECOVERY (in)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		LAB SAMPLE					
125		COMPLETE		SW	<b>Well Graded Sand With Gravel (SW)</b> 87.0-132.0' - yellowish brown, (10YR 5/4), dry to moist, loose, 20% gravel, 75% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz and mixed gravel.		Soil sample collected between 129.0 and 130.0 ft bgs.
129.0 130.0		10116					
135							
140				SW	<b>Well Graded Sand With Gravel (SW)</b> 132.0-157.0' - brown, (10YR 5/3), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, Color change to brown (10YR 5/3), saturated, loose to partially consolidated, change to 40% gravel, 40% sand, 20% fines, mixed gravel.		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 8 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Sand With Gravel (SW)</b> 132.0-157.0' - brown, (10YR 5/3), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		
145		COMPLETE		SW			
147.0							Grab groundwater sample collected from borehole between 147.0 and 157.0 ft bgs.
150							
155				SP	<b>Poorly Graded Sand (SP)</b> 157.0-162.5' - greyish brown, (10YR 5/2), saturated, loose, 5% gravel, 90% sand, 5% fines, subangular to subrounded, poorly graded and fining upwards, predominantly quartz sand.		
157.0							
160							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 9 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 157 ft BGS			START : 4/12/2011		END : 9/11/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)		LAB SAMPLE					
	COMPLETE			SP	<b>Poorly Graded Sand (SP)</b> 157.0-162.5' - greyish brown, (10YR 5/2), saturated, loose, 5% gravel, 90% sand, 5% fines, subangular to subrounded, poorly graded and fining upwards, predominantly quartz sand.			
165				SW	<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.			
					166.0-167.0' - Metadiorite boulder.			
170								
175								
				</				

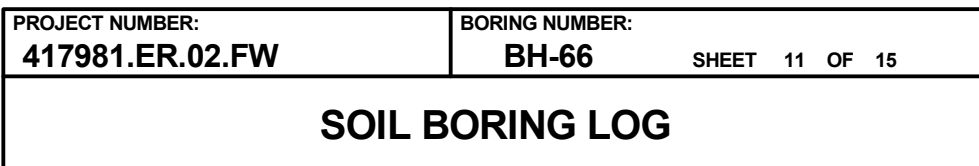


<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 10 OF 15	
<b>SOIL BORING LOG</b>	


PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft BGS		START : 4/12/2011		END : 9/17/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)		LAB SAMPLE				
		COMPLETE	BH-66-20102		<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		
185							
187.0							
							Rig down at 1640. Drilling resumes at 1200.
190				SW			
195							
							</

Rig down at 1640. Drilling resumes at 1200.



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE		SW	<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		Grab groundwater sample collected from borehole between 207.0 and 217.0 ft bgs.
205					204' - Change to 50% gravel and 50% fines, clast-supported.		
207.0							
210			BH-66-20103				
215					214' - Color change to reddish brown (5YR 4/4)  215.0-216.0' - Metadiorite boulder.		
217.0					217' - Color change to brown (7.5YR 4/4).		
220							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 12 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :


ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE		SW	<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		Grab groundwater sample collected from borehole between 224.0 and 234.0 ft bgs.   <



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 13 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
245		COMPLETE		Tmc	<b>Conglomerate Bedrock (Tmc)</b> 233.0-248.0' - massive.		
248.0					Begin rock coring from 248.0 ft bgs See the next page for the rock core log.		
250							
255							
260							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 14 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 130 ft BGS

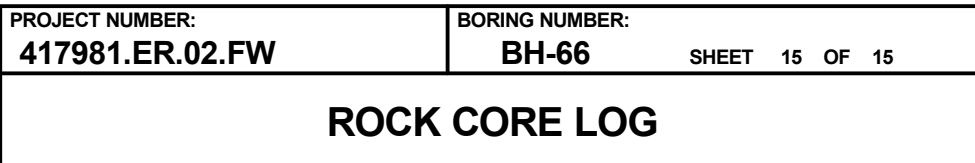
START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
250	248.0 R1 3 ft 100%	90	0	248' - Note: unless otherwise noted, all fractures in core are mechanical breaks caused by the drilling process. 249.1' - Joint, 60 deg, planar, <1mm calcite infilling, iron staining, slickenslided, tight.		<b>Conglomerate</b> 248.0-271.0' - dark reddish brown, (10YR 3/4), no dominant mineralogy, highly cemented, moderate (), angular to subangular, massive (no bedding planes), matrix-supported.	R1=0.43 FPM
			1				
			0				
	251.0		0				R2=0.53 FPM
			0				
			0				
255	R2 5 ft 100%	100	0				
			0				
	256.0		0				R3=0.49 FPM
			0				
			0				
260	R3 5 ft 100%	100	0				
			0				
	261.0		0				R4=0.54 FPM
			0				
			0				
265	R4 5 ft 100%	100	1				
			0				
	266.0		0	263.6' - Joint, 40 deg, smooth, undulating to planar, <1mm calcite infilling, iron staining, tight.		Presence of foliation at approximately 30 degree dip.	R5=0.74 FPM
			0				
			0				

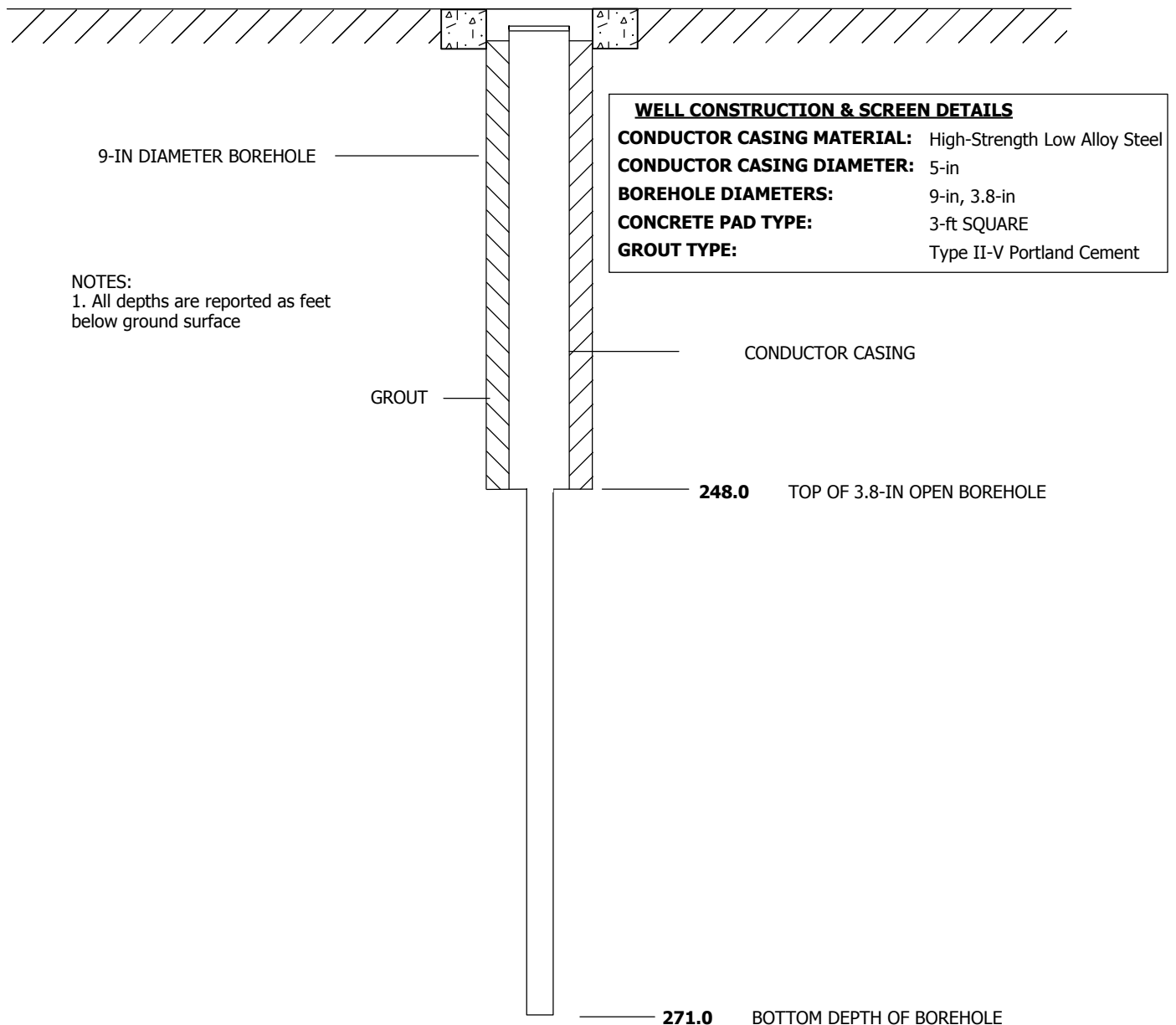




# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-66BR-270</b></i>
<b>LOCATION:</b> Site 6		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 8/30/2011	
<b>DRILLING METHOD:</b> Rotosonic/Wireline Rotary Core	<b>DRILLING END:</b> 9/11/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 9/11/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 586.5 ft AMSL	<b>GENERAL REMARKS:</b> Open 3.8" diameter borehole from 248 to 271 feet bgs. Centralizers at 50, 100, 150, 200, and 248 ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100950.25		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615153.99		

## SQUARE WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 1 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :





ORIENTATION : Vertical

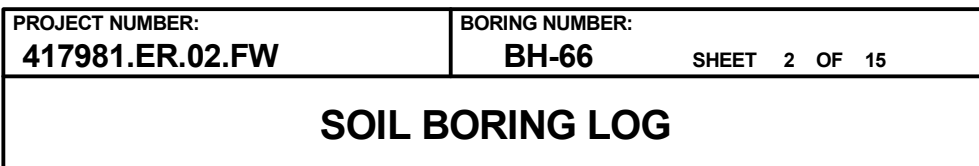
WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

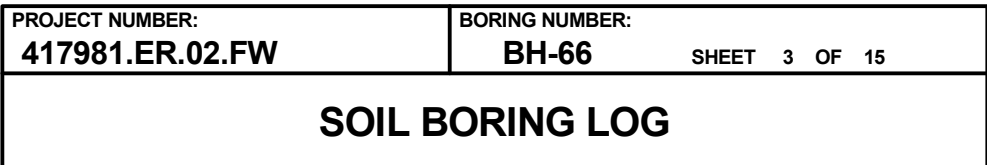
LOGGER : A. Brewster (Northstar)

WATER LEVELS: Approx. 15 ft bgs			START: 4/12/2011		END: 9/17/2011		LOGGER: A. Brewster (Northstar)		
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS			
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION			
5	0.0	COMPLETE	10101	<b>Poorly Graded Sand (SP)</b> 0.0-14.0' - yellowish brown, (10YR 5/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 0.0 and 1.0 ft bgs.			
	1.0								
	2.0								
	3.0					10102			
	5.0								
	6.0					10103			
15	14.0		10104, 50003	<b>Silty Sand (SM)</b> 14.0-17.0' - yellowish brown, (10YR 5/4), dry, loose, 10% gravel, 75% sand, 15% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 14.0 and 15.0 ft bgs.			
	15.0								
								<b>Poorly Graded Sand (SP)</b> 17.0-19.0' - yellowish brown, (10YR 5/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.	
20	19.0		10105	<b>Silt (ML)</b> 19.0-32.0' - dark yellow brown, (10YR 4/4), dry, loose to partially consolidated, poorly graded		Soil sample collected between 19.0 and 20.0 ft bgs.			
	20.0								



LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft bgs				START : 4/12/2011		END : 9/17/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
		RECOVERY (in)					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		LAB SAMPLE							
25		COMPLETE		ML	<b>Silt (ML)</b> 19.0-32.0' - dark yellow brown, (10YR 4/4), dry, loose to partially consolidated, poorly graded		Soil sample collected between 29.0 and 30.0 ft bgs.		
29.0 30.0		10106							
35									
40		39.0 40.0		SM	<b>Silty Sand (SM)</b> 32.0-67.0' - yellowish brown, (10YR 5/4), dry, loose to partially consolidated, 10% gravel, 65% sand, 25% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 39.0 and 40.0 ft bgs.		
		10107							





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 4 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :


ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011


LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft BGS				START : 4/12/2011		END : 9/17/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE							
65	COMPLETE			SM	<b>Silty Sand (SM)</b> 32.0-67.0' - yellowish brown, (10YR 5/4), dry, loose to partially consolidated, 10% gravel, 65% sand, 25% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 69.0 and 70.0 ft bgs.		
70		69.0 70.0	10110						
75					SW			<b>Well Graded Sand (SW)</b> 67.0-83.0' - brown, (10YR 4/3), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, predominantly quartz.  77' - Change to 5% gravel, 85% sand, 10% fines.	
80	79.0 80.0	10111							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 5 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft BGS				START : 4/12/2011		END : 9/11/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
85	COMPLETE			SW	<b>Well Graded Sand (SW)</b> 67.0-83.0' - brown, (10YR 4/3), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, predominantly quartz.		Soil sample collected between 89.0 and 90.0 ft bgs.		
	SM	<b>Silty Sand (SM)</b> 83.0-87.0' - yellowish brown, (10YR 5/4), dry, partially consolidated, 10% gravel, 70% sand, 20% fines, angular to subangular, poorly graded, predominantly quartz. 83.0-84.0' - Metadiorite boulder.							
	90	89.0 90.0	10112		SW				<b>Well Graded Sand With Gravel (SW)</b> 87.0-132.0' - yellowish brown, (10YR 5/4), dry to moist, loose, 20% gravel, 75% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz and mixed gravel.
95									
100	99.0 100.0	10113					Soil sample collected between 99.0 and 100.0 ft bgs.		



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 6 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :

ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
LAB SAMPLE							
105		COMPLETE		SW	104.0-105.0' - Metadiorite boulder.		
110	109.0 110.0		10114				Soil sample collected between 109.0 and 110.0 ft bgs.
115							
				NR	No Recovery (NR) 117.0-119.0'		Rig down at 1200. Drilling resumes at 0845.
					Well Graded Sand With Gravel (SW) 87.0-132.0' - yellowish brown, (10YR 5/4), dry to moist, loose, 20% gravel, 75% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz and mixed gravel.		
120	119.0 120.0		10115, 50004				Soil sample collected between 119.0 and 120.0 ft bgs.





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 7 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :

ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

WATER LEVEL (ft) (10YR 5/5)		START DATE (10YR 5/5)		END DATE (10YR 5/5)		EQUIPMENT (10YR 5/5)	
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/LITHOLOGY		SOIL DESCRIPTION		COMMENTS	
INTERVAL (ft)		RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
LAB SAMPLE						SYMBOLIC LOG	
125		COMPLETE		SW		Well Graded Sand With Gravel (SW) 87.0-132.0' - yellowish brown, (10YR 5/4), dry to moist, loose, 20% gravel, 75% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz and mixed gravel.	
129.0		10116					
130						Soil sample collected between 129.0 and 130.0 ft bgs.	
135				SW		Well Graded Sand With Gravel (SW) 132.0-157.0' - brown, (10YR 5/3), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, Color change to brown (10YR 5/3), saturated, loose to partially consolidated, change to 40% gravel, 40% sand, 20% fines, mixed gravel.	
140							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 8 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Sand With Gravel (SW)</b> 132.0-157.0' - brown, (10YR 5/3), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		
145		COMPLETE		SW			
147.0							Grab groundwater sample collected from borehole between 147.0 and 157.0 ft bgs.
150							
155				SP	<b>Poorly Graded Sand (SP)</b> 157.0-162.5' - greyish brown, (10YR 5/2), saturated, loose, 5% gravel, 90% sand, 5% fines, subangular to subrounded, poorly graded and fining upwards, predominantly quartz sand.		
157.0							
160							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 9 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 157 ft BGS			START : 4/12/2011		END : 9/11/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)		LAB SAMPLE					
		COMPLETE		SP	<b>Poorly Graded Sand (SP)</b> 157.0-162.5' - greyish brown, (10YR 5/2), saturated, loose, 5% gravel, 90% sand, 5% fines, subangular to subrounded, poorly graded and fining upwards, predominantly quartz sand.			
165				SW	<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.			
					166.0-167.0' - Metadiorite boulder.			
170								
175								
	177.0				177' - Change to 40% gravel, 20% sand, 40% fines, dense.		Grab groundwater sample collected from borehole between 177.0 and 187.0 ft bgs.	
180								



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 10 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 15 ft BGS		START : 4/12/2011		END : 9/17/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)		LAB SAMPLE				
		COMPLETE	BH-66-20102		<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		
185							
187.0							
190				SW			Rig down at 1640. Drilling resumes at 1200.
195							

Rig down at 1640. Drilling resumes at 1200.

# SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :

ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
<div style="display: flex; justify-content: space-between;"> <span>WATER LEVELS: Approx. 15 ft BGS</span> <span>START: 4/12/2011</span> <span>END: 9/17/2011</span> <span>LOGGER: A. Brewster (Northstar)</span> </div>							
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <div style="text-align: center;">COMPLETE</div> </div> <div style="width: 15%; border-left: 1px solid black; border-right: 1px solid black; text-align: center;">           BH-66-20103         </div> </div>				SW	<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		Grab groundwater sample collected from borehole between 207.0 and 217.0 ft bgs.
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">205</div> <div style="width: 15%; border-left: 1px solid black; border-right: 1px solid black;"></div> </div>					204' - Change to 50% gravel and 50% fines, clast-supported.		
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">210</div> <div style="width: 15%; border-left: 1px solid black; border-right: 1px solid black;"></div> </div>					214' - Color change to reddish brown (5YR 4/4)  215.0-216.0' - Metadiorite boulder.		
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">215</div> <div style="width: 15%; border-left: 1px solid black; border-right: 1px solid black;"></div> </div>					217' - Color change to brown (7.5YR 4/4).		
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">217.0</div> <div style="width: 15%; border-left: 1px solid black; border-right: 1px solid black;"></div> </div>							
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">220</div> <div style="width: 15%; border-left: 1px solid black; border-right: 1px solid black;"></div> </div>							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 12 OF 15

## SOIL BORING LOG

PROJECT : ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD :


ORIENTATION : Vertical

WATER LEVELS : Approx. 131 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE		SW	<b>Well Graded Sand With Gravel (SW)</b> 162.5-233.0' - dark brown, (7.5YR 3/4), saturated, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, mixed gravel.		Grab groundwater sample collected from borehole between 224.0 and 234.0 ft bgs.   <



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-66</b>
SHEET 13 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : ER-TCS Investigation	LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)
ELEVATION : 586.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD :	ORIENTATION : Vertical
WATER LEVELS : Approx. 131 ft BGS	START : 4/12/2011      END : 9/11/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
245		COMPLETE		Tmc	<b>Conglomerate Bedrock (Tmc)</b> 233.0-248.0' - massive.		
248.0					Begin rock coring from 248.0 ft bgs See the next page for the rock core log.		
250							
255							
260							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 14 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary






ORIENTATION : Vertical

WATER LEVELS : Approx. 130 ft BGS

START : 4/12/2011

END : 9/11/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS: ADJUX: 150 R DGS			START: 4/12/2011			END: 9/17/2011			LOGGERS: A. Brewster (Northstar)		
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES				SYMBOLIC LOG	LITHOLOGY	COMMENTS			
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS		SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.				
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS							
250	248.0	90	0	248' - Note: unless otherwise noted, all factures in core are mechanical breaks caused by the drilling process.  249.1' - Joint, 60 deg, planar, <1mm calcite infilling, iron staining, slickenslided, tight.		<b>Conglomerate</b> 248.0-271.0' - dark reddish brown, (10YR 3/4), no dominant mineralogy, highly cemented, moderate (), angular to subangular, massive (no bedding planes), matrix-supported.	R1=0.43 FPM				
	1										
	0										
255	251.0	100	0	263.6' - Joint, 40 deg, smooth, undulating to planar, <1mm calcite infilling, iron staining, tight.		Presence of foliation at approximately 30 degree dip.	R2=0.53 FPM				
	0										
	0										
	0										
	0										
	0										
260	256.0	100	0				263.6' - Joint, 40 deg, smooth, undulating to planar, <1mm calcite infilling, iron staining, tight.		Presence of foliation at approximately 30 degree dip.	R3=0.49 FPM	
	0										
	0										
	0										
	0										
	0										
265	261.0	100	0	263.6' - Joint, 40 deg, smooth, undulating to planar, <1mm calcite infilling, iron staining, tight.		Presence of foliation at approximately 30 degree dip.				R4=0.54 FPM	
	0										
	0										
	1										
	0										
	0										
	266.0		0				263.6' - Joint, 40 deg, smooth, undulating to planar, <1mm calcite infilling, iron staining, tight.		Presence of foliation at approximately 30 degree dip.	R5=0.74 FPM	
	0										
	0										





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-66** SHEET 15 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 6 (TCS) (2100957.7 N, 7615153.8 E)

ELEVATION : 586.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 130 ft BGS

START : 4/12/2011

END : 9/11/2011

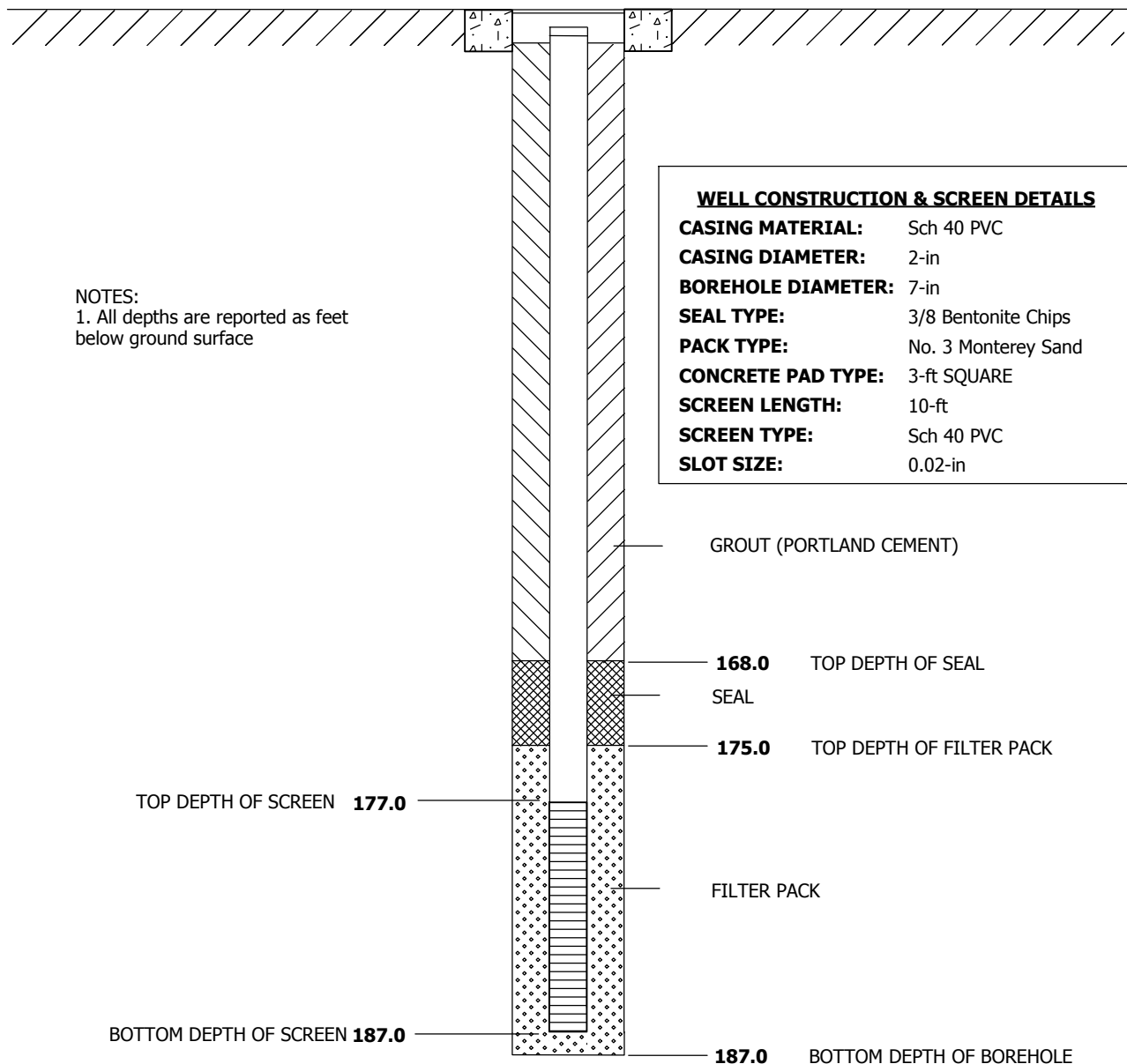
LOGGER : A. Brewster (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
270	R5 5 ft 100%	100	0			<b>Conglomerate</b> 248.0-271.0' - dark reddish brown, (10YR 3/4), no dominant mineralogy, highly cemented, moderate (), angular to subangular, massive (no bedding planes), matrix-supported.	
			0				
271.0			0				
						End Drilling on 9/11/2011 Total Borehole Depth: 271.0 ft bgs	This borehole was converted into the following monitoring well(s): MW-66-165, MW-66-230, and MW-66BR-270
275							
280							
285							

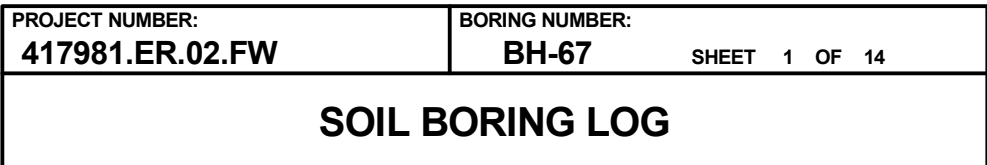
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-67-185</b></i>
<b>LOCATION:</b> Site 2		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 9/22/2011	
<b>DRILLING METHOD:</b> Rotosonic/Wireline Rotary Core	<b>DRILLING END:</b> 9/23/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 9/23/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 626.2 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 15, 35, 55, 75, 95, 115, 135, and 155 ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2101040.21		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615335.52		

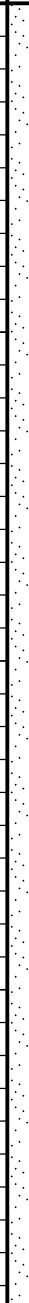
## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)

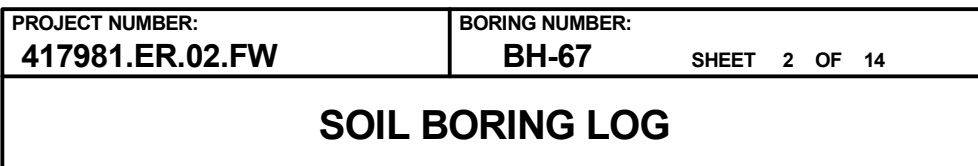


WELL DIAGRAM IS NOT TO SCALE





LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
		RECOVERY (in)					
		LAB SAMPLE					
	0.0	COMPLETE	10201	SP	<b>Poorly Graded Sand (SP)</b> 0.0-21.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.		Start 04/29/2011 at 0800
	1.0						Soil sample collected between 0.0 and 1.0 ft bgs.
	2.0		10202				Soil sample collected between 2.0 and 3.0 ft bgs.
	3.0						
5	5.0		10203				Soil sample collected between 5.0 and 6.0 ft bgs.
	6.0						
	9.0		10204				Soil sample collected between 9.0 and 10.0 ft bgs.
10	10.0						
	14.0		10205				Soil sample collected between 14.0 and 15.0 ft bgs.
15	15.0						
	19.0						Soil sample collected between 19.0 and 20.0 ft bgs.
20	20.0		10206				



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
25		COMPLETE		SP	<b>Poorly Graded Sand (SP)</b> 0.0-21.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.		
				SW	<b>Well Graded Sand (SW)</b> 21.0-24.0' - yellowish brown, (10YR 5/4), dry, loose, subangular to subrounded, predominantly quartz.		
					<b>Boulder</b> 24.0-28.0' - Unknown pulverized boulder.		
30	29.0 30.0		10207	SM	<b>Silty Sand (SM)</b> 28.0-40.0' - yellowish brown, (10YR 5/4), dry, loose to partially consolidated, 10% gravel, 75% sand, 15% fines, subangular, poorly graded, predominantly quartz.		Soil sample collected between 29.0 and 30.0 ft bgs.
40	39.0 40.0		10208, 50006				Soil sample collected between 39.0 and 40.0 ft bgs.



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-67** SHEET 3 OF 14

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS: Approx. 17.9 ft bgs			START: 4/29/2011		END: 5/3/2011		LOGGER: A. Brewster (Noninistat)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
45		COMPLETE	SP	<b>Poorly Graded Sand (SP)</b> 40.0-47.0' - yellowish brown, (10YR 5/4), dry, loose, 5% gravel, 90% sand, 5% fines, subangular to subrounded, poorly graded, predominantly quartz.				
50	49.0 50.0	10209	SM	<b>Silty Sand With Gravel (SM)</b> 47.0-52.0' - yellowish brown, (10YR 5/4), dry, loose, 15% gravel, 65% sand, 20% fines, subangular to angular, poorly graded, no predominant mineral.		Soil sample collected between 49.0 and 50.0 ft bgs.		
55			SP	<b>Poorly Graded Sand (SP)</b> 52.0-53.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.				
			CL	<b>Lean Clay (CL)</b> 53.0-63.0' - brown, (7.5YR 4/4), moist, stiff, slow dilatancy, poorly graded				
60	59.0 60.0	10210				Soil sample collected between 59.0 and 60.0 ft bgs.		



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-67** SHEET 4 OF 14

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic



ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

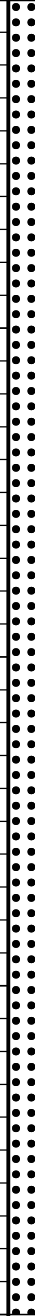
WATER LEVELS : Approx. 170 ft BGS			START : 4/29/2011		END : 5/3/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
65	COMPLETE		CL	<b>Lean Clay (CL)</b> 53.0-63.0' - brown, (7.5YR 4/4), moist, stiff, slow dilatancy, poorly graded		Soil sample collected between 69.0 and 70.0 ft bgs.		
			SP	<b>Poorly Graded Sand (SP)</b> 63.0-64.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.				
			CL	<b>Lean Clay (CL)</b> 64.0-73.0' - brown, (7.5YR 4/4), moist, stiff, slow dilatancy, rusty staining on some surfaces.				
70	69.0 70.0	10211						
75			ML	<b>Silt (ML)</b> 73.0-92.0' - brown, (7.5YR 4/4), dry, stiff to medium stiff, moderate dilatancy, friable in spots.		Soil sample collected between 79.0 and 80.0 ft bgs.		
80	79.0 80.0	10212						



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 5 OF 14	
<b>SOIL BORING LOG</b>	

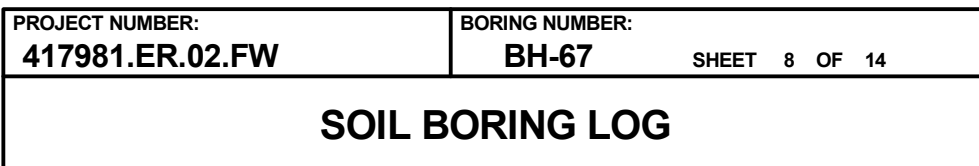
PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Silt (ML)</b> 73.0-92.0' - brown, (7.5YR 4/4), dry, stiff to medium stiff, moderate dilatancy, friable in spots.		
85				ML			
	89.0 90.0		10213				Soil sample collected between 89.0 and 90.0 ft bgs.
90							
				GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		
95							
	99.0 100.0		10214				Soil sample collected between 99.0 and 100.0 ft bgs.
100							

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
				GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		Soil sample collected between 109.0 and 110.0 ft bgs.
105							
109.0							
110	110.0		10215				
115							
119.0				GW			Soil sample collected between 119.0 and 120.0 ft bgs.
120	120.0		10216				

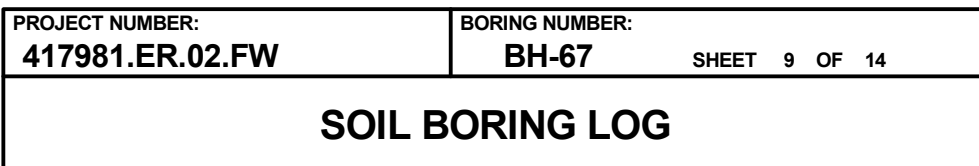






LOGGER : A. Brewster (Northstar)

[illegible]



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
<div style="text-align: center;">COMPLETE</div>				GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy, matrix-supported. 160.5-161.0' - Metadiorite boulder.		
					169' - Change to saturated, color change to brown (10YR 5/3).		
180							

# SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic



ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
				GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		Grab groundwater sample collected from borehole between 187.0 and 197.0 ft bgs.
COMPLETE							
185	187.0	BH-67-20201					
				ML	<b>Silt With Gravel (ML)</b> 197.0-211.0' - dark brown, (7.5YR 3/4), saturated, stiff, 15% gravel, 10% sand, 75% fines, moderate dilatancy, subangular to subrounded, poorly graded, no dominant mineralogy.		Stop 04/30/2011 at 1700 at 197 ft bgs. Resume on 05/01/2011 at 0730.
195							
197.0							
200							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-67** SHEET 11 OF 14

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic



ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 170 ft BGS			START : 4/29/2011			END : 5/3/2011			LOGGER : A. Brewster (Northstar)		
DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS			
INTERVAL (ft)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY			DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION						
RECOVERY (in)											
LAB SAMPLE											
205	COMPLETE			ML	<b>Silt With Gravel (ML)</b> 197.0-211.0' - dark brown, (7.5YR 3/4), saturated, stiff, 15% gravel, 10% sand, 75% fines, moderate dilatancy, subangular to subrounded, poorly graded, no dominant mineralogy.						
210					SW	<b>Well Graded Sand With Gravel (SW)</b> 211.0-221.0' - dark brown, (7.5YR 3/4), saturated, loose, 35% gravel, 55% sand, 10% fines, subangular to subrounded, no dominant mineralogy.					
215											
217.0							Drilling very slow (<0.1 FPM)  Grab groundwater sample collected from borehole between 217.0 and 227.0 ft bgs.				
220											



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 12 OF 14	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
				SW	<b>Well Graded Sand With Gravel (SW)</b> 211.0-221.0' - dark brown, (7.5YR 3/4), saturated, loose, 35% gravel, 55% sand, 10% fines, subangular to subrounded, no dominant mineralogy.		
					<b>Silt With Gravel (ML)</b> 221.0-258.5' - dark brown, (7.5YR 3/4), saturated, stiff, 40% gravel, 5% sand, 55% fines, slow to moderate dilatancy, subangular to angular, poorly graded, no dominant mineralogy.		
225					225' - increase in proportion of metadiorite gravel.		
227.0							
230				ML			
235							
240							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 13 OF 14	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Sand With Gravel (SW)</b> 258.5-259.5' - dark brown, (7.5YR 3/4), saturated, loose, 40% gravel, 50% sand, 10% fines, subangular to subrounded, predominantly quartz sand and metadiorite gravel.		
245		COMPLETE					
	247.0						
250				ML			Grab groundwater sample collected from borehole between 247.0 and 257.0 ft bgs.
			BH-67-20203				
255							
	257.0				<b>Silt With Gravel (ML)</b> 221.0-258.5' - dark brown, (7.5YR 3/4), saturated, stiff, 40% gravel, 5% sand, 55% fines, slow to moderate dilatancy, subangular to angular, poorly graded, no dominant mineralogy.		
				SW			
				ML	<b>Well Graded Sand With Gravel (SW)</b> 258.5-259.5' - dark brown, (7.5YR 3/4), saturated, loose, 40% gravel, 50% sand, 10% fines, subangular to subrounded, predominantly quartz sand and metadiorite gravel.		
260							Stop 05/01/2011 at 1700 at 257 ft bgs. Resume 05/02/2011 at 1400.



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 14 OF 14	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 170 ft BGS			START : 4/29/2011		END : 5/3/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)	LAB SAMPLE						
		COMPLETE		ML	<b>Silt With Gravel (ML)</b> 259.5-264.0' - dark brown, (7.5YR 3/4), saturated, stiff to moderately stiff, 40% gravel, 5% sand, 55% fines, moderate dilatancy, subangular to angular, poorly graded, predominantly metadiorite gravel.		Stop 05/02/2011 at 1600 at 264 ft bgs, refusal with 6" conductor at 254.0 ft bgs. Resume 05/03/2011 at 1330.	
265				Tmc	<b>Conglomerate (Tmc)</b> 264.0-271.0' - Miocene conglomerate; yellowish red (5YR 4/6) from 264.0-265.0', red (2.5YR 4/6) from 265.0-271.0'.			
270				pTbr	<b>Metadiorite (pTbr)</b> 271.0-272.5' - Metadiorite bedrock.			
275					End Drilling on 5/3/2011 Total Borehole Depth: 272.5 ft bgs		This borehole was converted into the following monitoring well(s): MW-67-185, MW-67-225, and MW-67-260	
280								



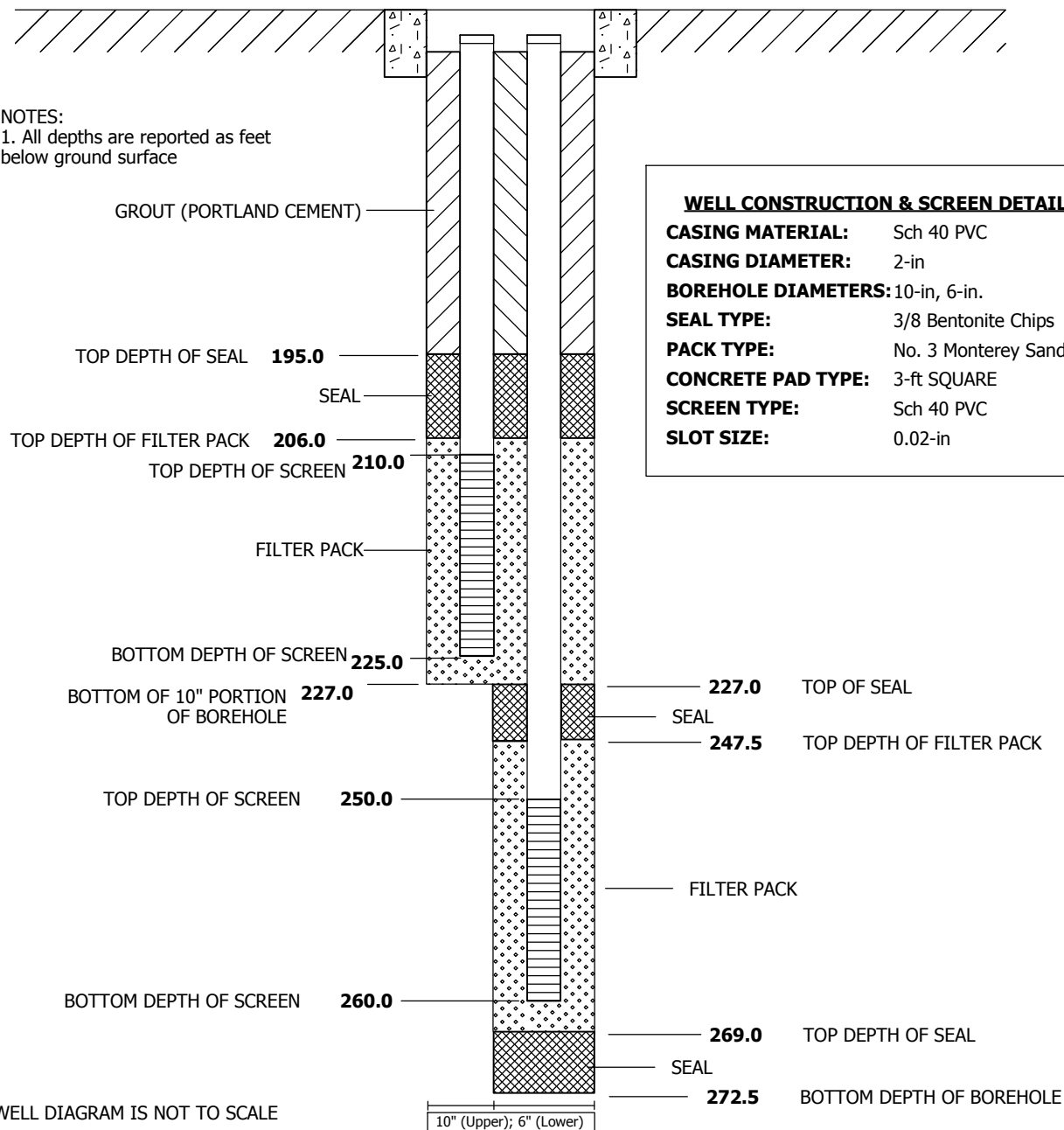
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-67-225</b></i> <i><b>MW-67-260</b></i>
<b>LOCATION:</b> Site 2		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 4/29/2011	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 5/2/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 5/10/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 626.3 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 10, 25, 40, 55, 70, 85, 100, 115, 130, 145, 160, 175, 190, 205, and 245ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2101047.85		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615332.58		

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)

**NOTES:**

1. All depths are reported as feet below ground surface





# SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic


ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
25		COMPLETE		SP	<b>Poorly Graded Sand (SP)</b> 0.0-21.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.		Soil sample collected between 29.0 and 30.0 ft bgs.
				SW	<b>Well Graded Sand (SW)</b> 21.0-24.0' - yellowish brown, (10YR 5/4), dry, loose, subangular to subrounded, predominantly quartz.		
					<b>Boulder</b> 24.0-28.0' - Unknown pulverized boulder.		
					<b>Silty Sand (SM)</b> 28.0-40.0' - yellowish brown, (10YR 5/4), dry, loose to partially consolidated, 10% gravel, 75% sand, 15% fines, subangular, poorly graded, predominantly quartz.		
30	29.0 30.0		10207				
35				SM			
40	39.0 40.0		10208, 50006				Soil sample collected between 39.0 and 40.0 ft bgs.



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-67** SHEET 3 OF 14

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic



ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
45	COMPLETE			SP	<b>Poorly Graded Sand (SP)</b> 40.0-47.0' - yellowish brown, (10YR 5/4), dry, loose, 5% gravel, 90% sand, 5% fines, subangular to subrounded, poorly graded, predominantly quartz.		
	49.0			SM	<b>Silty Sand With Gravel (SM)</b> 47.0-52.0' - yellowish brown, (10YR 5/4), dry, loose, 15% gravel, 65% sand, 20% fines, subangular to angular, poorly graded, no predominant mineral.		
	50.0	10209					
55				SP	<b>Poorly Graded Sand (SP)</b> 52.0-53.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.		Soil sample collected between 49.0 and 50.0 ft bgs.
				CL	<b>Lean Clay (CL)</b> 53.0-63.0' - brown, (7.5YR 4/4), moist, stiff, slow dilatancy, poorly graded		
60	59.0						
	60.0	10210					

# SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

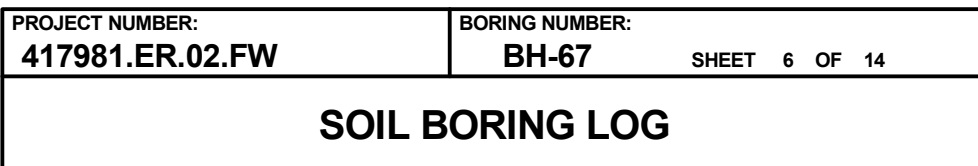
WATER LEVELS : Approx. 170 ft bgs				START : 4/29/2011		END : 5/3/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
65		COMPLETE		CL	<b>Lean Clay (CL)</b> 53.0-63.0' - brown, (7.5YR 4/4), moist, stiff, slow dilatancy, poorly graded		Soil sample collected between 69.0 and 70.0 ft bgs.		
				SP	<b>Poorly Graded Sand (SP)</b> 63.0-64.0' - light yellowish brown, (10YR 6/4), dry, loose, subangular to subrounded, poorly graded, predominantly quartz.				
				CL	<b>Lean Clay (CL)</b> 64.0-73.0' - brown, (7.5YR 4/4), moist, stiff, slow dilatancy, rusty staining on some surfaces.				
70	69.0 70.0		10211						
75				ML	<b>Silt (ML)</b> 73.0-92.0' - brown, (7.5YR 4/4), dry, stiff to medium stiff, moderate dilatancy, friable in spots.		Soil sample collected between 79.0 and 80.0 ft bgs.		
80	79.0 80.0		10212						

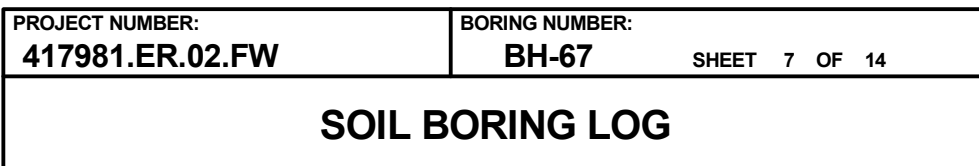


<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 5 OF 14	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Silt (ML)</b> 73.0-92.0' - brown, (7.5YR 4/4), dry, stiff to medium stiff, moderate dilatancy, friable in spots.		
85				ML			
	89.0 90.0		10213				Soil sample collected between 89.0 and 90.0 ft bgs.
90							
				GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		
95							
	99.0 100.0		10214				Soil sample collected between 99.0 and 100.0 ft bgs.
100							

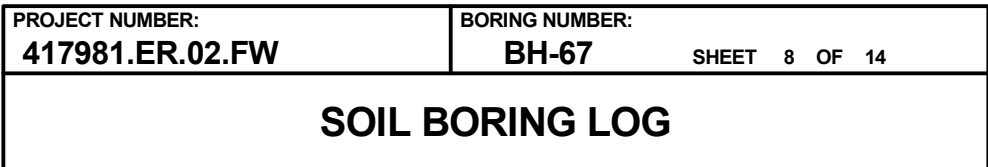




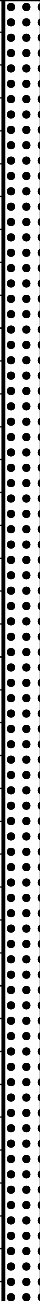
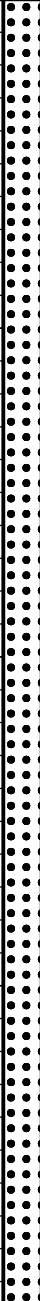
LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
				GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		<p>Stop 04/29/2011 at 1645 at 127 ft bgs. Resume on 4/30/2011 at 0700.</p> <p>Soil sample collected between 129.0 and 130.0 ft bgs.</p> <p>Soil sample collected between 139.0 and 140.0 ft bgs.</p>
125							
130	129.0 130.0		10217				
135							
140	139.0 140.0		10218, 50007				





LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		
145							
	149.0						
150	150.0		10219				
155							
					157' - Change to moist.		
	159.0						
160	160.0		10220				



# SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic



ORIENTATION : Vertical

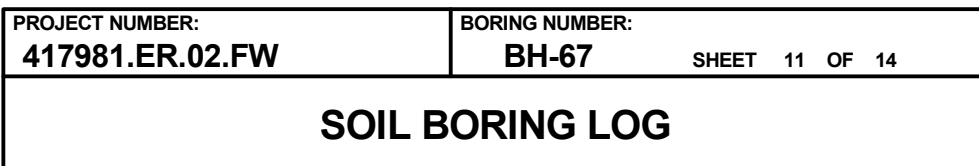
WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011


END : 5/3/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)						
		LAB SAMPLE					
185	187.0	COMPLETE	BH-67-20201	GW	<b>Well Graded Gravel (GW)</b> 92.0-197.0' - dark greyish brown, (10YR 4/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, no dominant mineralogy.		Grab groundwater sample collected from borehole between 187.0 and 197.0 ft bgs.
190							
195	197.0			ML	<b>Silt With Gravel (ML)</b> 197.0-211.0' - dark brown, (7.5YR 3/4), saturated, stiff, 15% gravel, 10% sand, 75% fines, moderate dilatancy, subangular to subrounded, poorly graded, no dominant mineralogy.		Stop 04/30/2011 at 1700 at 197 ft bgs. Resume on 05/01/2011 at 0730.
200							



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
<div>205</div> <div>COMPLETE</div>				ML	<b>Silt With Gravel (ML)</b> 197.0-211.0' - dark brown, (7.5YR 3/4), saturated, stiff, 15% gravel, 10% sand, 75% fines, moderate dilatancy, subangular to subrounded, poorly graded, no dominant mineralogy.		
<div>210</div>					<b>Well Graded Sand With Gravel (SW)</b> 211.0-221.0' - dark brown, (7.5YR 3/4), saturated, loose, 35% gravel, 55% sand, 10% fines, subangular to subrounded, no dominant mineralogy.		
<div>215</div>				SW			Drilling very slow (<0.1 FPM)  Grab groundwater sample collected from borehole between 217.0 and 227.0 ft bgs.
<div>217.0</div>							
<div>220</div>							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 12 OF 14	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE	BH-67-20202	SW	<b>Well Graded Sand With Gravel (SW)</b> 211.0-221.0' - dark brown, (7.5YR 3/4), saturated, loose, 35% gravel, 55% sand, 10% fines, subangular to subrounded, no dominant mineralogy.		
					<b>Silt With Gravel (ML)</b> 221.0-258.5' - dark brown, (7.5YR 3/4), saturated, stiff, 40% gravel, 5% sand, 55% fines, slow to moderate dilatancy, subangular to angular, poorly graded, no dominant mineralogy.		
225					225' - increase in proportion of metadiorite gravel.		
227.0							
230				ML			
235							
240							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-67</b>
SHEET 13 OF 14	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 2 (2101040.2 N, 7615335.5 E)
ELEVATION : 626.2 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 170 ft BGS	START : 4/29/2011      END : 5/3/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Sand With Gravel (SW)</b> 258.5-259.5' - dark brown, (7.5YR 3/4), saturated, loose, 40% gravel, 50% sand, 10% fines, subangular to subrounded, predominantly quartz sand and metadiorite gravel.		
245		COMPLETE					
	247.0						
250				ML			Grab groundwater sample collected from borehole between 247.0 and 257.0 ft bgs.
			BH-67-20203				
255							
	257.0				<b>Silt With Gravel (ML)</b> 221.0-258.5' - dark brown, (7.5YR 3/4), saturated, stiff, 40% gravel, 5% sand, 55% fines, slow to moderate dilatancy, subangular to angular, poorly graded, no dominant mineralogy.		
				SW			
				ML	<b>Well Graded Sand With Gravel (SW)</b> 258.5-259.5' - dark brown, (7.5YR 3/4), saturated, loose, 40% gravel, 50% sand, 10% fines, subangular to subrounded, predominantly quartz sand and metadiorite gravel.		
260							Stop 05/01/2011 at 1700 at 257 ft bgs. Resume 05/02/2011 at 1400.



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-67** SHEET 14 OF 14

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 2 (2101040.2 N, 7615335.5 E)

ELEVATION : 626.2 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 170 ft BGS

START : 4/29/2011

END : 5/3/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 170 ft BGS		START : 4/29/2011		END : 5/3/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)	LAB SAMPLE					
265	COMPLETE			ML	<b>Silt With Gravel (ML)</b> 259.5-264.0' - dark brown, (7.5YR 3/4), saturated, stiff to moderately stiff, 40% gravel, 5% sand, 55% fines, moderate dilatancy, subangular to angular, poorly graded, predominantly metadiorite gravel.		Stop 05/02/2011 at 1600 at 264 ft bgs, refusal with 6" conductor at 254.0 ft bgs. Resume 05/03/2011 at 1330.
270				Tmc	<b>Conglomerate (Tmc)</b> 264.0-271.0' - Miocene conglomerate; yellowish red (5YR 4/6) from 264.0-265.0', red (2.5YR 4/6) from 265.0-271.0'.		
				pTbr	<b>Metadiorite (pTbr)</b> 271.0-272.5' - Metadiorite bedrock.		
275					End Drilling on 5/3/2011 Total Borehole Depth: 272.5 ft bgs		This borehole was converted into the following monitoring well(s): MW-67-185, MW-67-225, and MW-67-260
280							

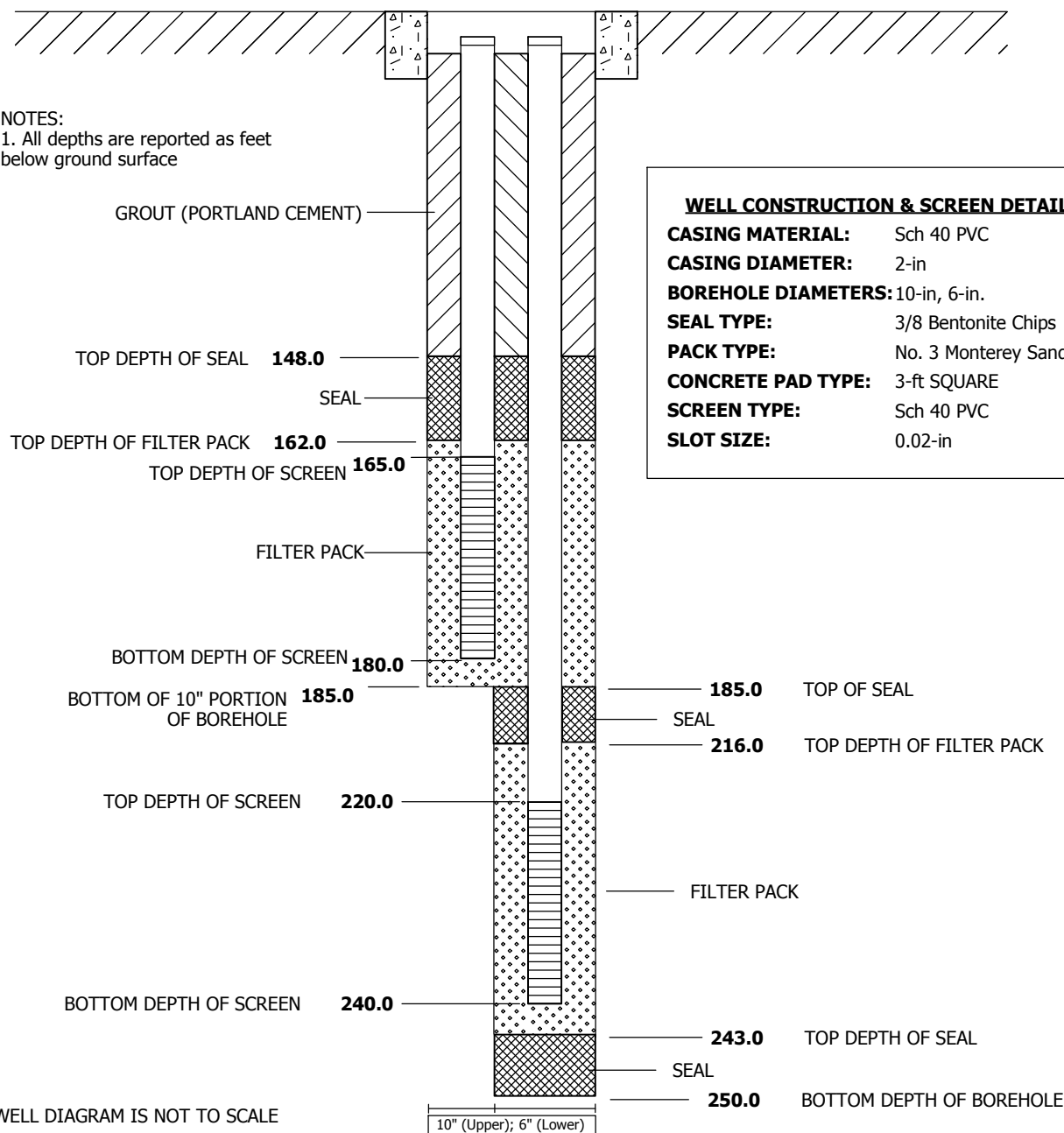
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-68-180</b></i> <i><b>MW-68-240</b></i>
<b>LOCATION:</b> Site 3		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 5/13/2011	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 5/16/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 5/18/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 621.6 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 10, 25, 40, 55, 70, 85, 100, 115, 130, 145, 160, and 215 ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100773.64		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615453.36		

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)

**NOTES:**




1. All depths are reported as feet below ground surface

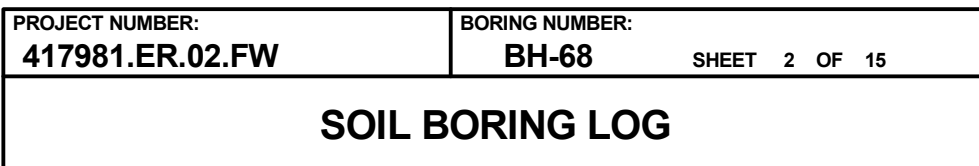


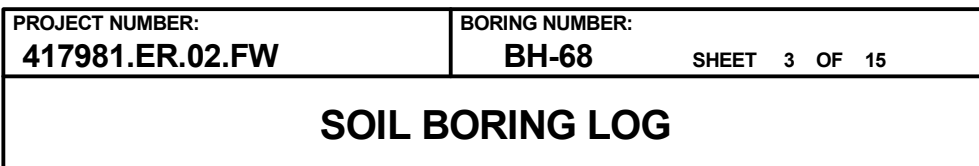


<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 1 OF 15	
<h2 style="margin: 0;">SOIL BORING LOG</h2>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

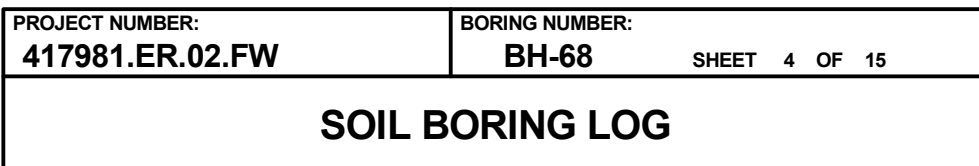
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
		RECOVERY (in)				
		LAB SAMPLE				
	0.0	COMPLETE	10301	<b>Poorly Graded Sand (SP)</b> 0.0-17.0' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 0.0 and 1.0 ft bgs.
	1.0					
	2.0		10302			Soil sample collected between 3.0 and 4.0 ft bgs.
	3.0					
5	5.0		10303, 50009	SP		Soil sample collected between 5.0 and 6.0 ft bgs.
	6.0					
	9.0		10304			Soil sample collected between 9.0 and 10.0 ft bgs.
10	10.0					
	14.0		10305	14' - Color change to yellowish brown, (10YR 5/4)		Soil sample collected between 14.0 and 15.0 ft bgs.
15	15.0					
	19.0		10306			Soil sample collected between 19.0 and 20.0 ft bgs.
20	20.0					





LOGGER : R. Tweidt (Northstar)

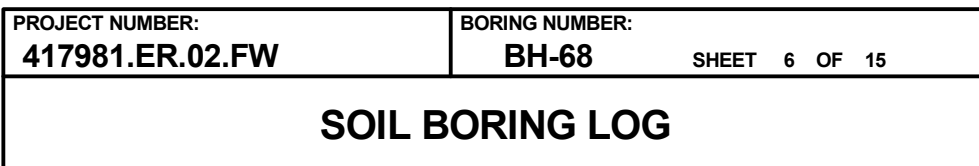
DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		RECOVERY (in)	LAB SAMPLE				
		COMPLETE		SW	<b>Well Graded Sand With Gravel (SW)</b> 35.0-62.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 25% gravel, 75% sand, subrounded to subangular, predominantly quartz.		
45							
50	49.0 50.0		10309		48.0-50.0' - Rock flour		Soil sample collected between 49.0 and 50.0 ft bgs.
55							
60	59.0 60.0		10310				Soil sample collected between 59.0 and 60.0 ft bgs.

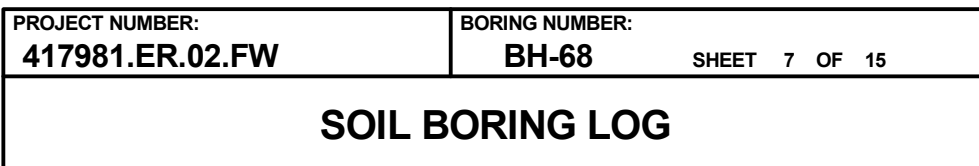


LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
COMPLETE				SW	<b>Well Graded Sand With Gravel (SW)</b> 35.0-62.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 25% gravel, 75% sand, subrounded to subangular, predominantly quartz.		
				GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - greyish brown, (10YR 5/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.		
65							
69.0					69' - color change to light yellow brown, (2.5Y 6/3)	Soil sample collected between 69.0 and 70.0 ft bgs.	
70				70.0	10311		
					70.0-71.0' - Rock flour		

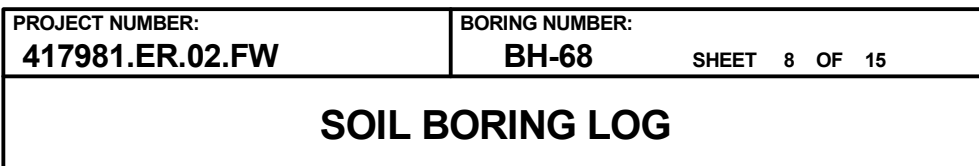






LOGGER : R. Tweidt (Northstar)

[illegible]



LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), dry, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy, partially consolidated from 102.0 ft		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
145							
150	149.0 150.0		10319				
155							
160	159.0 160.0		10320				Soil sample collected between 159.0 and 160.0 ft bgs.





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 9 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	LAB SAMPLE					
165	COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - greyish brown, (10YR 5/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.  163' - Increase in metadiorite fraction of gravel; increase in average gravel size to coarse; change to subangular. 164' - Saturated  <		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 10 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.		
185		COMPLETE	BH-68-20301	GW			
187.0							Grab groundwater sample collected from borehole between 187.0 and 197.0 ft bgs.
190							
195							
200					197.0-198.0' - Metadiorite boulder		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 11 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVELS: Approx. 104 ft bgs			START: 9/19/2011		END: 9/19/2011		LOGGER: R. Twardt (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE						
		COMPLETE		<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.				
205				205.0-207.0' - Coarse-grained sand				
207.0						Grab groundwater sample collected from borehole between 207.0 and 217.0 ft bgs.		
210			GW					
				212' - Color change to pale olive (5Y 6/3)				
215								
217.0						Stop 05/14/2011 at 1700 at 217 ft bgs. Resume 05/15/2011 at 1130		
220								



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 12 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools

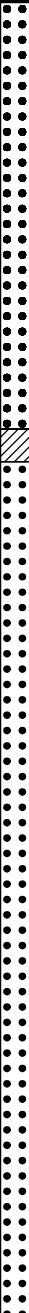
ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	LAB SAMPLE					
225	COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - olive grey, (5Y 5/2), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.		Grab groundwater sample collected from borehole between 235.0 and 245.0 ft bgs.
			CL	<b>Clay With Silt (CL)</b> 226.5-227.0' - olive grey, (5Y 5/2), saturated, 100% fines, low dilatancy, soft, matrix-supported		
			GW	<b>Well Graded Gravel (GW)</b> 227.0-243.0' - pale olive, (5Y 6/3), saturated, 40% gravel, 40% sand, 20% fines, angular to subangular, predominantly metadiorite gravel, dense. 229.0-230.0' - Rock flour  233.0-234.0' - Change to 40% gravel, 50% sand, 10% fines, color change to light olive brown (2.5Y 5/3)  238.5-239.0' - Color change to black 239' - Color change to brown (10YR 5/3)		
230						
235	235.0					
240						



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 13 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Gravel (GW)</b> 227.0-243.0' - brown, (10YR 5/3), saturated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, predominantly metadiorite gravel, dense, matrix-supported,		
					<b>Conglomerate (Tmc)</b> 243.0-257.0' - massive, red (2.5YR 4/8)		Stop 05/15/2011 at 1630 at 245 ft bgs. Resume 05/16/2011 at 1000
245	245.0						
							Stop 05/16/2011 at 1100. Drilling complete.
250							
							Initiate rock core drilling at 1115 on 8/10/2011
255							
					Begin rock coring from 257.0 ft bgs See the next page for the rock core log.		
257.0							
260							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68**

SHEET 14 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : RS-350, Wire-Line Rotary

ORIENTATION : Vertical

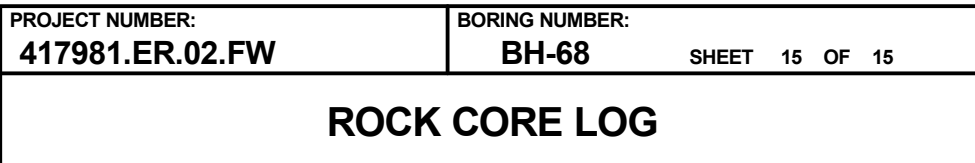
WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
257.0	R1 3 ft 70%	28	NR			<b>Miocene Conglomerate (Tmc)</b> 257.0-257.8' - moderate brown, (5YR 4/4)	Run 1 (257 ft - 260 ft), Drill rate = 0.55 ft/min
260	260.0		8	258.0-258.5' - abundant joints, no dominant orientation, not healed, rough, dry			
			>10	258.5-263.5' - fracture zone, no dominant orientation, presence of moderately to totally healed fractures, some 60 degree dip angles between 262 and 263 ft bgs.		<b>Metadiorite (pTbr)</b> 257.8-280.5' - pale yellowish brown (10YR 8/6), non-foliated, uniform, slightly to moderately decomposed, slightly disintegrated, slightly to moderately fractured	
			>10				Run 2 (260 ft - 264.5 ft), Drill rate = 0.28 ft/min
			3				
	R2 4.5 ft 75%	44	>10	263.0-264.5' - shear zone, dry, rough			
			>10				
265	264.5		>10	264.5-269.5' - undulating, few joints observed, narrow presence of totally healed fractures, mineralization, dry		265.5' - Color change to dusky yellow green (5GY 5/2)	Run 3 (264.5 ft - 269.5 ft), Drill rate = 0.41 ft/min
			2				
	R3 5 ft 80%	93	1				
			1				
			1				
270	269.5		>10	269.5-273.5' - undulating, fracture zones, no dominant orientation, not healed, dry			Run 4 (269.5 ft - 270.5 ft), Drill rate = 0.44 ft/min
	R4 1 ft 50%	0	>10				Run 5 (270.5 ft - 275.5 ft), Drill rate = 0.45 ft/min
			>10				
	R5 5 ft 70%	15	>10				
			3				
275			5				
	275.5		>10	276.0-280.5' - undulating, fracture zone, no dominant orientation, not healed, surface staining			Run 6 (275.5 ft - 280.5 ft), Drill rate = 0.3 ft/min
			>10				



# WELL COMPLETION DIAGRAM

**PROJECT NO:** 417981.ER.02.FW

**PROJECT:** ER-TCS Groundwater Investigation

**WELL NO:** ***MW-68BR-280***

**LOCATION:** Site 3

**DRILLING CONTRACTOR:** Boart Longyear (R. Sawrey)

**DRILLING START:** 8/3/2011

**DRILLING METHOD:** Rotosonic/Wireline Rotary Core

**DRILLING END:** 8/11/2011

**LOGGER:** R. Tweidt (Northstar)

**WELL COMPLETION DATE:** 8/11/2011

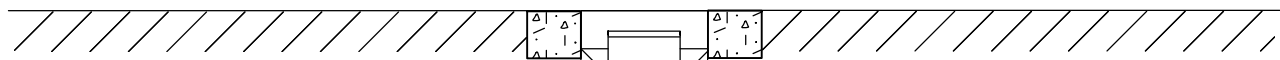
**GROUND SURFACE ELEVATION (NAVD 88):** 621.4 ft AMSL

**GENERAL REMARKS:** Open 3.8" diameter borehole from 257 to 279 feet bgs. Centralizers at 50, 100, 150, 200, and 250 ft bgs.

**NORTHING (CCS NAD 83 Z 5):**  
2100767.09

**EASTING (CCS NAD 83 Z 5):**  
7615453.92

## SQUARE WELL VAULT (FLUSH WITH GRADE)



9-IN DIAMETER BOREHOLE

**NOTES:**

1. All depths are reported as feet below ground surface

### WELL CONSTRUCTION & SCREEN DETAILS

**CONDUCTOR CASING MATERIAL:** High-Strength Low Alloy Steel

**CONDUCTOR CASING DIAMETER:** 5-in

**BOREHOLE DIAMETERS:** 9-in, 3.8-in

**CONCRETE PAD TYPE:** 3-ft SQUARE

**GROUT TYPE:** Type II-V Portland Cement

GROUT

CONDUCTOR CASING

**257.0** TOP OF 3.8-IN OPEN BOREHOLE

**279.0** BOTTOM DEPTH OF BOREHOLE

WELL DIAGRAM IS NOT TO SCALE



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 1 OF 15	
<h2 style="margin: 0;">SOIL BORING LOG</h2>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

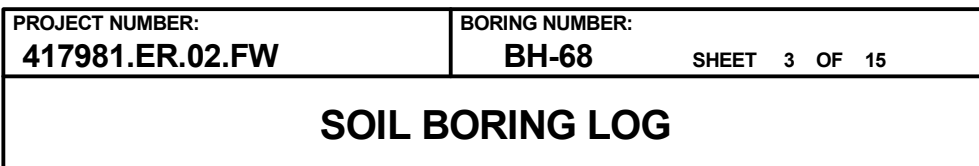
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
		RECOVERY (in)				
		LAB SAMPLE				
	0.0	COMPLETE	10301	<b>Poorly Graded Sand (SP)</b> 0.0-17.0' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.		Soil sample collected between 0.0 and 1.0 ft bgs.
	1.0					
	2.0		10302			Soil sample collected between 3.0 and 4.0 ft bgs.
	3.0					
5	5.0		10303, 50009	SP		Soil sample collected between 5.0 and 6.0 ft bgs.
	6.0					
	9.0		10304			Soil sample collected between 9.0 and 10.0 ft bgs.
10	10.0					
	14.0		10305	14' - Color change to yellowish brown, (10YR 5/4)		Soil sample collected between 14.0 and 15.0 ft bgs.
15	15.0					
	19.0					
	20.0		10306			Soil sample collected between 19.0 and 20.0 ft bgs.
20				<b>Silty Sand (SM)</b> 17.0-35.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz.		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 2 OF 15	
<b>SOIL BORING LOG</b>	

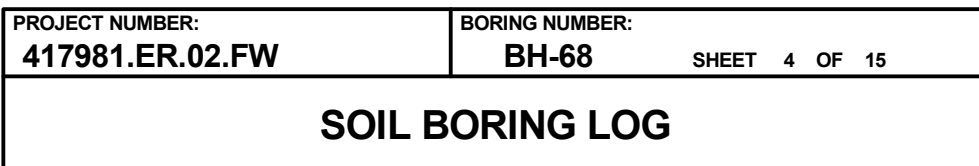
PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
25		COMPLETE		SM	<b>Silty Sand (SM)</b> 17.0-35.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz.		Soil sample collected between 29.0 and 30.0 ft bgs.
29.0	30.0		10307				
35				SW	<b>Well Graded Sand With Gravel (SW)</b> 35.0-62.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 25% gravel, 75% sand, subrounded to subangular, predominantly quartz.		Soil sample collected between 39.0 and 40.0 ft bgs.
39.0	40.0	10308					



LOGGER : R. Tweidt (Northstar)

[illegible]



LOGGER : R. Tweidt (Northstar)

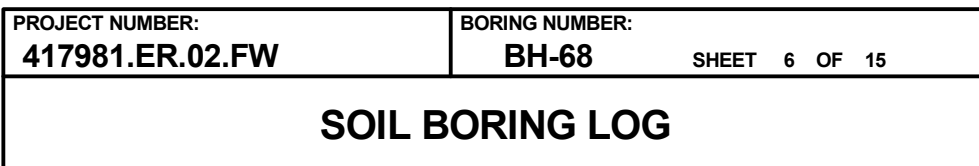
DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
				SW	<b>Well Graded Sand With Gravel (SW)</b> 35.0-62.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 25% gravel, 75% sand, subrounded to subangular, predominantly quartz.		
				GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - greyish brown, (10YR 5/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.		
65							
70	69.0 70.0		10311		69' - color change to light yellow brown, (2.5Y 6/3)  70.0-71.0' - Rock flour		Soil sample collected between 69.0 and 70.0 ft bgs.
75							
80	79.0 80.0		10312				Soil sample collected between 79.0 and 80.0 ft bgs.

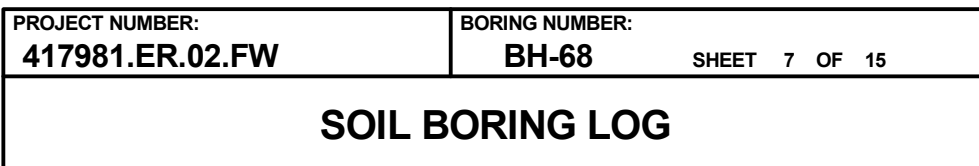


<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 5 OF 15	
<b>SOIL BORING LOG</b>	

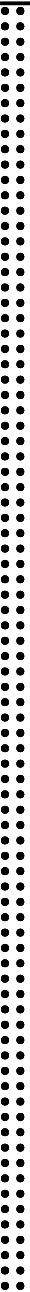
PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.		
85					84' - Change to unconsolidated		
90	89.0 90.0		10313				Soil sample collected between 89.0 and 90.0 ft bgs.
95							
100	99.0 100.0		10314, 50010				Soil sample collected between 99.0 and 100.0 ft bgs.





LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), dry, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy, partially consolidated from 102.0 ft		Soil sample collected between 129.0 and 130.0 ft bgs.  

# SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

[illegible]





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 9 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
RECOVERY (in)							
LAB SAMPLE							
165	COMPLETE			GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - greyish brown, (10YR 5/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.  163' - Increase in metadiorite fraction of gravel; increase in average gravel size to coarse; change to subangular. 164' - Saturated  170.0-172.0' - Decrease in average gravel size (fine), increase in average sand size (coarse).  173.0-177.0' - Change to highly angular  175' - light yellow brown, (2.5Y 6/3)  177' - Color change to strong brown (7.5YR 4/6)	163 ft bgs: Drill rate (~10 FPM to ~0.1 FPM)  170 ft bgs: Drill rate ~10 FPM  172 ft bgs: Drill rate ~0.1 FPM	
170							
175							
177.0							
180							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 10 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.		
185		COMPLETE	BH-68-20301				
187.0							Grab groundwater sample collected from borehole between 187.0 and 197.0 ft bgs.
190				GW			
195							
200					197.0-198.0' - Metadiorite boulder		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 11 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVELS: Approx. 104 ft bgs			START: 9/19/2011		END: 9/19/2011		LOGGER: R. Twardt (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)	LAB SAMPLE						
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.			
205					205.0-207.0' - Coarse-grained sand			
207.0							Grab groundwater sample collected from borehole between 207.0 and 217.0 ft bgs.	
210								
			BH-68-20302			212' - Color change to pale olive (5Y 6/3)		
215								
217.0						Stop 05/14/2011 at 1700 at 217 ft bgs. Resume 05/15/2011 at 1130		
220								



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 12 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools



ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION			
RECOVERY (in)								
LAB SAMPLE								
225	COMPLETE			GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - olive grey, (5Y 5/2), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.			
				CL	<b>Clay With Silt (CL)</b> 226.5-227.0' - olive grey, (5Y 5/2), saturated, 100% fines, low dilatancy, soft, matrix-supported			
				GW	<b>Well Graded Gravel (GW)</b> 227.0-243.0' - pale olive, (5Y 6/3), saturated, 40% gravel, 40% sand, 20% fines, angular to subangular, predominantly metadiorite gravel, dense. 229.0-230.0' - Rock flour  233.0-234.0' - Change to 40% gravel, 50% sand, 10% fines, color change to light olive brown (2.5Y 5/3)  238.5-239.0' - Color change to black 239' - Color change to brown (10YR 5/3)			
235	235.0					Grab groundwater sample collected from borehole between 235.0 and 245.0 ft bgs.		
240								



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 13 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Gravel (GW)</b> 227.0-243.0' - brown, (10YR 5/3), saturated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, predominantly metadiorite gravel, dense, matrix-supported,		
					<b>Conglomerate (Tmc)</b> 243.0-257.0' - massive, red (2.5YR 4/8)		Stop 05/15/2011 at 1630 at 245 ft bgs. Resume 05/16/2011 at 1000
245	245.0						
							Stop 05/16/2011 at 1100. Drilling complete.
250							
							Initiate rock core drilling at 1115 on 8/10/2011
255							
					Begin rock coring from 257.0 ft bgs See the next page for the rock core log.		
257.0							
260							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-68**

SHEET 14 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : RS-350, Wire-Line Rotary

ORIENTATION : Vertical

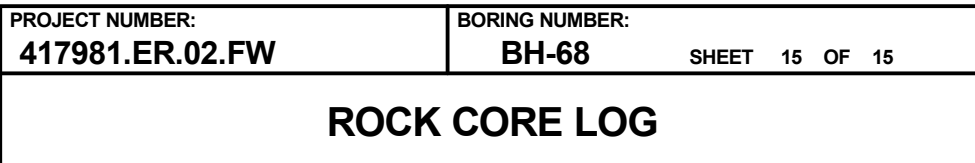
WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

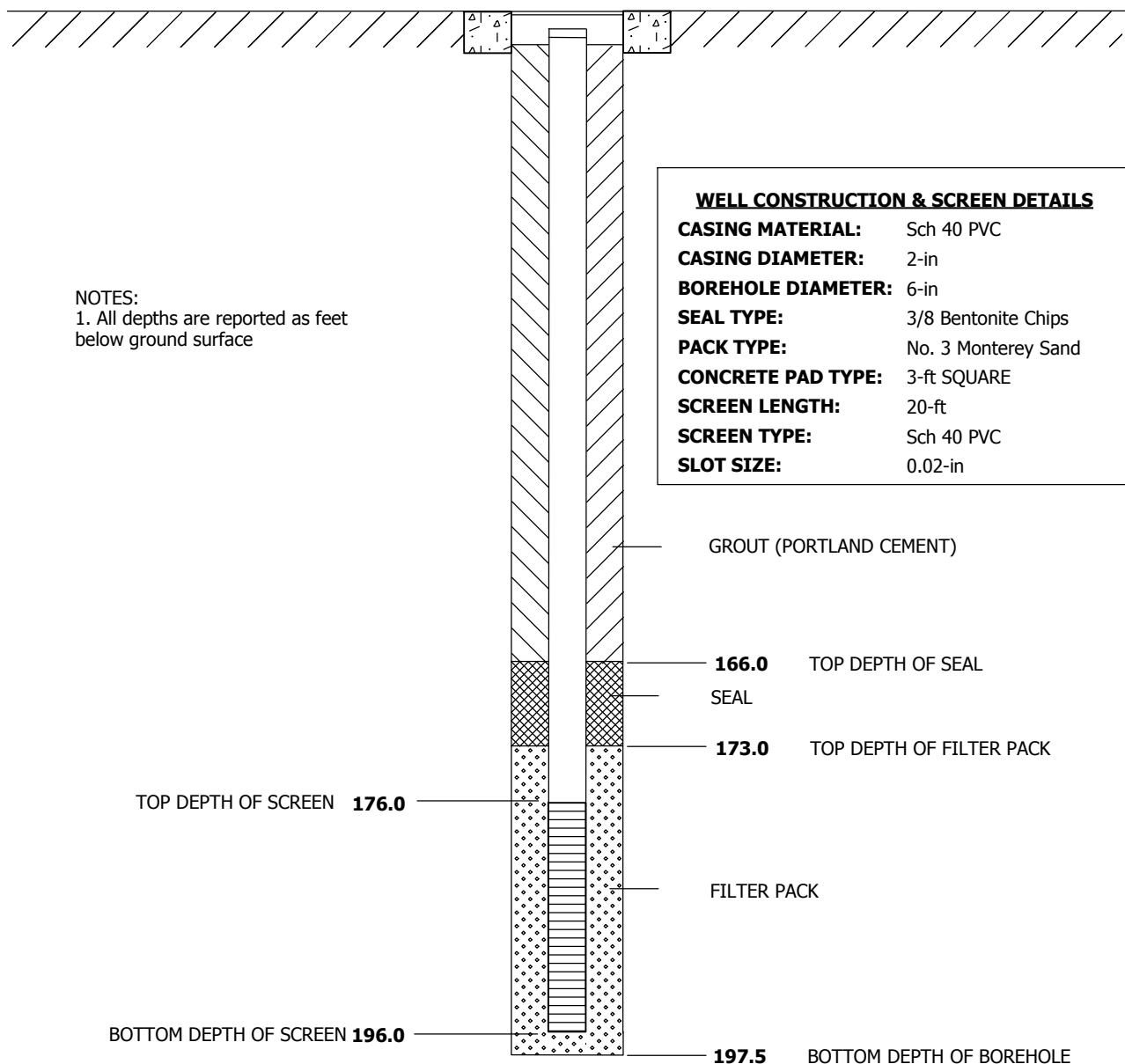
DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
257.0	R1 3 ft 70%	28	NR			<b>Miocene Conglomerate (Tmc)</b> 257.0-257.8' - moderate brown, (5YR 4/4)	Run 1 (257 ft - 260 ft), Drill rate = 0.55 ft/min
260	260.0		8	258.0-258.5' - abundant joints, no dominant orientation, not healed, rough, dry			
			>10	258.5-263.5' - fracture zone, no dominant orientation, presence of moderately to totally healed fractures, some 60 degree dip angles between 262 and 263 ft bgs.		<b>Metadiorite (pTbr)</b> 257.8-280.5' - pale yellowish brown (10YR 8/6), non-foliated, uniform, slightly to moderately decomposed, slightly disintegrated, slightly to moderately fractured	
			>10				Run 2 (260 ft - 264.5 ft), Drill rate = 0.28 ft/min
			3				
	R2 4.5 ft 75%	44	>10	263.0-264.5' - shear zone, dry, rough			
			>10				
265	264.5		>10	264.5-269.5' - undulating, few joints observed, narrow presence of totally healed fractures, mineralization, dry		265.5' - Color change to dusky yellow green (5GY 5/2)	Run 3 (264.5 ft - 269.5 ft), Drill rate = 0.41 ft/min
			2				
	R3 5 ft 80%	93	1				
			1				
			1				
270	269.5		>10	269.5-273.5' - undulating, fracture zones, no dominant orientation, not healed, dry			Run 4 (269.5 ft - 270.5 ft), Drill rate = 0.44 ft/min
	R4 1 ft 50%	0	>10				Run 5 (270.5 ft - 275.5 ft), Drill rate = 0.45 ft/min
			>10				
	R5 5 ft 70%	15	>10				
			3				
			5				
275	275.5		>10	276.0-280.5' - undulating, fracture zone, no dominant orientation, not healed, surface staining			Run 6 (275.5 ft - 280.5 ft), Drill rate = 0.3 ft/min
			>10				



# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-69-195</b></i>
<b>LOCATION:</b> Site 4		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 5/30/2011	
<b>DRILLING METHOD:</b> Rotosonic/Wireline Rotary Core	<b>DRILLING END:</b> 6/22/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 6/22/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 632.1 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 22, 35, 55, 75, 95, 115, 135, 155, and 175 feet bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100291.55		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615142.96		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-69** SHEET 1 OF 10

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 4 (2100291.6 N, 7615143.0 E)

ELEVATION : 632.1 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic


ORIENTATION : Vertical

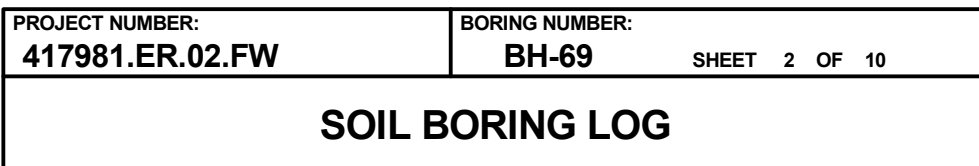
WATER LEVELS : Approx. 178 ft BGS

START : 5/31/2011

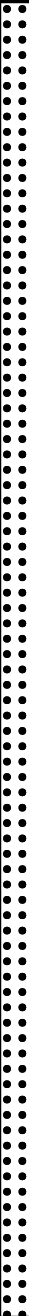
END : 6/20/2011

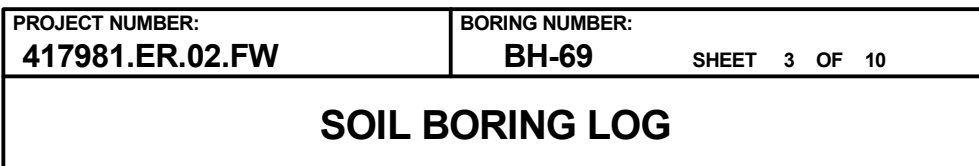
LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 175 ft BGS				START : 9/5/2011		END : 9/20/2011		LOGGER : A. Brewster (Northstar)				
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY		SOIL DESCRIPTION		SYMBOLIC LOG		COMMENTS				
INTERVAL (ft)		RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION				
		LAB SAMPLE										
5	0.0	COMPLETE	10401	GW	<b>Well Graded Gravel (GW)</b> 0.0-42.0' - light yellowish brown, (2.5Y 6/3), dry, loose, 40% gravel, 40% sand, 20% fines, subangular to subrounded, no dominant mineralogy.		Soil sample collected between 0.0 and 1.0 ft bgs.					
	1.0						Soil sample collected between 2.0 and 3.0 ft bgs.					
	2.0		10402				Soil sample collected between 5.0 and 6.0 ft bgs.					
	3.0						Soil sample collected between 9.0 and 10.0 ft bgs.					
	5.0		10403				Soil sample collected between 14.0 and 15.0 ft bgs.					
	6.0						Soil sample collected between 19.0 and 20.0 ft bgs.					
10	9.0						10404					
	10.0											
	14.0						10405					
	15.0											
15	19.0						10406					
	20.0											
20												



LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 17% R BGS				START : 9/5/2011		END : 9/20/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS		
		RECOVERY (in)					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		LAB SAMPLE							
25		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 0.0-42.0' - light yellowish brown, (2.5Y 6/3), dry, loose, 40% gravel, 40% sand, 20% fines, subangular to subrounded, no dominant mineralogy.				
30		29.0 30.0	10407				Soil sample collected between 29.0 and 30.0 ft bgs.		
35									
40		39.0 40.0	10408				Soil sample collected between 39.0 and 40.0 ft bgs.		



LOGGER : A. Brewster (Northstar)

[illegible]



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-69** SHEET 4 OF 10

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 4 (2100291.6 N, 7615143.0 E)

ELEVATION : 632.1 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic


ORIENTATION : Vertical

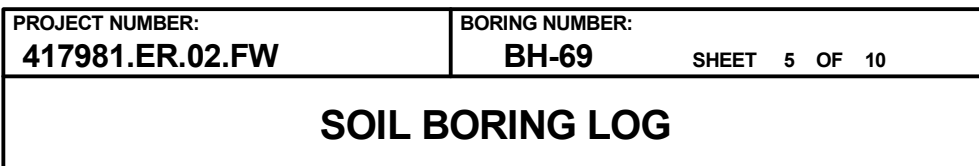
WATER LEVELS : Approx. 178 ft BGS

START : 5/31/2011

END : 6/20/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)			SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
RECOVERY (in)							
LAB SAMPLE							
65	COMPLETE			pTbr	<b>Metadiorite (pTbr)</b> 42.0-157.0' - greenish black, (5G 2/1), chlorite cement in fractures, aphanitic, slight weathering to fresh, strong, massive, non-foliated.  62' - Color change to dusky yellowish green (10GY 3/2), change to phaneritic, predominantly sodium feldspar, slightly weathered, non-foliated, less highly fractured.		Drill rate 67-77 ft: 0.43 FPM   <



LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
					<b>Metadiorite (pTbr)</b> 42.0-157.0' - dusky yellowish green, (10GY 3/2), predominantly sodium feldspar, phaneritic, slight weathered, strong, massive, slightly fractured and healed with chlorite cement, non-foliated.  82' - Color change to greenish black (5GY 2/1)		
85			COMPLETE	pTbr	87' - Change to moderately weathered, moderately foliated, highly fractured along foliation plane and perpendicular to foliation plane, presence of iron staining on all fracture surfaces and some calcite mineralization on surfaces.		Drill rate 87-97 ft: 0.77 FPM
90							Lost circulating water at approximately 93 ft below ground surface (bgs).
95							Stop 6/1/2011 at 1530 at 97 ft bgs.
							Drill rate 97-107 ft: 0.91 FPM
100							





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-69** SHEET 7 OF 10

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 4 (2100291.6 N, 7615143.0 E)

ELEVATION : 632.1 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 178 ft BGS

START : 5/31/2011

END : 6/20/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE					
	COMPLETE			pTbr	<b>Metadiorite (pTbr)</b> 42.0-157.0' - pale olive, (10Y 6/3), predominantly sodium feldspar, strong (R4), slightly weathered, massive, moderately fractured with chlorite cement, non-foliated, some iron staining on surfaces, minor presence of calcite infill.		
125					127' - Less fracturing and moderately foliated; presence of iron and manganese staining on surfaces.		Drill rate 127-137 ft: 0.37 FPM
130							
135					137' - Fracture at approximately 80 degree dip, iron and black-colored staining.		Drill rate 137-147 ft: 0.56 FPM
140							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-69</b>
SHEET 8 OF 10	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 4 (2100291.6 N, 7615143.0 E)
ELEVATION : 632.1 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 178 ft BGS	START : 5/31/2011      END : 6/20/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
<div style="text-align: center;">COMPLETE</div> <div style="text-align: center;">145</div> <div style="text-align: center;">150</div> <div style="text-align: center;">155</div> <div style="text-align: center;">157.0</div> <div style="text-align: center;">160</div>				pTbr	<b>Metadiorite (pTbr)</b> 42.0-157.0' - pale olive, (10Y 6/2), predominantly sodium feldspar with moderate fraction of amphiboles, phaneritic, slight weathering, strong, massive, slightly fractured with chlorite cement, moderately foliated.		Drill rate 147-157 ft: 0.40 FPM
					Begin rock coring from 157.0 ft bgs See the next page for the rock core log.		





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-69**

SHEET 9 OF 10

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 4 (2100291.6 N, 7615143.0 E)

ELEVATION : 632.1 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 178 ft BGS

START : 5/31/2011

END : 6/20/2011

LOGGER : A. Brewster (Northstar)

WATER LEVELS: Appendix: 176 R DGS		START: 9/5/2011		END: 9/20/2011		LOGGERS: A. Brewster (Northstar)			
DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS		
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
160	Run 1 4 ft 100%	10.4	3	157.5, 157.8, 157.9' - Joint (3), 80, 30, and 30 deg, smooth at 157.5, rough at 157.8, 157.9, undulating, 5mm max calcite infilling, some iron staining, tight at 157.5, narrow at 157.8, 157.9.		Metadiorite dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphiboles, hard, slight to no foliation, highly fractured and healed with chlorite cement, massive.	Run 1: 13 min 50 sec		
			>10	158.0-158.6' - Highly fractured			Run 2: 25 min 0 sec		
			>10	158.7, 158.8' - Joint, 30 deg, smooth, undulating, <2mm calcite infilling, iron staining, tight.					
			>10	159.1, 159.2, 159.3' - Joint, 30, 50, and 40 deg, rough, undulating, <1mm calcite infilling, iron staining, narrow.					
165	Run 2 5 ft 100%	35	2	159.5-160.4' - Highly fractured, presence of sedimentary infill (coarse sand, silt).					
			>10	160.4, 160.9' - Mechanical breaks.					
			>10	161.5, 161.7' - Joint, 30 deg and 20 deg, rough, undulating, iron staining, no infill, narrow.					
			>10	162.0, 162.3' - Mechanical breaks.					
166.0	Run 3 3.3 ft 100%	12.5	2	162.2' - Joint, 80 deg, smooth, undulating, <4mm calcite infilling, iron staining, tight.					
			2	162.7-164.0' - Highly fractured, no infill, iron staining.					
			1	164.2, 164.8' - Joint, 20 deg and 50 deg, rough, stepped at 164.2, undulating at 164.8, <1mm calcite infilling, no iron staining, tight					
			>10	165.6' - Mechanical breaks.					
169.3	Run 4 1.7 ft 100%	24.5	>10	166.1-166.4' - Highly fractured, no infill, iron and black staining.					
			>10	166.6' - Joint, 50 deg, rough, undulating, no infill, iron and black staining, narrow.					
			>10	167.3-167.6, 167.8-168.1' - Highly fractured, calcite infill (<5mm), iron staining.					
			>10	168.1, 168.6' - Joint, 80 deg, smooth, undulating, iron staining, no infill, tight.					
170	Run 5 5 ft 100%	35	4	168.7-169.0' - highly fractured, some calcite infill (<1mm), iron staining.					
			3	169.3' - Mechanical breaks.					
			2	169.6, 169.7, 169.9' - Joint (3), 30, 10, and 40 deg, smooth, undualting, <1mm calcite infilling, some iron staining, tight.					
			2	170.4, 170.7, 170.9' - Joint (3), 20, 20, and 30 deg, rough, undualting, some iron staining, no infill, narrow.					
175	Run 5 5 ft 100%	35	2	171.1, 171.7' - Joint, 30 deg, rough, undualting, <1mm calcite infilling, iron staining, tight.					
			2	172.1, 172.5' - Joint, 30 deg, rough, undualting, <1mm calcite infilling, iron staining, tight.					
			3	173.3, 173.7, 173.8' - Joint (3), 30, 30, and 60 deg, rough, undualting, <5mm calcite infilling, iron staining, narrow.					
			>10	174.1, 174.9,' - Joint, 30 deg and 80 deg, rough, undualting, iron and black staining, narrow.					
176.0	Run 5 5 ft 100%	35	2	174.5-174.9' - Highly fractured, some iron staining.					
			2	175.3, 175.7' - Joint, 30 deg and 30 deg, rough, undulating, iron staining, narrow.					
			3						
			3	175.3, 175.7' - Joint, 30 deg and 30 deg, rough, undulating, iron staining, narrow.					
								176.4' - Change to foliated	Run 6: 14 min 30 sec



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-69**

SHEET 10 OF 10

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 4 (2100291.6 N, 7615143.0 E)

ELEVATION : 632.1 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 178 ft BGS

START : 5/31/2011

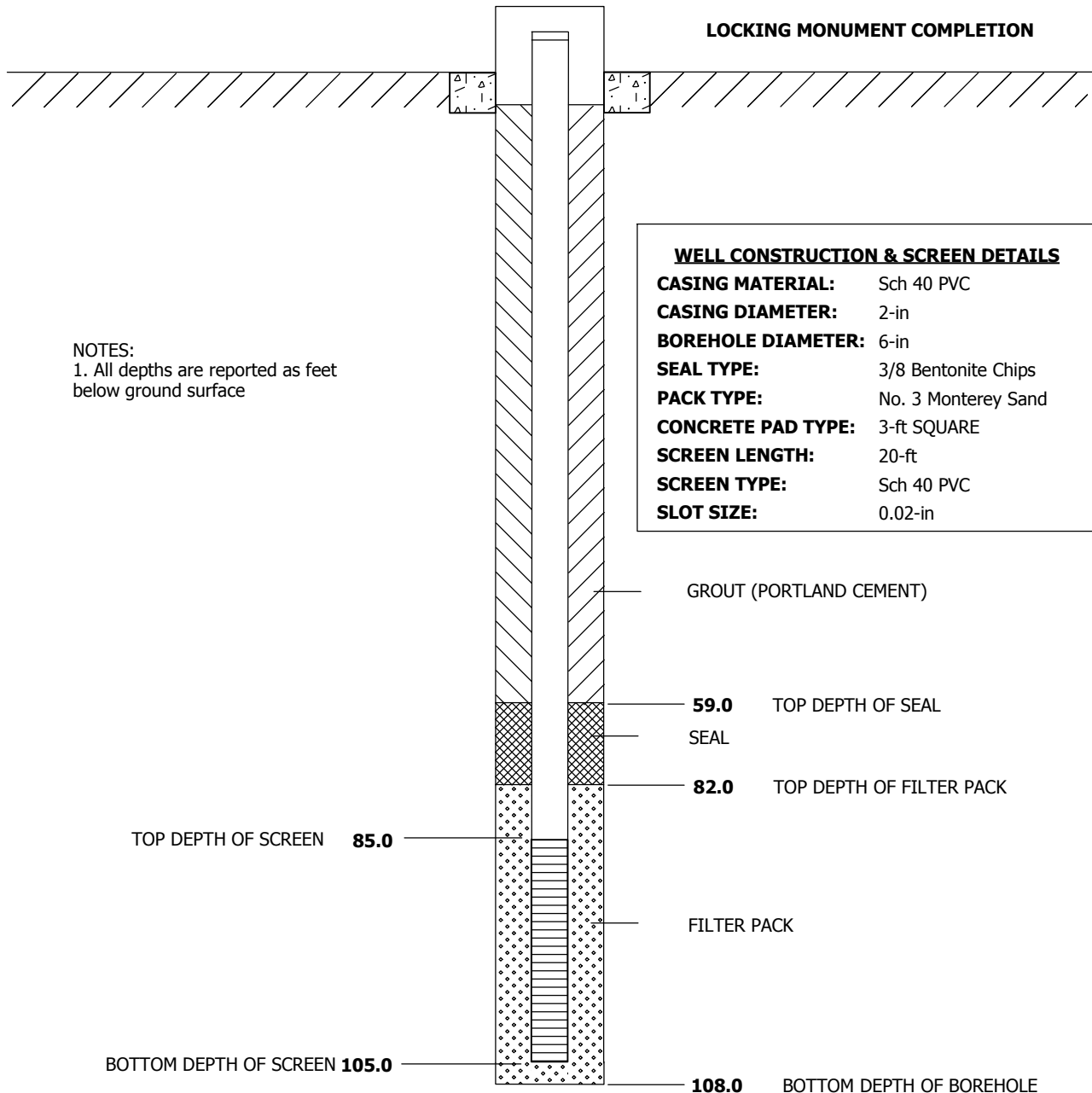
END : 6/20/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
180	Run 6 5 ft 100%	80	0	176.4, 176.7, 176.9' - Joint (3), 20, 30, and 60 deg, rough, undulating, <1mm calcite infilling, iron staining, tight.		<b>Metadiorite</b> dusky yellow green, (5GY 5/2), predominantly sodium feldspar and amphiboles, hard, foliated from 176.4 ft. bgs, highly fractured and healed with chlorite cement, massive	Run 7: 17 min 0 sec
			2	178.1, 178.9' - Joint, 50 deg and 30 deg, rough, undulating, some black staining, tight.			
			2				
181.0			1	179.7, 179.8' - Joint, 30 deg and 60 deg, rough, undulating at 179.7, stepped at 179.8, <10 mm calcite infilling, iron staining, healing incomplete (voids).			
	Run 7 5 ft 100%	58.3	0	180.5' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, some iron staining, tight.		183.0-185.0' - Healed shear zone with 5 mm displacement	Run 8: 40 min 50 sec
			>10	182.3-183.0' - Highly fractured, calcite infill (<3mm), no staining.			
185			5	183.6, 183.7, 183.7, 183.8, 183.9' - Joint (5), 30, 60, 30, 80, and 30 deg, rough, undulating, <1mm calcite infilling, iron staining, tight to narrow.			
			3	184.1, 184.5, 184.9' - Joint (3), 30, 30, and 80 deg, rough, stepped, <1mm calcite infilling, iron staining, narrow.			
186.0	Run 8 5 ft 100%	56	3	185.5, 185.8, 186.0' - Joint (3), 30 deg, rough, undulating, <2mm calcite infilling, some iron staining, narrow.		186' - Change to slightly fractured and healed with chlorite cement	Run 9: 46 min 0 sec
			1	187' - Mechanical breaks.			
			0				
190			3	188.2, 188.3, 188.7' - Joint (3), 20, 80, and 80 deg, rough, undulating to stepped, <1mm calcite infilling, some iron staining, tight.			
	Run 9 5 ft 100%	45	2	189.4' - Mechanical breaks.			
			>10	189.7' - Joint, 60 deg, rough, undulating, no staining, tight.			
191.0			>10	190.6-191.0' - Multiple fractures, calcite infill (<1mm), manganede staining, narrow.			
			>10	191.0-192.0' - Multiple mechanical fractures.			
	Run 9 5 ft 100%	45	1	192.3' - Joint, 80 deg, rough, undulating, <0.5mm calcite infilling, some iron staining, narrow.			
			3	193.2, 193.3, 193.7' - Mechanical fractures.			
195			3	194.3, 194.7' - Joint, 40 deg and 50 deg, rough, undulating, no staining, tight.			
			>10	195.0-196.0' - Multiple fractures, no infill, iron staining.			
196.0							
						End Drilling on 6/20/2011 Total Borehole Depth: 196.0 ft bgs	This borehole was converted into the following monitoring well(s): MW-69-195

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-70-105</b></i>
<b>LOCATION:</b> Site H		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 5/24/2011	
<b>DRILLING METHOD:</b> Rotosonic/Wireline Rotary Core	<b>DRILLING END:</b> 5/29/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 5/29/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 538.9 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 20, 40, 60, and 80 feet bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100513.91		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615825.97		



WELL DIAGRAM IS NOT TO SCALE



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 1 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVELS : Approx. 76 ft bgs		START : 9/24/2011		END : 10/22/2011		LOGGER : R. Tward (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
INTERVAL (ft)	RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
						LAB SAMPLE	
0.0 0.5	COMPLETE	10501	<b>Silty Sand (SM)</b> 0-68.5' - yellowish brown, (10YR 5/4), dry, loose, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz sand 1' - Color change to light olive brown (2.5Y 5/3)		Soil sample collected between 0.0 and 1.0 ft bgs.		
					Soil sample collected between 2.0 and 3.0 ft bgs.		
2.0 3.0		10502			Soil sample collected between 5.0 and 6.0 ft bgs.		
					Soil sample collected between 9.0 and 10.0 ft bgs.		
5		5.0 6.0			10503	Soil sample collected between 14.0 and 15.0 ft bgs.	
						Soil sample collected between 19.0 and 20.0 ft bgs.	
		9.0 10.0			10504		
10							
		14.0 15.0			10505		
15							
		19.0 20.0			10506, 50015		
20							





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 3 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic

ORIENTATION : Vertical

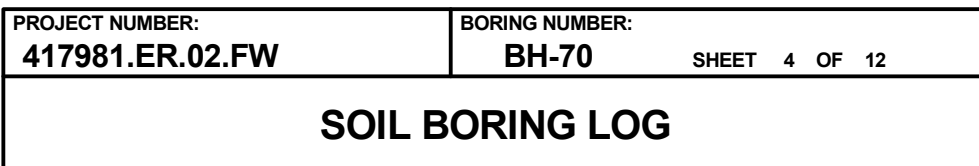
WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVELS : Approx. 76 ft bgs				START : 9/24/2011		END : 10/22/2011		LOGGER : R. Twardt (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
		RECOVERY (in)					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		LAB SAMPLE							
45		COMPLETE		SM	<b>Silty Sand (SM)</b> 0-68.5' - light yellowish brown, (10YR 6/4), dry, partially consolidated from 23.0 ft. bgs, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz sand and mixed gravel		Soil sample collected between 49.0 and 50.0 ft bgs.		
50		10509							
59.0		10510							
60					59' - Increase in fraction of metadiorite in gravel; change to 20% gravel, 50% sand, and 30% fines.		Soil sample collected between 59.0 and 60.0 ft bgs.		



LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
65		COMPLETE		SM	<b>Silty Sand (SM)</b> 0-68.5' - light yellowish brown, (10YR 6/4), dry, partially consolidated from 23.0 ft. bgs, 20% gravel, 50% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz sand and mixed gravel			
70	69.0		10511	ML	<b>Rock Flour (ML)</b> 68.5' - yellowish brown, (10YR 5/4), metadiorite fragments with weathered surfaces		Soil sample collected between 69.0 and 70.0 ft bgs.	
	70.0							
75					Color change to olive (5Y 5/3), highly angular metadiorite fragments with some weathering		Stop 5/24/2011 at 1530 at 76 ft. bgs. Resume 5/25/2011 at 715.	
80								



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-70</b>
SHEET 5 OF 12	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)
ELEVATION : 538.9 ft	DRILLING CONTRACTOR : Boart Longyear (B. Bradford)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 78 ft BGS	START : 5/24/2011      END : 10/22/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVEL: Approx. 78 ft bgs		START: 02/20/11		END: 10/22/2011		ECCOR P.R. Field (Normal)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)		LAB SAMPLE				
85	COMPLETE			ML	<b>Rock Flour (ML)</b> 68.5-87.0' - yellowish brown, (10YR 5/4), metadiorite fragments with weathered surfaces		
87.0					Begin rock coring from 87.0 ft bgs See the next page for the rock core log.		
90							
95							
100							





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 6 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

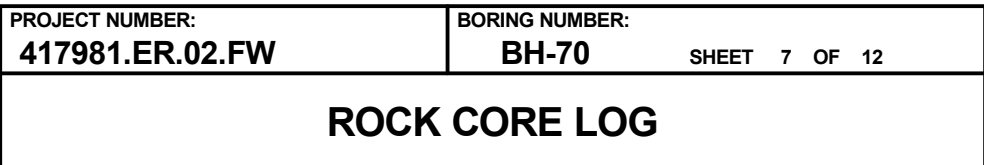
WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVEL (FUSAR) FOR LOG		DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY		COMMENTS			
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.			
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
90	87.0	71	>10	87.0-87.2' - Highly fractured, iron stained, calcite infill. 87.6' - Mechanical break		<b>Metadiorite (pTbr)</b> greyish olive green, (5GY 3/2), strong (R4), slightly weathered, slightly foliated, moderately disintegrated and cemented. Chlorite cement throughout Change to phaneritic, predominantly feldspar and quartz	Run 1: 15 min 40 sec			
	Run 1 3.2 ft 100%		>10	88.1' - Joint, 60 deg, rough, planar, iron staining, calcite mineralization (<1mm), iron staining, narrow. 88.2' - Fracture zone, 30 deg, 40mm chlorite infilling						
			2	88.3' - Joint, 30 deg, rough, stepped, 5mm calcite infilling, no staining, tight 88.7' - Mechanical break						
	90.2	43	2	89.9' - Joint, 15 deg, rough, stepped, 1mm calcite infilling, no staining, tight 90.2' - Mechanical break		<b>Metadiorite (pTbr)</b> greyish olive green, (5GY 3/2), strong (R4), slightly weathered, slightly foliated, moderately disintegrated and cemented, predominantly quartz and feldspar with chlorite cement	Run 2: 24 min 40 sec			
			3	90.8' - Joint, 60 deg, rough, undulating, <1mm calcite infilling, no staining, tight 91' - Mechanical break						
			3	91.3' - Joint, 30 deg, smooth, undulating, <1mm calcite infilling, no staining, tight 91.7' - Joint, 30 deg, smooth, undulating, <1mm calcite infilling, no staining, tight						
			2	92.1' - Joint, 30 deg, smooth, undulating, <1mm calcite infilling, no staining, tight 92.5, 92.6' - Joint, 30 deg, rough, stepped, <1mm calcite infilling, no staining, tight to narrow						
			1	93.0, 93.2' - Joint, 60 deg and 30 deg, rough, stepped, iron staining, narrow 94.8' - Joint, 30 deg, rough, stepped, iron staining, narrow						
			Run 3 2.1 ft 100%	3				95.1, 95.3, 95.8' - Joint (3), 60, 30, and 30 deg, rough, stepped, no staining, tight 96.0-96.6' - highly fractured, evidence of joints at 80° dip, rough, stepped to undulating, some calcite infill in healed fractures (<1mm), presence of sedimentary infill (quartz silt, sand) on surfaces (<5mm thick), narrow apertures, no staining.	95' - Change to thickly foliated	Run 3: 11 min 20 sec
				>10				97.2, 97.3, 97.7, 97.8' - Joint (4), 20, 40, 20, and 20 deg, rough, stepped, 1mm calcite infilling, no staining, very narrow apertures 97.3-97.4' - Highly fractured 98.3, 98.5' - Joint, 30 deg and 30 deg, smooth, stepped, <1mm calcite infilling, silt infill (<5mm), no staining, narrow aperture 98.5-99.2' - Highly fractured, iron staining 99.5, 99.6' - Joint, 20 deg, smooth, undulating, 1mm calcite infilling, no staining, very narrow apertures 100.1, 100.2, 100.7, 100.8' - Joint (4), 20, 20, 30, and 60 deg, rough, undulating, <3mm calcite infilling, iron staining at 100.7 and 100.8, very narrow to tight apertures 100.3' - Healed shear with 50mm of displacement, 60° dip.		
95	95.2	42	3	101.3-107.8' - Highly fractured, calcite on some surfaces (<1mm), minimal iron staining, some silt infill (<1mm), rough, undulating		97' - Change to non-foliated	Run 4: 12 min 15 sec			
	>10									
	97.3	44	>10			98.5' - Change to aphanitic	Run 5: 53 min 40 sec			
			>10							
			2							
	100.2	20	4			99.3' - Megacryst of chlorite (10 x 35mm) 99.5-100.0' - Megacryst of feldspar (>40mm) 100.4-100.7' - Color change to very dusky red (10R 2/2). 100.5' - Fracture at 40 degree dip healed with very dusky red (10R 2/2) mineralization 100.6' - presence of xenocryst (max diameter of 25mm) 100.9-101.4' - Medium banding (<120mm thick) with metadiorite, feldspar, and chlorite bands	Run 6: 61 min 0 sec			
			>10							
			>10							
			>10							
			>10							
>10										
>10										
104.7	0	>10								
		>10								
Run 6 3.1 ft 100%	0	>10								
		>10								





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 8 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
130	130.0					<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspar, amphiboles, aphanitic, non-foliated, highly fractured and healed with chlorite cement, lightly weathered, strong, massive	Begin wire-line HQ rock coring
	Run 1 2 ft 85%	55	0				Run 1: drill rate = 0.27 feet per minute (ft/min)
	132.0		2	131.4, 131.7' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, narrow aperture		131' - Change to phaneritic	
			>10				Run 2: drill rate = 0.35 ft/min
	Run 2 4.5 ft 100%	27	2	133.5, 133.7' - Joint, 50 deg and 60 deg, rough, stepped, <1mm calcite infilling, no staining, tight aperture		134.0-135.0' - Foliated	
135			>10				
			2				
	136.5		1	135.6, 135.8' - Joint, 20 deg, rough, undulating, <1mm calcite infilling, iron staining, tight aperture		135.6-135.8' - Shear zone	Run 3: drill rate = 0.20 ft/min
			3	136' - Joint, 70 deg, rough, undulating, <2mm calcite infilling, no staining, narrow			
	Run 3 4.5 ft 100%	37	3	137.3, 137.6, 137.8' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, no staining, tight			
			>10	138.1, 138.3, 138.6' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, no staining, tight			
140			4	139.0-140.0' - Multiple fractures, calcite infill (<1mm), iron and manganese staining			
	141.0		1	140.2, 140.6, 140.7, 140.9' - Joint (4), 60, 70, 70, and 20 deg, rough, undulating, <2mm calcite infilling, iron and manganese stained, tight			Run 4: drill rate = 0.21 ft/min
			2	141.5, 142.3, 142.6, 143.5' - Joint (4), 30, 20, 30, and 20 deg, rough, undulating, <1mm calcite infilling, iron and manganese stained, tight			
	Run 4 5 ft 100%	50	>10				
			4	144.3, 144.4, 144.5, 144.6' - Joint (4), 30 deg, rough, undulating, no infill, iron stained, tight			
145			3	145.1, 145.5, 145.7' - Joint (3), 20, 20, and 70 deg, rough, undulating, no infill, iron stained, tight			
	146.0						Run 5: drill rate = 0.25 ft/min
			>10				



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 9 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
150	Run 5 5 ft 100%	72	0			<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspar, amphiboles, non-foliated, highly fractured and healed with chlorite cement, strong, massive	
			0				
			>10	148.8' - Joint, 10 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight			
			>10				
151.0							
	Run 6 3.5 ft 100%	79	1	151.1' - Joint, 60 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight		152.4' - Change to aphanitic, lightly fractured and healed with chlorite cement, higher average density	Run 6: drill rate = 0.32 ft/min
			1	152' - Joint, 10 deg, rough, highly fractured, white clay infill (<2mm), iron stained			
			0				
			>10				
154.5							
155	Run 7 1.5 ft 100%	0	>10	154.5-156.0'			Run 7: drill rate is not available
156.0							
	Run 8 4.2 ft 100%	45	2	156.2, 156.8' - Joint, 10 deg and 30 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight		157.6' - Foliated	Run 8: drill rate = 0.20 ft/min
			>10				
			>10	157.8-158.6' - Highly fractured, silt infill (<2mm), manganese staining			
			1				
160	160.2					159.4-159.6' - Shear zone	
			>10	160-161.4' - Highly fractured, some calcite (<2mm), some manganese and iron staining.			Run 9: drill rate = 0.21 ft/min
			>10				
	Run 9 5 ft 100%	58	2	161.8, 162.0, 162.9, 163.7, 164.0, 164.9' - Joint (6), 20, 20, 20, 10, 10, and 10 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight			
			1				
			2				
165	165.2						
			>10	165.2-166.0' - Highly fractured, calcite infill (<1mm), manganese staining		166.0-167.0' - Foliated	Run 10: drill rate = 0.18 ft/min
			1	166' - Joint, 20 deg, rough, undulating, <1mm manganese staining, tight			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 10 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
170	Run 10 4 ft 100%	33	>10	166.8-167.5' - Highly fractured, silty infill, manganese and iron staining	[Symbolic Log]	<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspars, and amphiboles, aphanitic, non-foliated, lightly fractured and healed with chlorite cement, slightly weathered to fresh, strong, massive 167.5, 167.7, 168.9, 169.2, 170.0, 170.3' - Joint (6), 10, 20, 70, 30, 30, and 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight	Run 11: drill rate = 0.26 ft/min
	169.2		1				
			1				
			2				
175	Run 11 5 ft 100%	78	1	171.6' - Joint, 70 deg, rough, stepped, no infill, manganese staining, tight.	[Symbolic Log]	171.2-179.2' - Intermittent veins (<10mm) of sodium feldspar	Run 12: drill rate = 0.20 ft/min
			0				
	174.2		3	173.3, 173.6, 173.7' - Joint (3), 30, 10, and 30 deg, rough, undulating, <1mm manganese staining, tight			
			0				
180	Run 12 5 ft 100%	68	4	176.0, 176.3, 176.4, 176.8' - Joint (4), 60, 60, 60, and 60 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight	[Symbolic Log]	176.4-176.6' - Foliated	Run 13: drill rate = 0.13 ft/min
			1				
	179.2		4	177.5, 178.2, 178.4, 178.7, 178.9' - Joint (5), 30, 30, 60, 30, and 60 deg, rough, undulating, <1mm manganese staining, narrow aperture			
			3	179.2, 179.4, 179.6' - Joint (3), 60, 30, and 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight			
185	Run 13 4.8 ft 100%	54	1	181.2, 182.2, 182.3, 182.5, 182.7, 182.8, 183.6' - Joint (7), 50, 30, 50, 40, 60, 60, and 40 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight	[Symbolic Log]	179.4-180.5' - Large increase in proportion of quartz, sodium feldspar, and chlorite	Run 14: drill rate = 0.24 ft/min
			5				
	184.0		1				
			1				
	Run 14 5 ft 100%	64	2	184.5' - Joint, 20 deg, rough, stepped, <1mm calcite infilling, manganese staining, tight	[Symbolic Log]		
			4	185.0, 185.5, 186.2, 186.4, 186.5, 186.6' - Joint (6), 20, 20, 50, 10, 50, and 40 deg, rough, undulating (stepped at 186.2), <1mm calcite infilling, white silt infill at 186.2 (<1mm), manganese staining, tight			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 11 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVELS - ADJ. FOR LOSS			START : 3/24/2011			END : 10/22/2011			LOGGERS : R. Twedt (Northstar)		
DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY		COMMENTS			
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS					
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.				
190	189.0		2	187.0, 187.2, 188.3, 188.6, 188.8' - Joint (5), 20, 20, 30, 30, and 60 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight		<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspars, and amphiboles, phaneritic, non-foliated, lightly fractured and healed with chlorite cement, slightly weathered to fresh, strong, massive 187.3' - Change to aphanitic 188.0-199.0' - Phaneritic	Run 15: drill rate = 0.18 ft/min				
		3									
	Run 15 5 ft 100%	15	2	189.4, 189.6, 190.7' - Joint (3), 50, 50, and 30 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight							
			>10								
			>10	190.8-193.0' - Highly fractured, moderately weathered, calcite infill (<4mm), manganese and iron staining							
			>10								
			>10								
	194.0		>10	193.6-193.8' - Highly fracture, white silt infill (<1mm), iron staining					191.6-192.6' - Highly weathered	Run 16: drill rate = 0.28 ft/min	
	Run 16 2.5 ft 100%	80	1	194.7, 195.1, 195.5, 196.8' - Joint (4), 10, 60, 40, and 20 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight							
			2								
1											
Run 17 5 ft 100%	100	3	197.1, 197.4, 197.8' - Joint (3), 10, 30, and 30 deg, rough, undulating, no infill, iron staining, tight								
		0									
		0									
		0									
		0									
201.5		1	201.5, 202.4, 202.5, 202.6, 202.9' - Joint (5), 30, 30, 80, 20, and 20 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight		201.7-202.6' - Foliated	Run 17: drill rate = 0.33 ft/min					
Run 18 5 ft 100%	51	4	<1mm calcite infilling, manganese and iron staining, tight								
		2	203.4, 203.7, 204.3, 204.5, 204.7' - Joint (5), 20, 70, 20, 60, and 30 deg, rough, undulating, <1mm calcite infilling, white silt infill (<1mm) in 203.7, manganese and iron staining, tight.								
		3									
		2	205.5, 205.6, 206.5, 207.6' - Joint (4), 60, 40, 30, and 10 deg, rough, undulating, <1mm calcite infilling, iron staining, tight								
		1									
206.5								206.2-207.1' - Foliated	Run 18: drill rate = 0.22 ft/min		



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 12 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

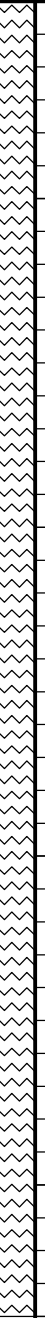
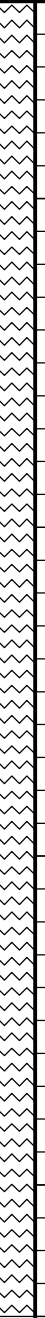
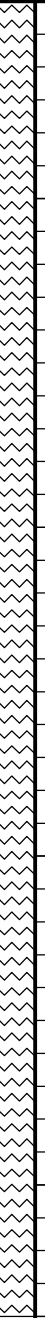
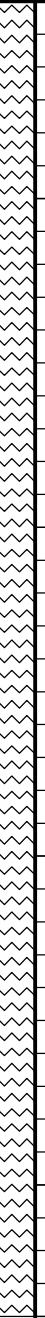
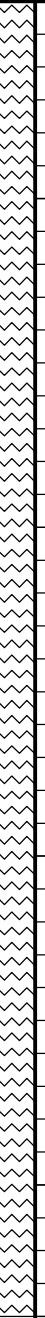
ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVELS : APPROX. 70R BGS				START : 9/24/2011		END : 10/22/2011		LOSSER : R. Tweed (Northstar)	
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY		COMMENTS	
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
210	207.4 Run 19 0.9 ft 100%	100	>10	207.4-207.6' - Multiple fractures, calcite infill, no staining		Metadiorite (pTbr) dusky yellow green, (5GY 5/2), predominantly quartz, feldspars, and amphiboles, phaneritic, non-foliated, lightly fractured and healed with chlorite cement, slightly weathered to fresh, strong, massive 208.8-209.4' - Aphanitic	Run 19: drill rate = 0.15 ft/min Run 20: drill rate = 0.27 ft/min		
	Run 20 4 ft 100%	80	2	208.2, 208.4, 209.2, 210.0, 210.1' - Joint (5), 10, 10, 40, 10, and 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight					
		1	2						
		2							
		211.4	1	211.4, 212.4, 212.9, 213.1, 213.6' - Joint (5), 20, 20, 20, 20, and 30 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight					
215	Run 21 5 ft 100%	74	2			212.5-212.8' - Foliated	Run 21: drill rate = 0.25 ft/min		
		>10	214.2-214.9' - Highly fractured, calcite infill (<1mm), manganese and iron staining						
		2	215.4, 215.7, 216.3, 216.4' - Joint (4), 40, 20, 40, and 30 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight						
		>10	216.4-220.4' - Highly fractured, no infill, heavy iron staining						
		>10							
220	Run 22 4 ft 125%	0	>10			216.6-219.2' - Increase in proportion of feldspars	Run 22: drill rate = 0.13 ft/min. Driller loses all drill fluid in this zone.		
		>10							
		>10							
		>10							
		220.4	>10	216.4-220.4' - Highly fractured, no infill, heavy iron staining					
225	Run 23 5.1 ft 100%	80	1	221.1, 222.0, 222.2, 222.6, 222.7' - Joint (5), 30, 60, 60, 60, and 30 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight			Run 23: drill rate = 0.34 ft/min		
		4							
		3	223.3, 223.4, 223.7, 224.7, 224.8' - Joint (5), 30, 30, 40, 30, and 10 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight						
		2							
		225.5	>10	225.5-226.4' - Highly fractured, calcite infill (<1mm), manganese and iron staining					
	Run 24 1.5 ft 100%	30	>10	226.4, 227' - Joint, 30 deg and 40 deg, rough, undulating, <1mm calcite infilling, iron staining, tight			Run 24: drill rate = 0.38 ft/min This borehole was converted into the following monitoring well(s): MW-70-105 and MW-70BR-225		
227.0		>10							
End Drilling on 10/22/2011 Total Borehole Depth: 227.0 ft bgs									

# WELL COMPLETION DIAGRAM

**PROJECT NO:** 417981.ER.02.FW **PROJECT:** ER-TCS Groundwater Investigation **WELL NO:** *MW-70BR-225*

**LOCATION:** Site H

**DRILLING CONTRACTOR:** Boart Longyear (B. Bradford)

**DRILLING START:** 10/13/2011

**DRILLING METHOD:** Rotosonic/Wireline Rotary Core

**DRILLING END:** 10/22/2011

**LOGGER:** A. Brewster (Northstar)

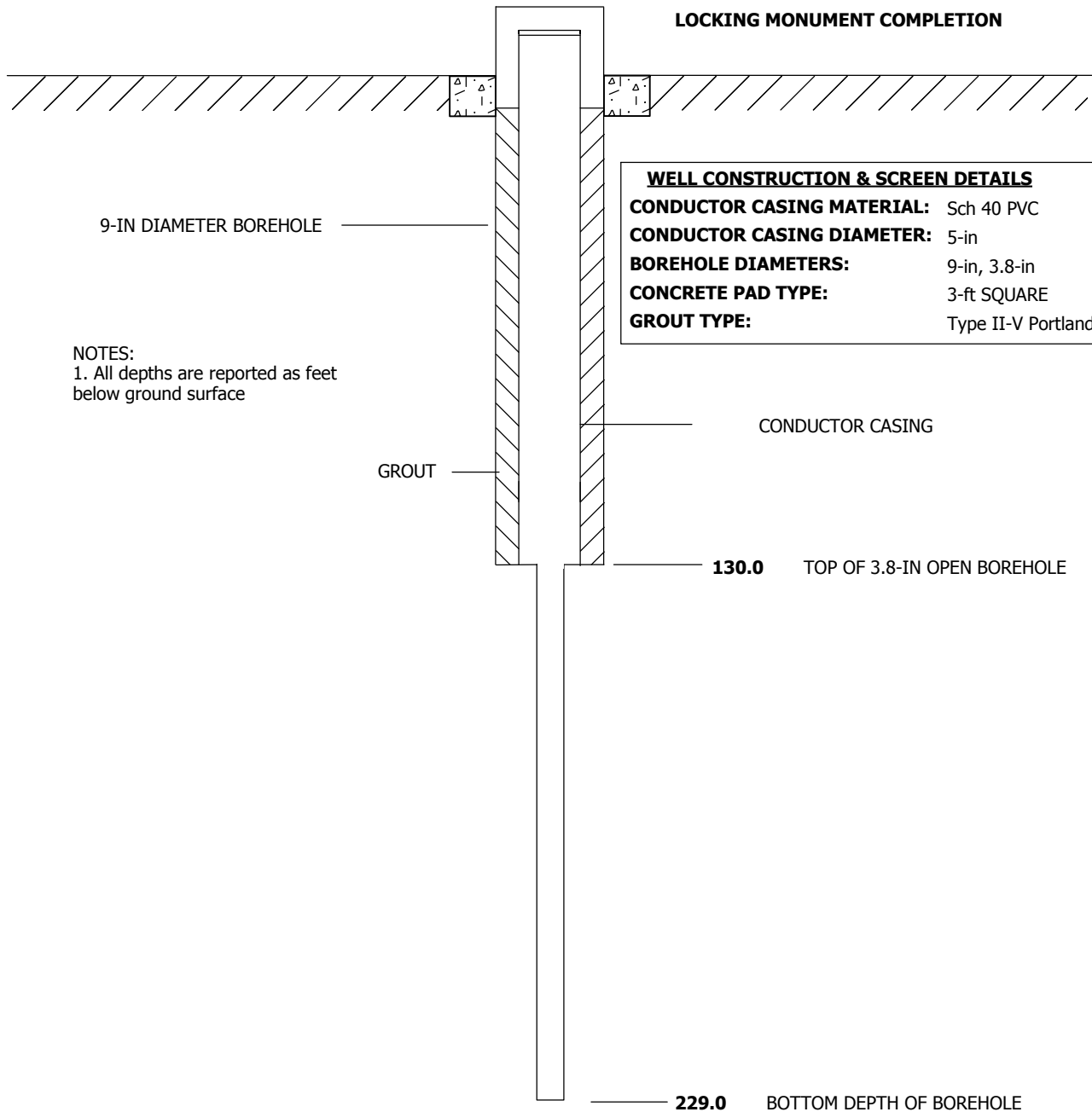
**WELL COMPLETION DATE:** 10/22/2011

**GROUND SURFACE ELEVATION (NAVD 88):** 537.6 ft AMSL

**GENERAL REMARKS:** Open 3.8" diameter borehole from 130 to 227 feet bgs. Centralizers at 50, 100, and 130 ft bgs.

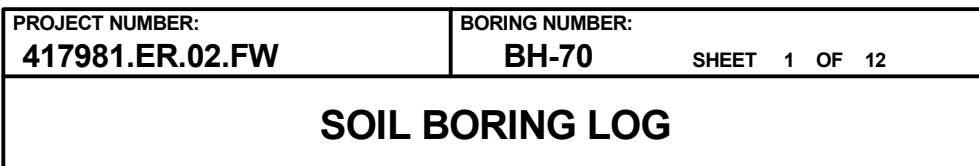
**NORTHING (CCS NAD 83 Z 5):**  
2100513.04

**EASTING (CCS NAD 83 Z 5):**  
7615840.08



WELL DIAGRAM IS NOT TO SCALE





LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)	RECOVERY (in)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
	LAB SAMPLE					
5	0.0 0.5	COMPLETE	10501	<b>Silty Sand (SM)</b> 0-68.5' - yellowish brown, (10YR 5/4), dry, loose, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz sand 1' - Color change to light olive brown (2.5Y 5/3)	Soil sample collected between 0.0 and 1.0 ft bgs.	
	2.0 3.0		10502		Soil sample collected between 2.0 and 3.0 ft bgs.	
	5.0 6.0		10503		Soil sample collected between 5.0 and 6.0 ft bgs.	
	9.0 10.0		10504		Soil sample collected between 9.0 and 10.0 ft bgs.	
	14.0 15.0		10505		Soil sample collected between 14.0 and 15.0 ft bgs.	
	19.0 20.0		10506, 50015		Soil sample collected between 19.0 and 20.0 ft bgs.	





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 3 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic


ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVELS : Approx. 76 ft bgs			START : 9/24/2011		END : 10/22/2011		LOGGER : R. Twardt (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)	LAB SAMPLE				DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
45		COMPLETE	SM	<b>Silty Sand (SM)</b> 0-68.5' - light yellowish brown, (10YR 6/4), dry, partially consolidated from 23.0 ft. bgs, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz sand and mixed gravel		Soil sample collected between 49.0 and 50.0 ft bgs.		
50	49.0 50.0	10509						
55								
60	59.0 60.0	10510		59' - Increase in fraction of metadiorite in gravel; change to 20% gravel, 50% sand, and 30% fines.		Soil sample collected between 59.0 and 60.0 ft bgs.		



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 4 OF 12

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
65	COMPLETE			SM	<b>Silty Sand (SM)</b> 0-68.5' - light yellowish brown, (10YR 6/4), dry, partially consolidated from 23.0 ft. bgs, 20% gravel, 50% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz sand and mixed gravel		
					64' - Color change to brown (10YR 5/3), change to moist		
69.0			10511	ML	<b>Rock Flour (ML)</b> 68.5' - yellowish brown, (10YR 5/4), metadiorite fragments with weathered surfaces		Soil sample collected between 69.0 and 70.0 ft bgs.
70.0					Color change to olive (5Y 5/3), highly angular metadiorite fragments with some weathering		
75							Stop 5/24/2011 at 1530 at 76 ft. bgs. Resume 5/25/2011 at 715.
80							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-70</b>
SHEET 5 OF 12	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)
ELEVATION : 538.9 ft	DRILLING CONTRACTOR : Boart Longyear (B. Bradford)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic	ORIENTATION : Vertical
WATER LEVELS : Approx. 78 ft BGS	START : 5/24/2011      END : 10/22/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVEL: Approx. 75 ft BGS		START: 02/20/11		END: 10/22/2011		ECCOR P.R. Field (Normal)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	RECOVERY (in)		LAB SAMPLE				
85	COMPLETE			ML	Rock Flour (ML) 68.5-87.0' - yellowish brown, (10YR 5/4), metadiorite fragments with weathered surfaces		
87.0					Begin rock coring from 87.0 ft bgs See the next page for the rock core log.		
90							
95							
100							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 6 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
87.0	Run 1 3.2 ft 100%	71	>10	87.0-87.2' - Highly fractured, iron stained, calcite infill. 87.6' - Mechanical break		<b>Metadiorite (pTbr)</b> greyish olive green, (5GY 3/2), strong (R4), slightly weathered, slightly foliated, moderately disintegrated and cemented. Chlorite cement throughout Change to phaneritic, predominantly feldspar and quartz	Run 1: 15 min 40 sec
90.2	Run 2 5 ft 100%	43	>10	88.1' - Joint, 60 deg, rough, planar, iron staining, calcite mineralization (<1mm), iron staining, narrow. 88.2' - Fracture zone, 30 deg, 40mm chlorite infilling 88.3' - Joint, 30 deg, rough, stepped, 5mm calcite infilling, no staining, tight 88.7' - Mechanical break 89.9' - Joint, 15 deg, rough, stepped, 1mm calcite infilling, no staining, tight 90.2' - Mechanical break 90.8' - Joint, 60 deg, rough, undulating, <1mm calcite infilling, no staining, tight 91' - Mechanical break 91.3' - Joint, 30 deg, smooth, undulating, <1mm calcite infilling, no staining, tight 91.7' - Joint, 30 deg, smooth, undulating, <1mm calcite infilling, no staining, tight 92.1' - Joint, 30 deg, smooth, undulating, <1mm calcite infilling, no staining, tight 92.5, 92.6' - Joint, 30 deg, rough, stepped, <1mm calcite infilling, no staining, tight to narrow		<b>Metadiorite (pTbr)</b> greyish olive green, (5GY 3/2), strong (R4), slightly weathered, slightly foliated, moderately disintegrated and cemented, predominantly quartz and feldspar with chlorite cement	Run 2: 24 min 40 sec
95.2	Run 3 2.1 ft 100%	42	2	93.0, 93.2' - Joint, 60 deg and 30 deg, rough, stepped, iron staining, narrow 94.8' - Joint, 30 deg, rough, stepped, iron staining, narrow 95.1, 95.3, 95.8' - Joint (3), 60, 30, and 30 deg, rough, stepped, no staining, tight 96.0-96.6' - highly fractured, evidence of joints at 80° dip, rough, stepped to undulating, some calcite infill in healed fractures (<1mm), presence of sedimentary infill (quartz silt, sand) on surfaces (<5mm thick), narrow apertures, no staining. 97.2, 97.3, 97.7, 97.8' - Joint (4), 20, 40, 20, and 20 deg, rough, stepped, 1mm calcite infilling, no staining, very narrow apertures 97.3-97.4' - Highly fractured 98.3, 98.5' - Joint, 30 deg and 30 deg, smooth, stepped, <1mm calcite infilling, silt infill (<5mm), no staining, narrow aperture 98.5-99.2' - Highly fractured, iron staining 99.5, 99.6' - Joint, 20 deg, smooth, undulating, 1mm calcite infilling, no staining, very narrow apertures 100.1, 100.2, 100.7, 100.8' - Joint (4), 20, 20, 30, and 60 deg, rough, undulating, <3mm calcite infilling, iron staining at 100.7 and 100.8, very narrow to tight apertures 100.3' - Healed shear with 50mm of displacement, 60° dip. 101.3-107.8' - Highly fractured, calcite on some surfaces (<1mm), minimal iron staining, some silt infill (<1mm), rough, undulating		95' - Change to thickly foliated  97' - Change to non-foliated  98.5' - Change to aphanitic  99.3' - Megacryst of chlorite (10 x 35mm) 99.5-100.0' - Megacryst of feldspar (>40mm) 100.4-100.7' - Color change to very dusky red (10R 2/2). 100.5' - Fracture at 40 degree dip healed with very dusky red (10R 2/2) mineralization 100.6' - presence of xenocryst (max diameter of 25mm) 100.9-101.4' - Medium banding (<120mm thick) with metadiorite, feldspar, and chlorite bands	Run 3: 11 min 20 sec  Approximately 100 gallons of water lost at approximately 96 ft. bgs.  Run 4: 12 min 15 sec          Run 5: 53 min 40 sec
100.2	Run 4 2.9 ft 100%	44	>10				
104.7	Run 5 4.5 ft 100%	20	>10				
104.7	Run 6 3.1 ft 100%	0	>10				Run 6: 61 min 0 sec



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 7 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES		SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT		DESCRIPTION	ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
					DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		
107.8			>10		<b>Metadiorite (pTbr)</b> greyish olive green, (5GY 3/2), strong (R4), slightly weathered, none-foliated, moderately disintegrated and cemented, chlorite cement in fractures	Stop 5/27/2011 at 1700.	
110							
115							
120							
125							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 8 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
130	130.0					<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspar, amphiboles, aphanitic, non-foliated, highly fractured and healed with chlorite cement, lightly weathered, strong, massive	Begin wire-line HQ rock coring
	Run 1 2 ft 85%	55	0				Run 1: drill rate = 0.27 feet per minute (ft/min)
	132.0		2	131.4, 131.7' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, narrow aperture		131' - Change to phaneritic	
			>10				Run 2: drill rate = 0.35 ft/min
	Run 2 4.5 ft 100%	27	2	133.5, 133.7' - Joint, 50 deg and 60 deg, rough, stepped, <1mm calcite infilling, no staining, tight aperture		134.0-135.0' - Foliated	
135			>10				
			2				
	136.5		1	135.6, 135.8' - Joint, 20 deg, rough, undulating, <1mm calcite infilling, iron staining, tight aperture		135.6-135.8' - Shear zone	Run 3: drill rate = 0.20 ft/min
			3	136' - Joint, 70 deg, rough, undulating, <2mm calcite infilling, no staining, narrow			
	Run 3 4.5 ft 100%	37	3	137.3, 137.6, 137.8' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, no staining, tight			
			>10	138.1, 138.3, 138.6' - Joint, 30 deg, rough, undulating, <1mm calcite infilling, no staining, tight			
140			4	139.0-140.0' - Multiple fractures, calcite infill (<1mm), iron and manganese staining			
	141.0		1	140.2, 140.6, 140.7, 140.9' - Joint (4), 60, 70, 70, and 20 deg, rough, undulating, <2mm calcite infilling, iron and manganese stained, tight			Run 4: drill rate = 0.21 ft/min
			2	141.5, 142.3, 142.6, 143.5' - Joint (4), 30, 20, 30, and 20 deg, rough, undulating, <1mm calcite infilling, iron and manganese stained, tight			
	Run 4 5 ft 100%	50	>10				
			4	144.3, 144.4, 144.5, 144.6' - Joint (4), 30 deg, rough, undulating, no infill, iron stained, tight			
145			3	145.1, 145.5, 145.7' - Joint (3), 20, 20, and 70 deg, rough, undulating, no infill, iron stained, tight			
	146.0						Run 5: drill rate = 0.25 ft/min
			>10				





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-70** SHEET 9 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
150	Run 5 5 ft 100%	72	0			<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspar, amphiboles, non-foliated, highly fractured and healed with chlorite cement, strong, massive	
			0				
			>10	148.8' - Joint, 10 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight			
			>10				
151.0							
	Run 6 3.5 ft 100%	79	1	151.1' - Joint, 60 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight		152.4' - Change to aphanitic, lightly fractured and healed with chlorite cement, higher average density	Run 6: drill rate = 0.32 ft/min
			1	152' - Joint, 10 deg, rough, highly fractured, white clay infill (<2mm), iron stained			
			0				
			>10				
154.5							
155	Run 7 1.5 ft 100%	0	>10	154.5-156.0'			Run 7: drill rate is not available
156.0							
	Run 8 4.2 ft 100%	45	2	156.2, 156.8' - Joint, 10 deg and 30 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight		157.6' - Foliated	Run 8: drill rate = 0.20 ft/min
			>10				
			>10	157.8-158.6' - Highly fractured, silt infill (<2mm), manganese staining			
			1				
160	160.2			160-161.4' - Highly fractured, some calcite (<2mm), some manganese and iron staining.		159.4-159.6' - Shear zone	Run 9: drill rate = 0.21 ft/min
			>10				
			>10				
	Run 9 5 ft 100%	58	2	161.8, 162.0, 162.9, 163.7, 164.0, 164.9' - Joint (6), 20, 20, 20, 10, 10, and 10 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight			
			1				
			2				
165	165.2						
			>10	165.2-166.0' - Highly fractured, calcite infill (<1mm), manganese staining		166.0-167.0' - Foliated	Run 10: drill rate = 0.18 ft/min
			1	166' - Joint, 20 deg, rough, undulating, <1mm manganese staining, tight			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 10 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
170	Run 10 4 ft 100%	33	>10	166.8-167.5' - Highly fractured, silty infill, manganese and iron staining	[Symbolic Log]	<b>Metadiorite (pTbr)</b> dusky yellow green, (5GY 5/2), predominantly quartz, feldspars, and amphiboles, aphanitic, non-foliated, lightly fractured and healed with chlorite cement, slightly weathered to fresh, strong, massive 167.5, 167.7, 168.9, 169.2, 170.0, 170.3' - Joint (6), 10, 20, 70, 30, 30, and 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight	Run 11: drill rate = 0.26 ft/min
	169.2		1				
			1				
			2				
175	Run 11 5 ft 100%	78	1	171.6' - Joint, 70 deg, rough, stepped, no infill, manganese staining, tight.	[Symbolic Log]	171.2-179.2' - Intermittent veins (<10mm) of sodium feldspar	Run 12: drill rate = 0.20 ft/min
			0				
	174.2		3	173.3, 173.6, 173.7' - Joint (3), 30, 10, and 30 deg, rough, undulating, <1mm manganese staining, tight			
			0				
180			0		[Symbolic Log]	176.4-176.6' - Foliated	Run 13: drill rate = 0.13 ft/min
	Run 12 5 ft 100%	68	4	176.0, 176.3, 176.4, 176.8' - Joint (4), 60, 60, 60, and 60 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight			
			1				
	179.2		4	177.5, 178.2, 178.4, 178.7, 178.9' - Joint (5), 30, 30, 60, 30, and 60 deg, rough, undulating, <1mm manganese staining, narrow aperture			
185			3	179.2, 179.4, 179.6' - Joint (3), 60, 30, and 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight	[Symbolic Log]	179.4-180.5' - Large increase in proportion of quartz, sodium feldspar, and chlorite	Run 14: drill rate = 0.24 ft/min
			0				
	Run 13 4.8 ft 100%	54	1	181.2, 182.2, 182.3, 182.5, 182.7, 182.8, 183.6' - Joint (7), 50, 30, 50, 40, 60, 60, and 40 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight			
	184.0		5				
			1		[Symbolic Log]		
			2				
	Run 14 5 ft 100%	64	4	184.5' - Joint, 20 deg, rough, stepped, <1mm calcite infilling, manganese staining, tight			
				185.0, 185.5, 186.2, 186.4, 186.5, 186.6' - Joint (6), 20, 20, 50, 10, 50, and 40 deg, rough, undulating (stepped at 186.2), <1mm calcite infilling, white silt infill at 186.2 (<1mm), manganese staining, tight			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 11 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

LOGGER : R. Tweidt (Northstar)

WATER LEVELS - ADJ. FOR LOSS				START : 3/24/2011		END : 10/22/2011		LOGGERS : R. Twedt (Northstar)	
DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY		COMMENTS	
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
190	189.0		2	187.0, 187.2, 188.3, 188.6, 188.8' - Joint (5), 20, 20, 30, 30, and 60 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight		Metadiorite (pTbr) dusky yellow green, (5GY 5/2), predominantly quartz, feldspars, and amphiboles, phaneritic, non-foliated, lightly fractured and healed with chlorite cement, slightly weathered to fresh, strong, massive 187.3' - Change to aphanitic 188.0-199.0' - Phaneritic  191.6-192.6' - Highly weathered	Run 15: drill rate = 0.18 ft/min		
		3							
	Run 15 5 ft 100%	15	2	189.4, 189.6, 190.7' - Joint (3), 50, 50, and 30 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight					
			>10						
			>10	190.8-193.0' - Highly fractured, moderately weathered, calcite infill (<4mm), manganese and iron staining					
			>10						
	194.0		>10	193.6-193.8' - Highly fracture, white silt infill (<1mm), iron staining			Run 16: drill rate = 0.28 ft/min		
	Run 16 2.5 ft 100%	80	1	194.7, 195.1, 195.5, 196.8' - Joint (4), 10, 60, 40, and 20 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight					
			2						
			1						
	Run 17 5 ft 100%	100	3	197.1, 197.4, 197.8' - Joint (3), 10, 30, and 30 deg, rough, undulating, no infill, iron staining, tight					Run 17: drill rate = 0.33 ft/min
			0						
			0						
			0						
201.5		1	201.5, 202.4, 202.5, 202.6, 202.9' - Joint (5), 30, 30, 80, 20, and 20 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight	201.7-202.6' - Foliated	Run 18: drill rate = 0.22 ft/min				
Run 18 5 ft 100%	51	4	<1mm calcite infilling, manganese and iron staining, tight						
		2	203.4, 203.7, 204.3, 204.5, 204.7' - Joint (5), 20, 70, 20, 60, and 30 deg, rough, undulating, <1mm calcite infilling, white silt infill (<1mm) in 203.7, manganese and iron staining, tight.						
		3							
		2	205.5, 205.6, 206.5, 207.6' - Joint (4), 60, 40, 30, and 10 deg, rough, undulating, <1mm calcite infilling, iron staining, tight						
		1							
206.5				206.2-207.1' - Foliated					



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-70**

SHEET 12 OF 12

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : PG&E Topock, Site H (2100513.9 N, 7615826.0 E)

ELEVATION : 538.9 ft

DRILLING CONTRACTOR : Boart Longyear (B. Bradford)

CORING EQUIPMENT AND METHOD : RS-350, HQ Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 78 ft BGS

START : 5/24/2011

END : 10/22/2011

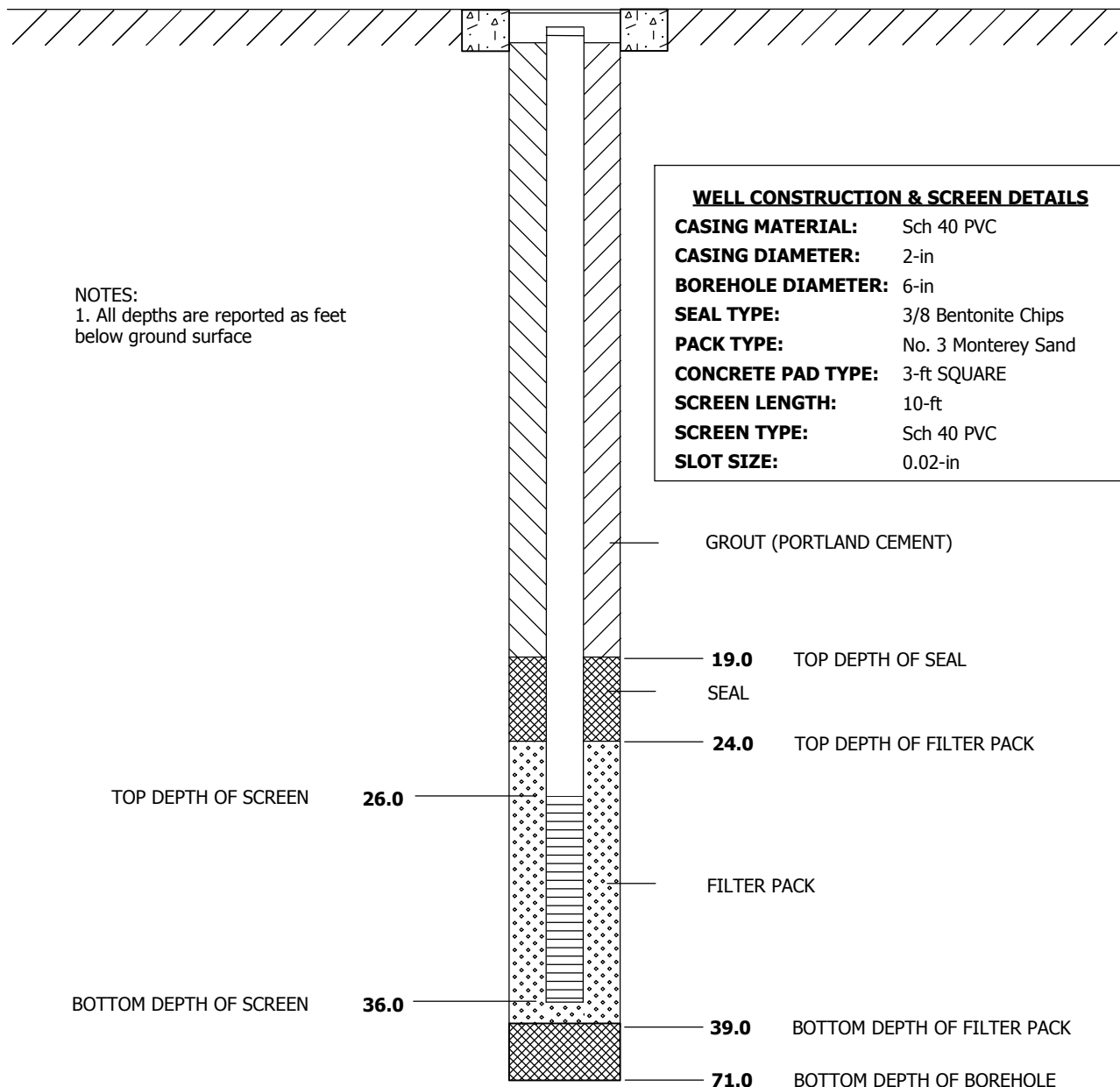
LOGGER : R. Tweidt (Northstar)

WATER LEVELS : APPROX. 70R BGS				START : 9/24/2011		END : 10/22/2011		LOSSER : R. Tweed (Northstar)	
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY		COMMENTS	
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.		
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS					
210	207.4 Run 19 0.9 ft 100%	100	>10	207.4-207.6' - Multiple fractures, calcite infill, no staining		Metadiorite (pTbr) dusky yellow green, (5GY 5/2), predominantly quartz, feldspars, and amphiboles, phaneritic, non-foliated, lightly fractured and healed with chlorite cement, slightly weathered to fresh, strong, massive 208.8-209.4' - Aphanitic	Run 19: drill rate = 0.15 ft/min Run 20: drill rate = 0.27 ft/min		
	Run 20 4 ft 100%	80	2	208.2, 208.4, 209.2, 210.0, 210.1' - Joint (5), 10, 10, 40, 10, and 30 deg, rough, undulating, <1mm calcite infilling, manganese staining, tight					
		1							
		2							
		211.4	1	211.4, 212.4, 212.9, 213.1, 213.6' - Joint (5), 20, 20, 20, 20, and 30 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight					
215	Run 21 5 ft 100%	74	2			212.5-212.8' - Foliated	Run 21: drill rate = 0.25 ft/min		
		>10	214.2-214.9' - Highly fractured, calcite infill (<1mm), manganese and iron staining						
		2	215.4, 215.7, 216.3, 216.4' - Joint (4), 40, 20, 40, and 30 deg, rough, undulating, <1mm calcite infilling, manganese and iron staining, tight						
		>10	216.4-220.4' - Highly fractured, no infill, heavy iron staining						
		>10							
220	Run 22 4 ft 125%	0	>10			216.6-219.2' - Increase in proportion of feldspars	Run 22: drill rate = 0.13 ft/min. Driller loses all drill fluid in this zone.		
		>10							
		>10							
		>10							
		220.4	>10	216.4-220.4' - Highly fractured, no infill, heavy iron staining					
225	Run 23 5.1 ft 100%	80	1	221.1, 222.0, 222.2, 222.6, 222.7' - Joint (5), 30, 60, 60, 60, and 30 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight			Run 23: drill rate = 0.34 ft/min		
		4							
		3	223.3, 223.4, 223.7, 224.7, 224.8' - Joint (5), 30, 30, 40, 30, and 10 deg, rough, undulating, <1mm calcite infilling, iron and manganese staining, tight						
		2							
		225.5	>10	225.5-226.4' - Highly fractured, calcite infill (<1mm), manganese and iron staining					
	Run 24 1.5 ft 100%	30	>10	226.4, 227' - Joint, 30 deg and 40 deg, rough, undulating, <1mm calcite infilling, iron staining, tight			Run 24: drill rate = 0.38 ft/min <div>This borehole was converted into the following monitoring well(s): MW-70-105 and MW-70BR-225</div>		
227.0									
						End Drilling on 10/22/2011 Total Borehole Depth: 227.0 ft bgs			

# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-71-35</b></i>
<b>LOCATION:</b> Site L		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 9/12/2011	
<b>DRILLING METHOD:</b> Rotosonic/Wireline Rotary Core	<b>DRILLING END:</b> 9/14/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 9/14/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 484.0 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 15 feet bgs. HQ rock core hole 39 to 71 feet bgs backfilled with bentonite chips.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2101338.43		
<b>EASTING (CCS NAD 83 Z 5):</b> 7616207.60		

## 12-IN DIAMETER WELL VAULT (FLUSH WITH GRADE)



WELL DIAGRAM IS NOT TO SCALE



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-71</b>
SHEET 1 OF 4	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site L (2101338.4 N, 7616207.6 E)
ELEVATION : 484.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : HQ wireline rotary	ORIENTATION : Vertical
WATER LEVELS : Approx. 29 ft BGS	START : 9/14/2011      END : 9/14/2011      LOGGER : A. Brewster (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
LAB SAMPLE							
5		COMPLETE		SM	<b>Silty Sand (SM)</b> 0.0-35.0' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 80% sand, 15% fines, subangular to subrounded, poorly graded, no dominant mineralogy.		
10							



PROJECT NUMBER: <b>417981.ER.02.FW</b>	BORING NUMBER: <b>BH-71</b>	SHEET 2 OF 4
<b>SOIL BORING LOG</b>		

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site L (2101338.4 N, 7616207.6 E)
ELEVATION : 484.0 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : HQ wireline rotary	ORIENTATION : Vertical
WATER LEVELS : Approx. 29 ft BGS	START : 9/14/2011      END : 9/14/2011      LOGGER : A. Brewster (Northstar)

WATER LEVELS : Approx. 29 ft BGS		START : 9/14/2011		END : 9/14/2011		LOGGER : A. Brewster (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION  SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS  DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	RECOVERY (in)	LAB SAMPLE					
25	COMPLETE			SM	<b>Silty Sand (SM)</b> 0.0-35.0' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 80% sand, 15% fines, subangular to subrounded, poorly graded, no dominant mineralogy.		
30					32' - Color change to reddish brown (5YR 4/4)		
35					Begin rock coring from 35.0 ft bgs See the next page for the rock core log.		
40							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-71** SHEET 3 OF 4

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site L (2101338.4 N, 7616207.6 E)

ELEVATION : 484.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ wireline rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 29 ft BGS

START : 9/14/2011

END : 9/14/2011

LOGGER : A. Brewster (Northstar)

WATER LEVEL: 7.000' LGR LOG		START: 3/1/2011		END: 3/1/2011		LOGGERS: J. Brown, R. Smith		
DEPTH BELOW SURFACE (ft)	CORE RUN, LENGTH, AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS	
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.	
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS				
				35' - Note: All fractures in core are mechanical breaks generated during the drilling process, unless otherwise noted.		<b>Conglomerate (Tmc)</b> 35.0-71.0' - dark reddish brown, (10YR 4/4), no dominant mineralogy, heavily cemented, slightly weathered, moderate strength, massive. Angular to very angular clasts. Nobedding or foliation. Well-graded.		
37.0								
	R1 4 ft 100%	100	0					R1=0.82 FPM
			0					
40			0					
			0					
41.0								
	R2 5 ft 100%	100	0					R2=0.67 FPM
			0					
			0					
45			0					
			0					
			0					
46.0								
	R3 5 ft 100%	100	0					R3=0.72 FPM
			0					
			0					
50			0					
			0					
			0					
51.0								
	R4 5 ft 100%	100	0				R4=0.75 FPM	
			0					
			0					
55			0					





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-71**

SHEET 4 OF 4

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site L (2101338.4 N, 7616207.6 E)

ELEVATION : 484.0 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : HQ wireline rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 29 ft BGS

START : 9/14/2011

END : 9/14/2011

LOGGER : A. Brewster (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
56.0			0			<b>Conglomerate (Tmc)</b> 35.0-71.0' - dark reddish brown, (10YR 4/4), no dominant mineralogy, heavily cemented, slightly weathered, moderate strength, massive. Angular to very angular clasts. Nobedding or foliation. Well-graded.	R5=0.59 FPM
			0				
			0				
	R5 5 ft 100%	100	0				
			0				
60			0				R6=0.57 FPM
61.0			1	61.6' - Joint, 40 deg, rough, planar, no infill material, no staining, tight.			
			0				
	R6 5 ft 100%	100	0				
			0				
65			0			End Drilling on 9/14/2011 Total Borehole Depth: 71.0 ft bgs	R7=0.77 FPM
66.0			0				
			0				
	R7 5 ft 100%	100	0				
			0				
70			0			This borehole was converted into the following monitoring well(s): MW-71-35	
71.0							
75							

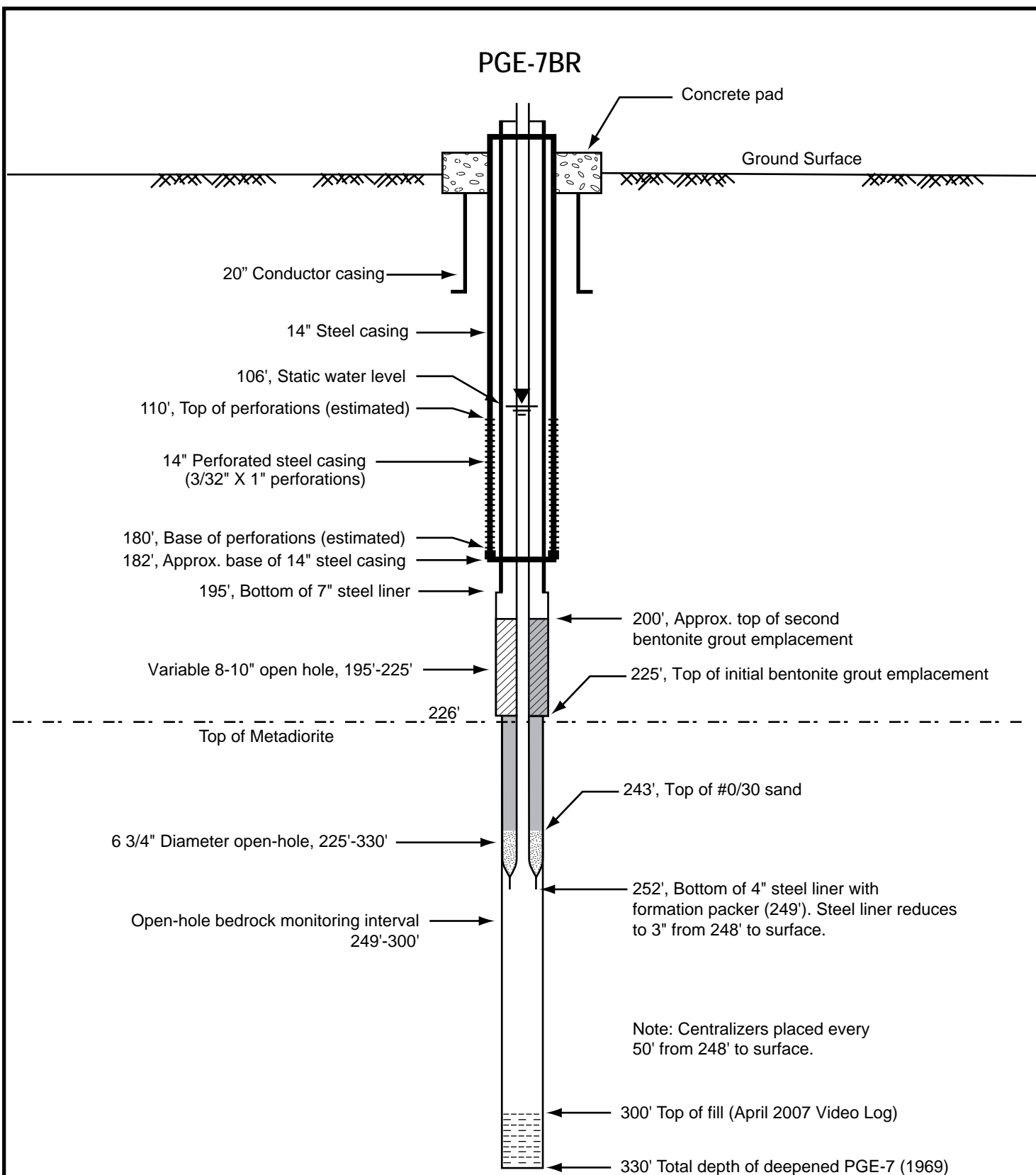


DIAGRAM NOT TO SCALE

All depths in feet below ground surface (bgs)

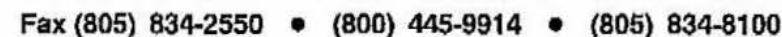
PGE-7 (inactive supply well) was installed in 1964 to 195' and deepened in 1969 to 330' for monitoring purpose.

PGE-7 was re-completed as an isolated bedrock monitoring well PGE-7BR; construction completed on October 16, 2007.

## WELL CONSTRUCTION DIAGRAM BEDROCK MONITORING WELL PGE-7BR

PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

**CH2MHILL**



**Fax (805) 834-2550 • (800) 445-9914 • (805) 834-8100**

[illegible]

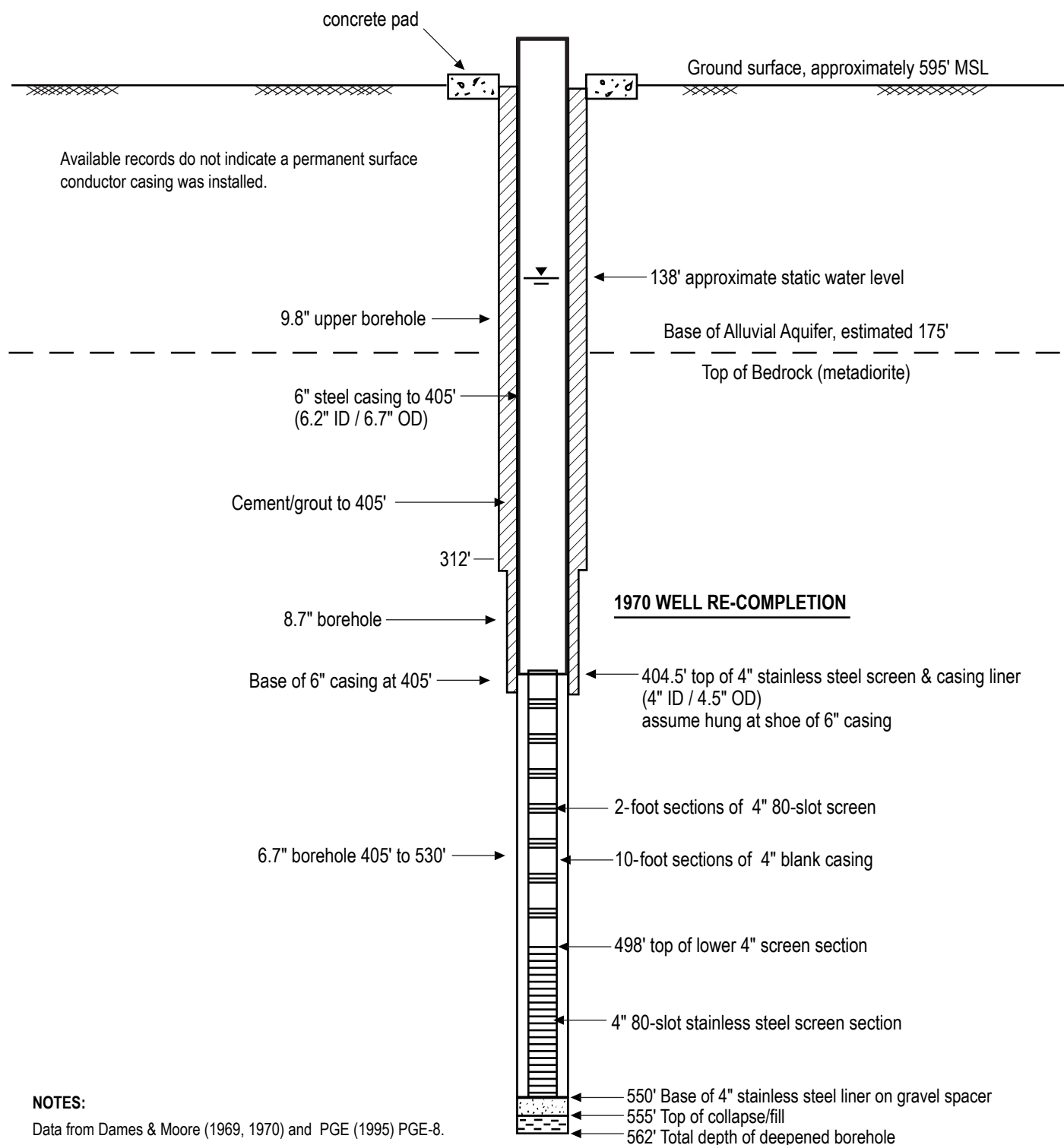
**CASING CONDITION:**

Surface 7' Reduces to OPEN HOLE at 195' : \_\_\_\_\_ at \_\_\_\_\_ : \_\_\_\_\_ at \_\_\_\_\_

Diameter Reference: ☐ Caliper Survey ☐ Estimate from TV/Photo Survey ☐ Well Records

Corrosion/Incrustation Build-up ☐ Light ☐ Moderate ☒ Heavy ☒ Increases with Depth

## Schematic Well Diagram PGE – 8



### NOTES:

Data from Dames & Moore (1969, 1970) and PGE (1995) PGE-8.

All depths in feet below ground surface.

Well PGE-8 was initially completed June 1969 with 6" casing to 405' and open-hole from 405' to 530'. PGE-8 was deepened to 562' and 4" screen & casing liner installed June 1970.

Pipe and packer equipment installed for injection 1969-1974 not shown. The sheared top of a 3-inch injection pipe (362') is attached to a mechanical packer that was reportedly installed to a depth of 405' btoc. Sediment has accumulated in the well up to 382' btoc.

**FIGURE 3-2**  
**WELL SCHEMATIC DIAGRAM OF**  
**INACTIVE SUPPLY WELL PGE-8**  
SUMMARY REPORT FOR HYDRAULIC TESTING  
IN BEDROCK WELLS  
PG&E TOPOCK COMPRESSOR STATION  
NEEDLES, CALIFORNIA

REVISIONS

DATE

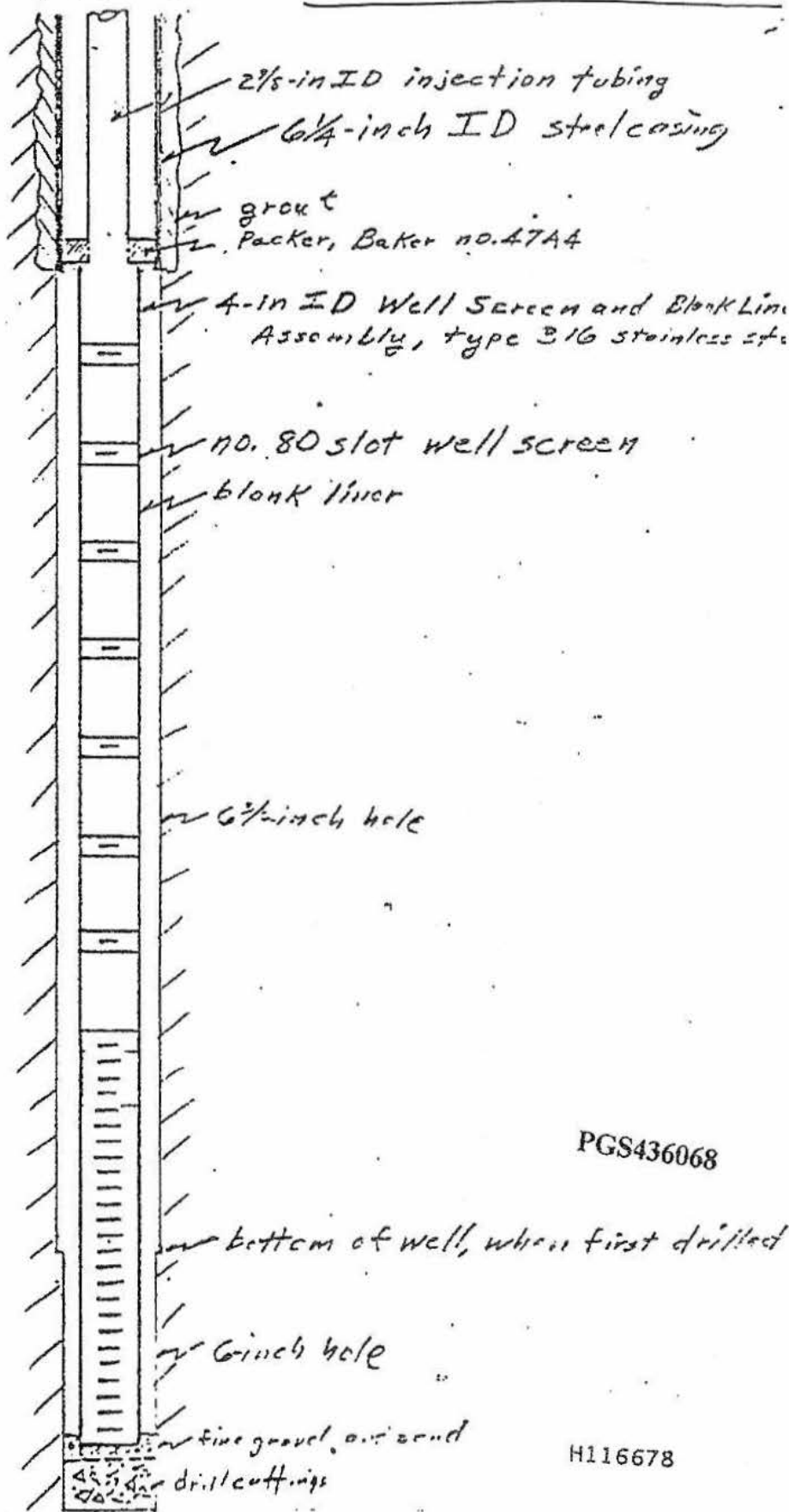
FILE 160-148-02

DATE 8-28-70

CHECKED BY

Elevation, in feet above mean sea level

220-  
210-  
200-  
190-  
180-  
170-  
160-  
150-  
140-  
130-  
120-  
110-  
100-  
90-  
80-  
70-  
60-  
50-  
40-  
30-



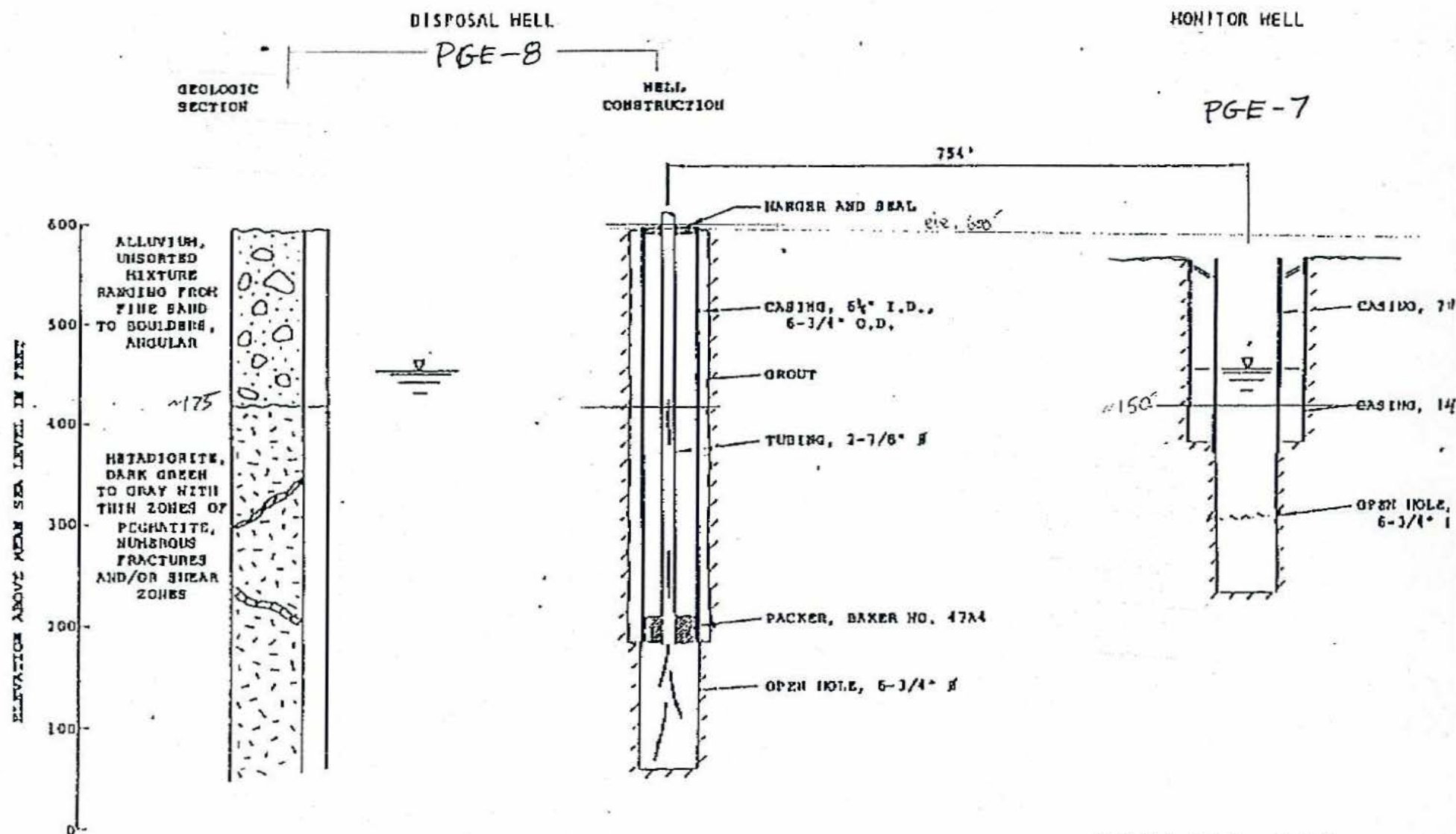
PGS436068

H116678

Diagram of well construction

DAMES & MOORE  
APPLIED EARTH SCIENCE

FIGURE B-4



GEOLOGY AND  
WELL CONSTRUCTION

## LOG OF BORING PT-7 S/D

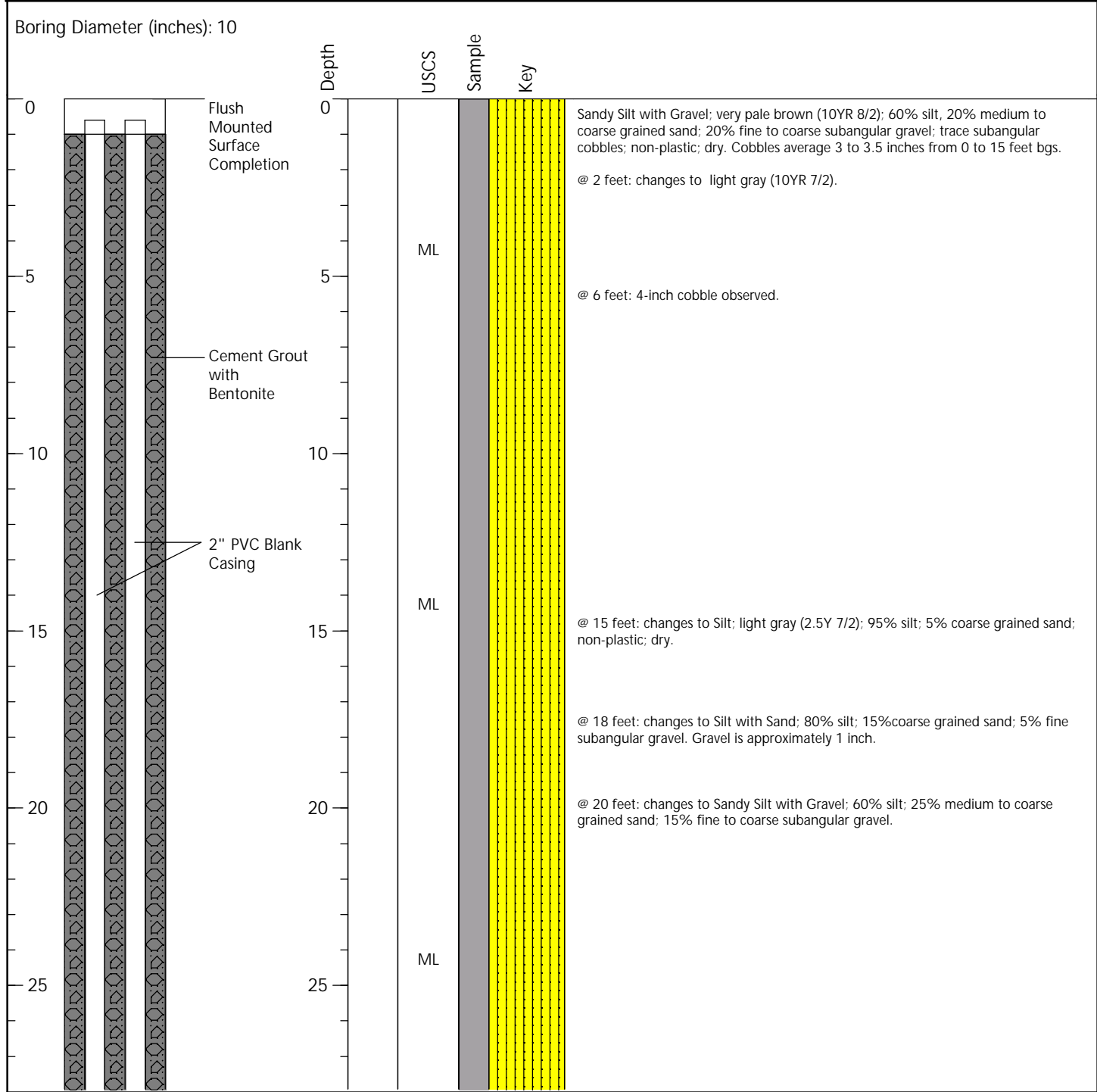
### PG&E Topock Site

### Needles, California

Project No.: RC000689.0004	Date Started: 9 May 2007
Logged by: Brett Bardsley	Date Completed: 11 May 2007
Drilling Co.: WDC	Drilling Method: Rotosonic/Mud Rotary
Drillers: Rivera, West, Sakioka, Villegas	Sample Method: 4" x 6" Core Rod
Well Permit #2007040402, 2007040400	Driller's License: C57-283326

## WELL CONSTRUCTION

## LITHOLOGIC DESCRIPTION





WELL CONSTRUCTION		Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
<p>Cement Grout with Bentonite</p> <p>2" PVC Blank Casing</p>	30	ML			<p>@ 30 feet: Silt with Sand; 90% silt; 10% medium to coarse grained sand.</p> <p>@ 31 feet: Silt with Gravel; 85% silt; 15% fine to coarse subangular gravel ranging from 1 to 3 inches.</p> <p>@ 32 feet: Sandy Silt; grayish brown (10YR 5/2); 60% silt; 40% medium to coarse grained sand; non-plastic; moist.</p> <p>@ 34 feet: trace subangular cobbles ranging from 3 to 4 inches.</p> <p>@ 35 feet: no cobbles.</p>	
	35				<p>@ 37 feet: changes to light gray (2.5Y 7/2); 75% silt; 25% medium to coarse grained sand; non-plastic; dry.</p> <p>@ 40 feet: Sandy Silt with Gravel; light gray (2.5Y 7/2); 60% silt; 20% fine to coarse grained sand; 20% fine subangular gravel.</p> <p>@ 42 feet: changes to light gray (5Y 7/1).</p> <p>@ 43 feet: changes to pinkish gray (5YR 6/2) to dark reddish brown (5YR 3/4).</p>	
	40	ML			<p>@ 45 feet: Sandy Silt with Gravel; light gray (2.5Y 7/2); 60% silt; 30% fine to medium grained sand; 10% fine subangular gravel.</p> <p>@ 47 feet: fine to coarse grained sand.</p>	
	45					
	50	ML				
	55					
	60					
					<p>@ 63 feet: trace subangular cobbles up to 3.5 inches.</p>	

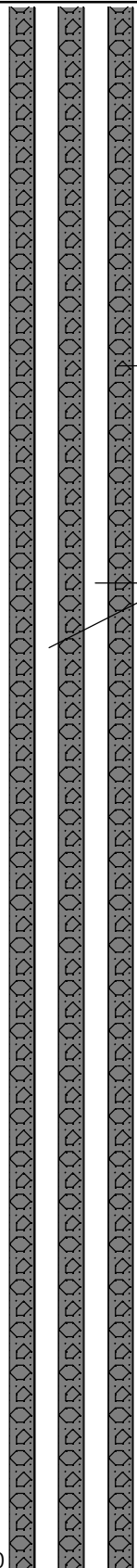
ARCADIS

Boring PT-7 S/D

Sheet 2 of 7



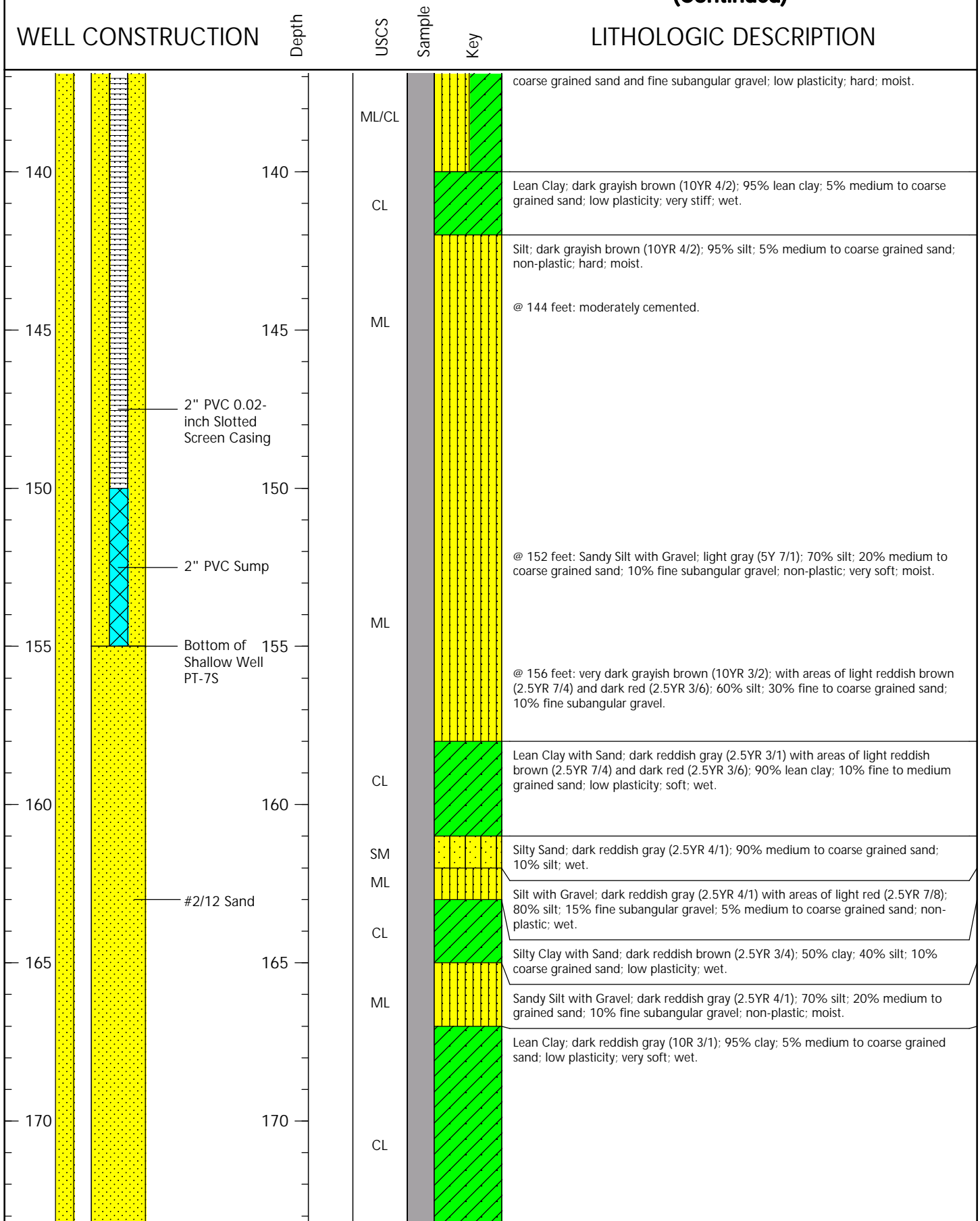
# LOG OF BORING PT-7 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
 <p>Cement Grout with Bentonite</p> <p>2" PVC Blank Casing</p>	65	CL			Sandy Clay; dark reddish brown (5YR 3/3); 60% lean clay; 40% fine to coarse grained sand; low plasticity; wet.
		SM			@ 65 feet: Sandy Clay with Gravel; dark grayish brown (10YR 5/2); 60% lean clay; 30% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; wet.
	70	CL			Silty Sand; dark grayish brown (10YR 5/2); 90% medium to coarse grained sand; 10% silt; non-plastic; wet.
					Lean Clay with Gravel; very dark gray (6YR 3/1); 90% clay; 10% fine subangular gravel; low plasticity; moist.
					@ 72 feet: Lean Clay; dark grayish brown (10YR 4/2); 95% lean clay; 5% fine subangular gravel; low plasticity; moderately cemented; moist.
	75	ML			Silt with Sand; light brownish gray (10YR 6/2); 80% silt; 15% coarse grained sand; 5% fine subangular gravel; non-plastic; dry.
					@ 77 feet: trace subangular cobbles.
					@ 78 feet: Sandy Silt with Gravel; light brownish gray; 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel; trace cobbles to 3.5 inches; non-plastic; dry.
	80	ML			
	85	CL			Sandy Clay; dark grayish brown (10YR 4/2) and zones of dark red (10R 3/6); 80% lean clay; 20% medium to coarse grained sand; trace cobbles up to 4 inches; low plasticity; moist.
	90	ML			Sandy Silt with Gravel; dark grayish brown (10YR 4/2); 55% silt; 35% medium to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; moist. Thin moderately cemented zones (hardpan).
					@ 90 feet: pale brown (10YR 6/3); trace subangular cobbles up to 3.5 inches; dry.
					@ 93 feet: 70% silt; 20% medium to coarse grained sand; 10% fine to coarse grained gravel; trace subangular cobbles.
					@ 97 feet: larger quantity of cobbles ranging from 3.5 to 4 inches.
					@ 98 feet: Silt with Gravel; pale brown (10YR 6/3); 85% silt; 10% fine subangular gravel; 5% coarse grained sand; one 3.5-inch subangular cobble; non-plastic; dry.
	100	ML			@ 100 feet: Sandy Silt with Gravel; pale brown (10YR 6/3); 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel.

# LOG OF BORING PT-7 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
<p>Cement Grout with Bentonite</p> <p>2" PVC Blank Casing</p> <p>Bentonite Seal</p> <p>2" PVC 0.02-inch Slotted Screen Casing</p> <p>#2/12 Sand</p>	105	ML			
		SM			Silty Sand with Gravel; dark grayish brown (10YR 4/2); 70% medium to coarse grained sand; 20% silt; 10% fine subangular gravel; wet.
	105	CL			Sandy Lean Clay; dark reddish gray (5YR 4/2); 75% lean clay; 20% medium to coarse grained sand; 5% fine subangular gravel; low plasticity; moist. @ 106 feet: dark reddish gray (5YR 4/2); 90% lean clay; 5% coarse grained sand; 5% fine subangular gravel; low plasticity; moist.
	110	SM			Silty Sand; dark reddish gray (5YR 4/2); moist.
		ML			Silt; dark reddish gray (5YR 4/2); moist.
		CL			Lean Clay; dark reddish gray (5YR 4/2) with dark olive gray seams (5Y 3/2); moist.
	115	SM			Silty Sand; dark reddish gray (5YR 4/2); moist.
		CL			Lean Clay; dark reddish gray (5YR 4/2) with dark olive gray seams (5Y 3/2); moist.
		SM			Silty Sand; dark reddish gray (5YR 4/2); moist.
	120	ML			Sandy Silt with Gravel; dark reddish gray (5YR 4/2); 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel; non-plastic; moist.
	125	CL			Lean Clay; dark grayish brown (10YR 4/2); 95% clay; 5% fine to medium grained sand; low plasticity; wet. @ 125 feet: moist.
		ML			Silt; dark reddish gray (5YR 4/2); 95% silt; 5% fine to medium grained sand; non-plastic; moist. @ 128 feet: 3 to 4-inch layers of low plasticity lean clay.
	130	CL			Lean Clay with Sand; light gray (5YR 7/1), pink (5YR 8/4), and dark gray (2.5Y 4/1); 85% clay; 10% medium to coarse grained sand; 5% fine subangular gravel; trace subangular cobbles; low to medium plasticity; wet. @ 135.5 feet: a seam of greenish black (GLEY2 5BG).
	135				Clayey Silt; dark grayish brown (10YR 4/2); 55% silt; 45% clay; trace medium to

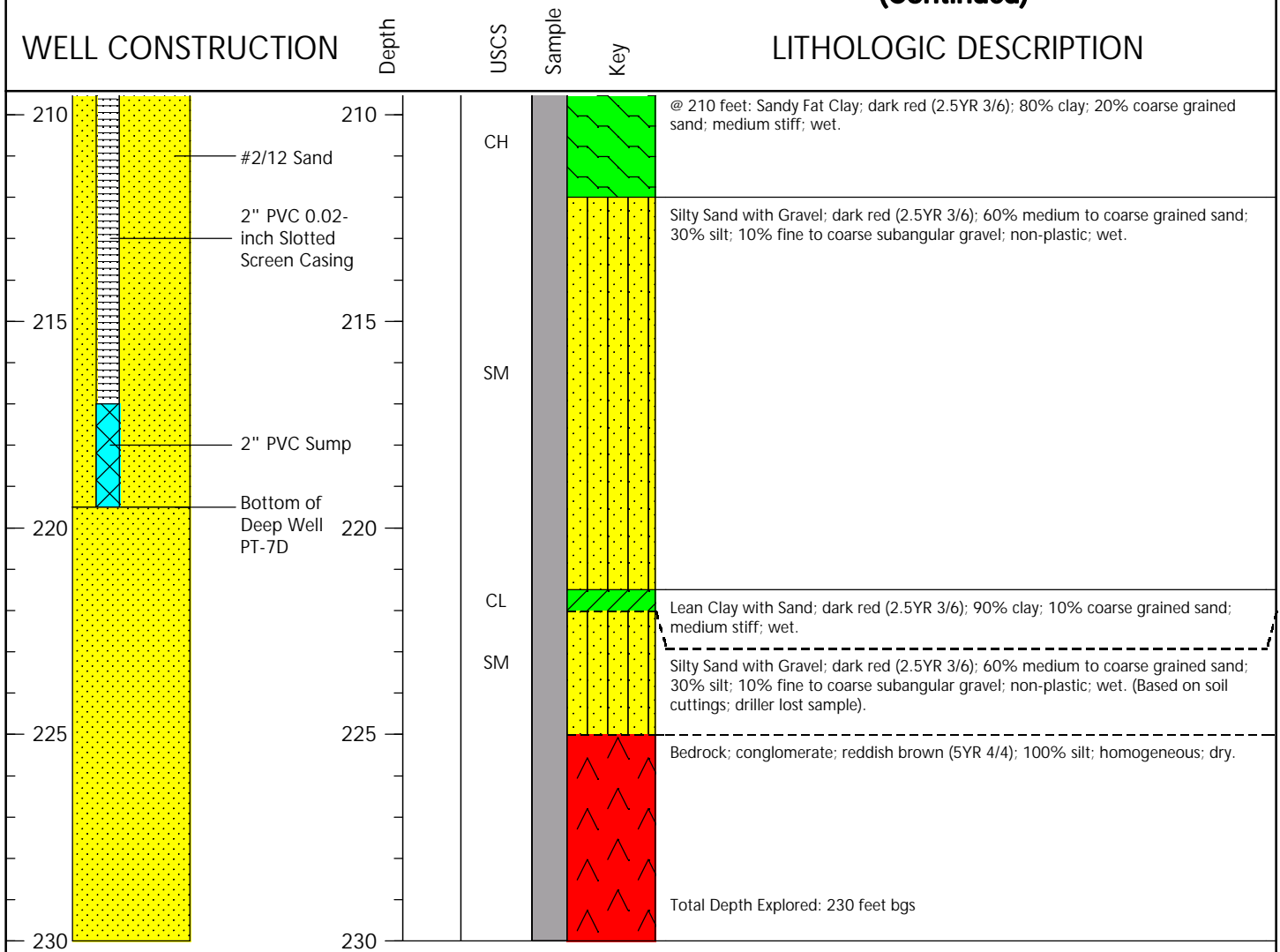
# LOG OF BORING PT-7 S/D (Continued)

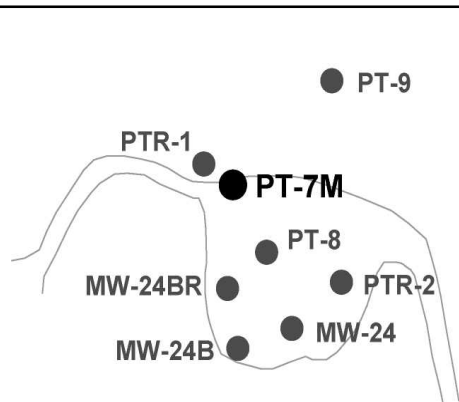


# LOG OF BORING PT-7 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
<p>#2/12 Sand</p> <p>Neat Cement Grout with Bentonite</p> <p>Bentonite Seal</p> <p>2" PVC 0.02-inch Slotted Screen Casing</p>	175	CL			Silty Sand; dark reddish gray (10R 3/1); 70% medium to coarse grained sand; 30% silt; non-plastic; wet.
		SM			
		CL			Lean Clay; dark reddish gray (2.5YR 3/1); 95% clay; 5% medium to coarse grained sand; trace fine subangular gravel; low plasticity; medium stiff; moist.
	180	SM			Silty Sand with Gravel; dark reddish brown (2.5YR 3/4); 60% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; moist.  @ 181 feet: coarse subangular gravel ranging from 2.5 to 2.9 inches.
		ML			Sandy Silt with Gravel; dark red (2.5YR 3/6); 60% silt; 30% fine to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; moist.
	185	SM			Silty Sand with Gravel; dark reddish gray (10R 3/1); 60% medium to coarse grained sand; 30% silt; 10% fine to coarse grained gravel; non-plastic; wet.  @ 186 feet: dark reddish gray (2.5YR 4/1).
		CL			Lean Clay with Gravel; dark reddish gray (2.5YR 4/1); 85% clay; 10% fine subangular gravel; 5% fine to coarse grained sand; low plasticity; very stiff; moist.
	190	ML			Silt with Gravel; reddish gray (2.5YR 6/1); 90% silt; 10% fine to coarse subangular gravel; trace coarse grained sand; moist.  Gravel coarsens with depth.  @ 192 feet: Gravelly Silt; dark reddish gray (2.5YR 4/1); 60% silt; 35% fine to coarse subangular gravel; 5% fine to coarse grained sand; non-plastic; moist.
	195	SM			Silty Sand with Gravel; dark reddish gray (2.5YR 4/1); 60% fine to coarse grained sand; 25% silt; 15% fine to coarse subangular gravel; moist.  @ 198 feet: very dark grayish green (GLEY1 2.5/2).
		SP			Poorly Graded Sand; dark grayish brown (2.5Y 3/2); 100% fine to medium grained sand; wet.
	200	CL			Silty Sand with Gravel; dark reddish gray (2.5YR 4/1); 60% fine to coarse grained sand; 25% silt; 15% fine to coarse subangular gravel; wet.
		SM			Sandy Lean Clay with Gravel; dark reddish gray (2.5YR 4/1); 70% clay; 20% medium to coarse grained sand; fine subangular gravel; low plasticity; wet.
	205	CH			Silty Sand with Gravel; dark reddish gray (2.5YR 4/1); 60% fine to coarse grained sand; 25% silt; 15% fine to coarse subangular gravel; wet. @ 203.5 feet: very dark grayish green (GLEY1 2.5/2).
					Fat Clay; dark red (2.5YR 3/6); 100% clay; plasticity; very soft; wet.  @ 209 feet: trace fine subangular gravel.

# LOG OF BORING PT-7 S/D (Continued)





## LOG OF BORING PT-7 M

## PG&E Topock Site Needles, California

Project No.: RC000689.0004

Date Started: 9 May 2007

Logged by: Brett Bardsley

Date Completed: 11 May 2007

Drilling Co.: WDC

Drilling Method: Rotosonic/Mud Rotary

Drillers: Rivera, West, Sakioka, Villegas

Sample Method: 4" x 6" Core Rod

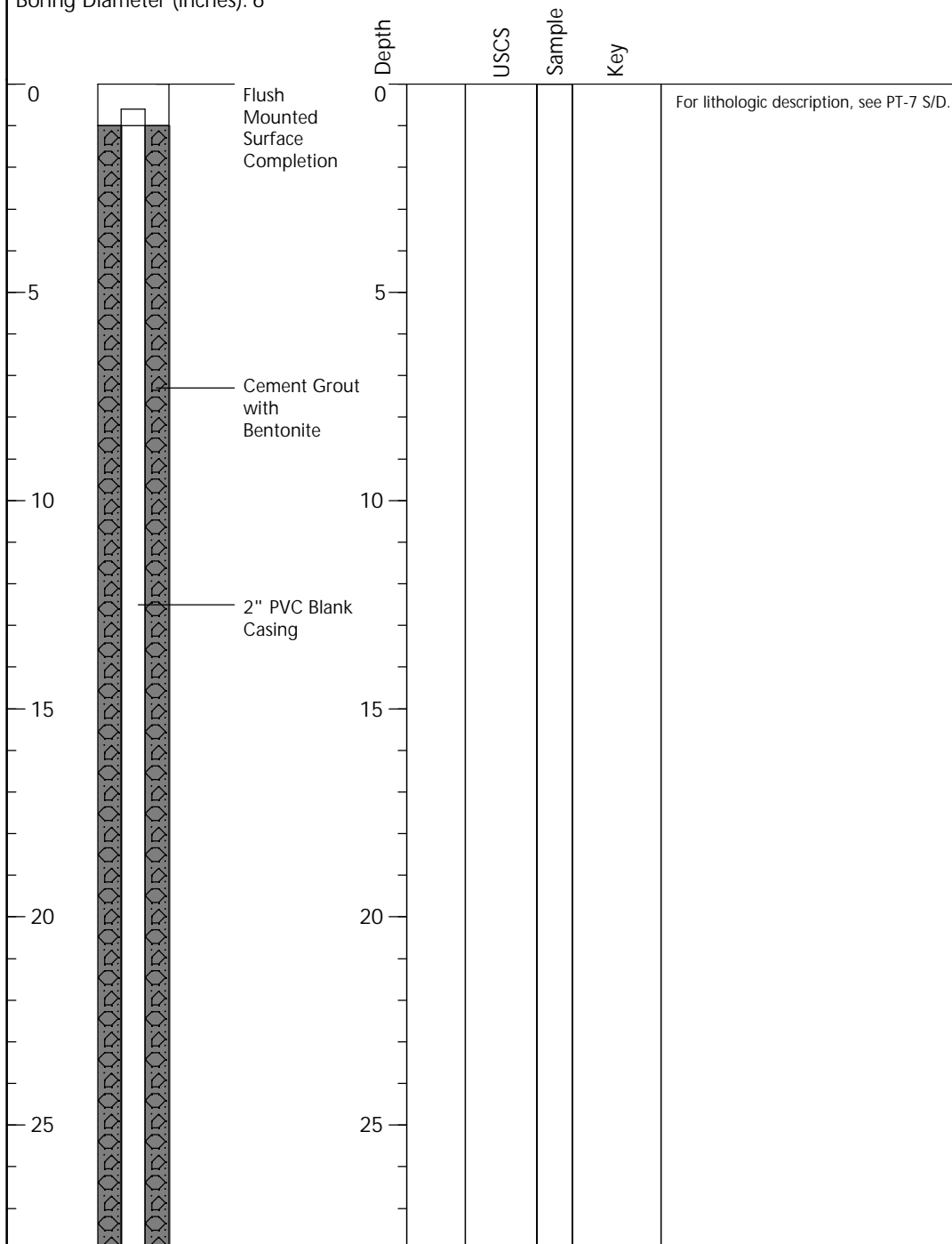
Well Permit #:2007040401

Driller's License: C57-283326

## WELL CONSTRUCTION

## LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 6



# LOG OF BORING PT-7 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

30					
35					
40					
45					
50					
55					
60					

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

# LOG OF BORING PT-7 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

65		65				
70		70				
75		75				
80		80				
85		85				
90		90				
95		95				
100		100				

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing



# LOG OF BORING PT-7 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

105					
110					
115					
120					
125					
130					
135					

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

# LOG OF BORING PT-7 M (Continued)

WELL CONSTRUCTION

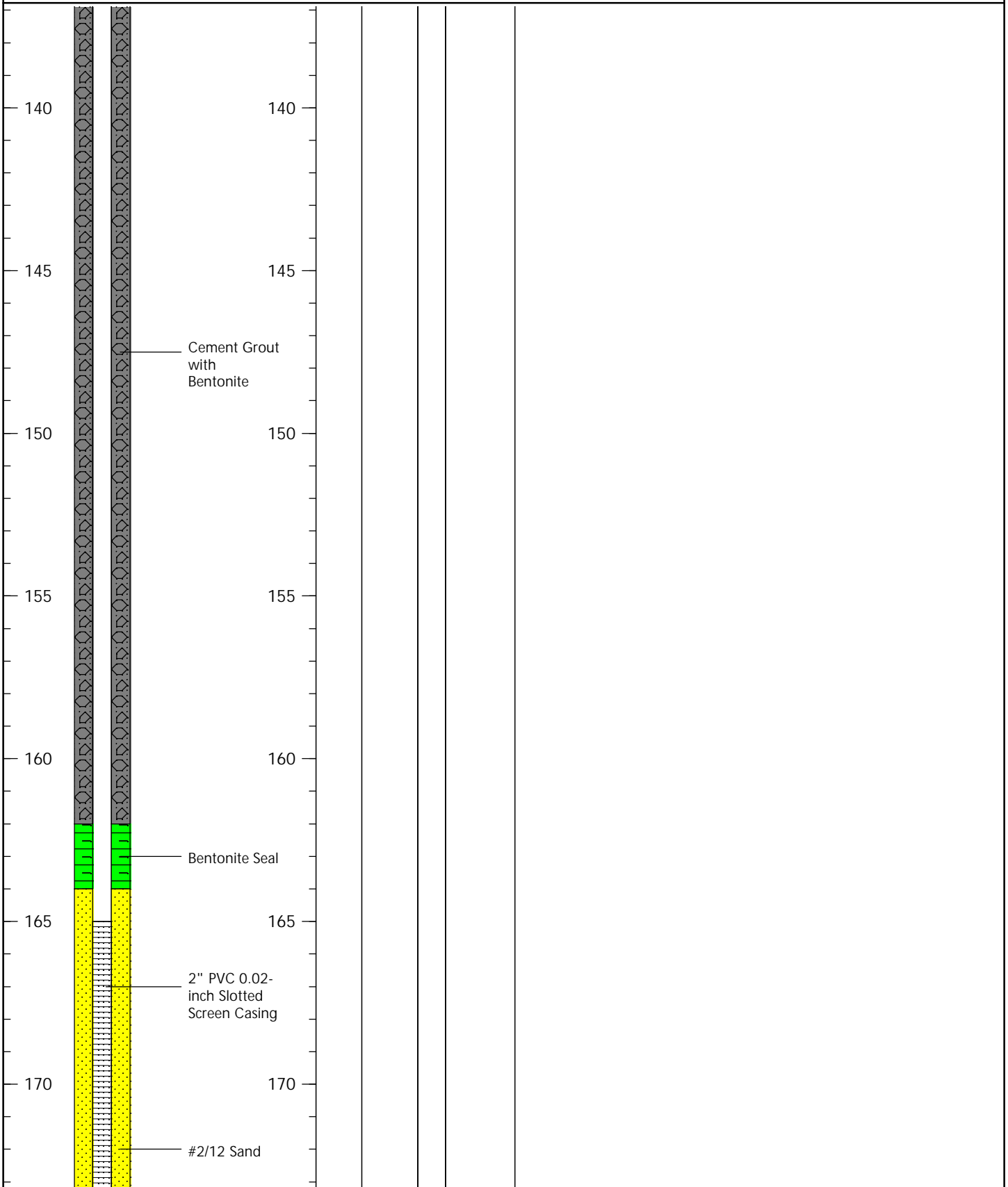
Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION



# LOG OF BORING PT-7 M (Continued)

## WELL CONSTRUCTION

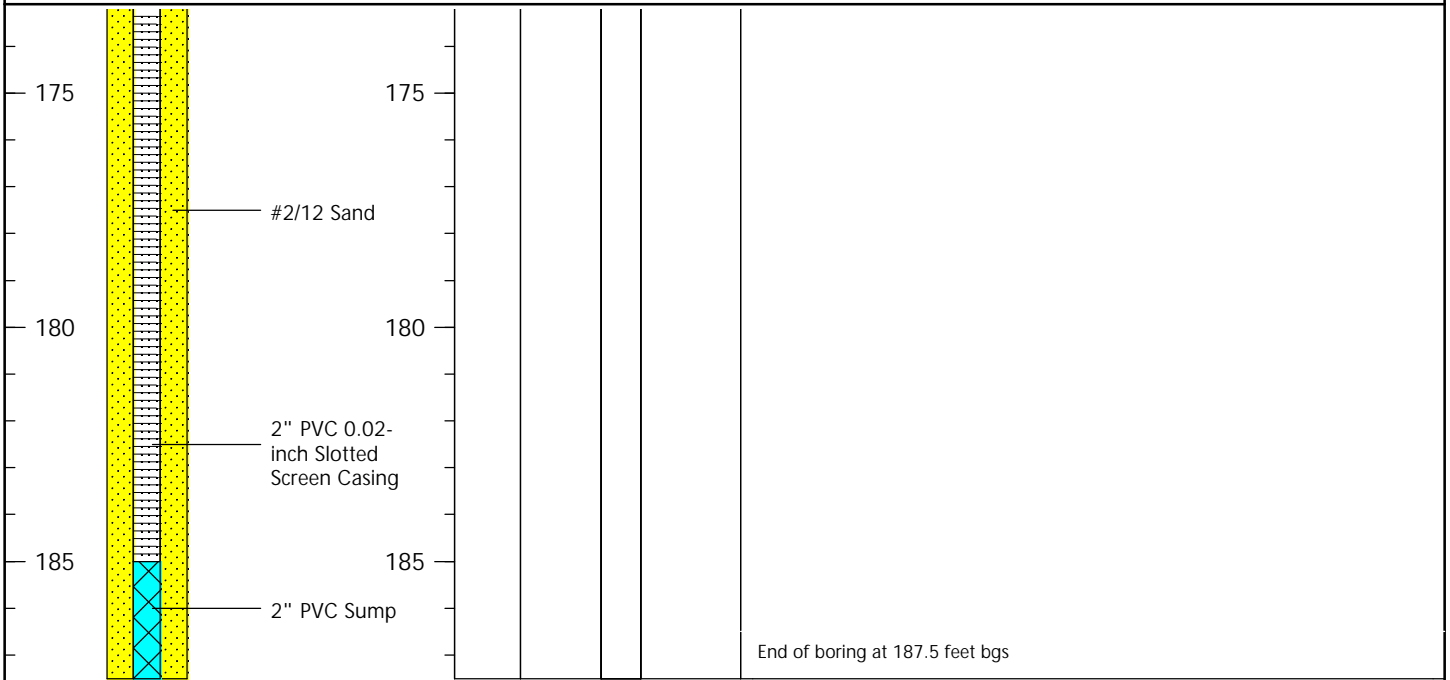
Depth

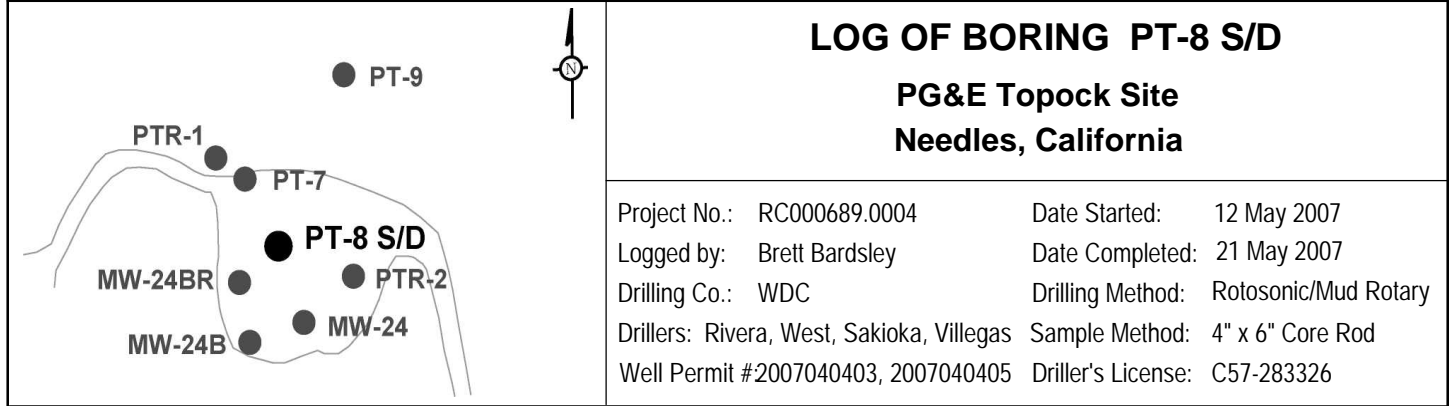
USCS

Sample

Key

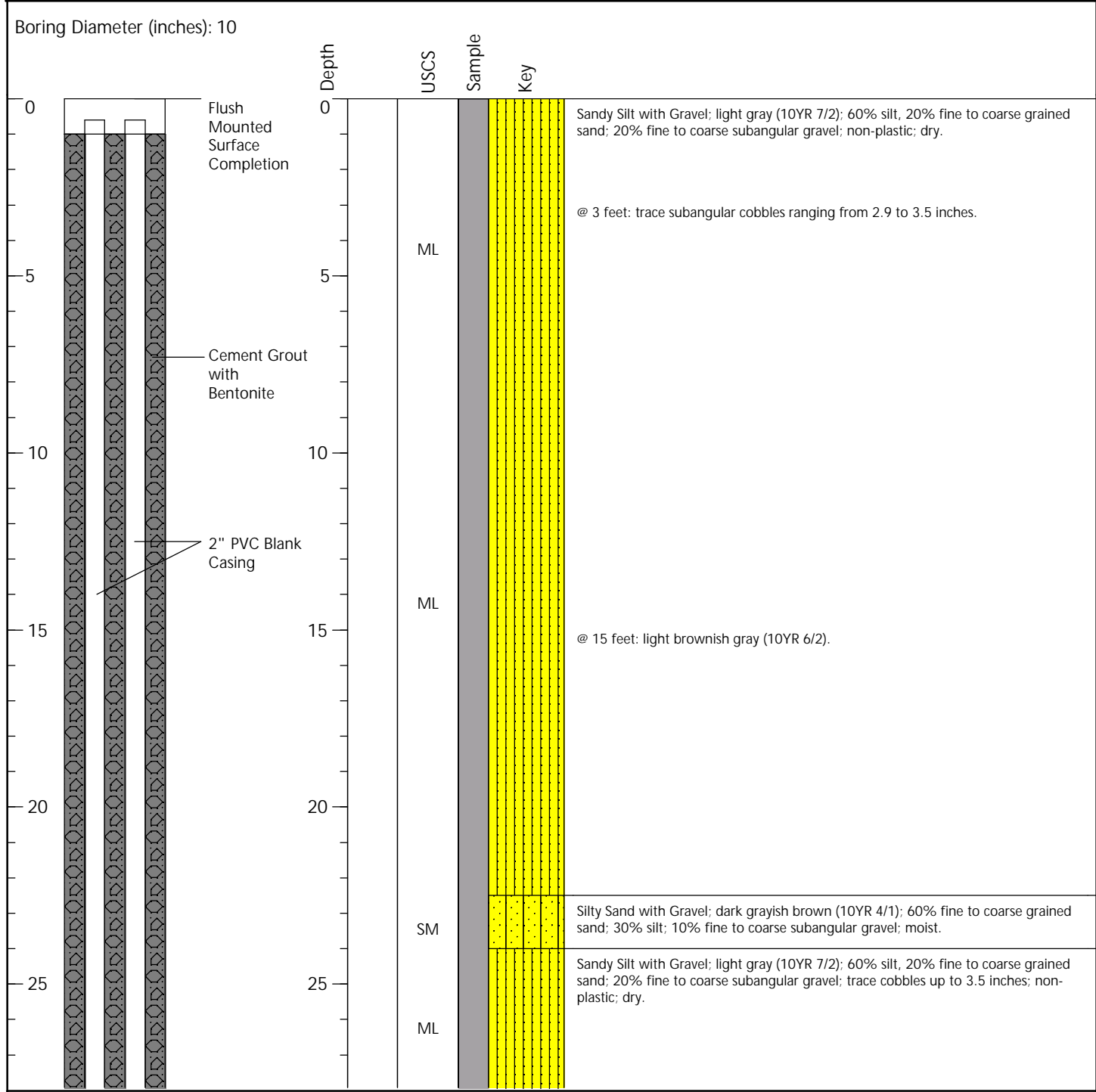
## LITHOLOGIC DESCRIPTION



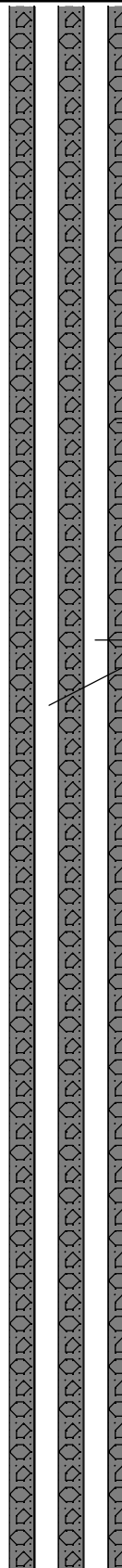


WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION



# LOG OF BORING PT-8 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
	30	ML			
		SM			Silty Sand with Gravel; pale brown (10YR 6/3); 70% fine to coarse grained sand; 20% silt; 10% fine to coarse subangular gravel; dry.
		ML			Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt, 20% fine to coarse grained sand; 20% fine to coarse subangular gravel; non-plastic; dry.
	35				
		SM			Silty Sand; dark reddish gray (10YR 7/2); 70% medium to coarse grained sand; 25% silt; 5% fine subangular gravel; wet. @ 37 feet: fine to coarse grained sand and trace cobbles up to 3.3 inches.
	40				
		ML			Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt, 30% fine to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; dry.
	45				
		CL			Sandy Lean Clay; dark reddish gray (2.5YR 3/1) with some dark red (2.5YR 3/6); 60% lean clay; 40% medium to coarse grained sand; low plasticity; medium stiff, wet. @ 47 feet: changes to very dark grayish brown (10YR 3/2) with some dark red (2.5YR 3/6); 80% lean clay; 20% medium to coarse grained sand; soft; moist.
	50				
		ML			Sandy Silt with Gravel; reddish gray (2.5YR 6/1); 70% silt, 20% fine to coarse grained sand; 10% fine to coarse subangular gravel up to 2 inches; non-plastic; dry.
	55				
		SM			Silty Sand; dark reddish gray (10R 3/1); with a seam of dark greenish gray (GLE Y1 4/1); 60% medium to coarse grained sand; 40% silt; trace fine subangular gravel; wet.
	60				
		CL			Lean Clay with Gravel; very dark grayish brown (10YR 3/2); 90% lean clay; 10% fine subangular gravel; low plasticity; stiff; moist. @ 60 feet: 4-inch moderately cemented layer; hard.
		ML			Sandy Silt with Gravel; light reddish gray (2.5YR 7/1); 70% silt, 20% medium to coarse grained sand; 10% fine subangular gravel; non-plastic; dry.

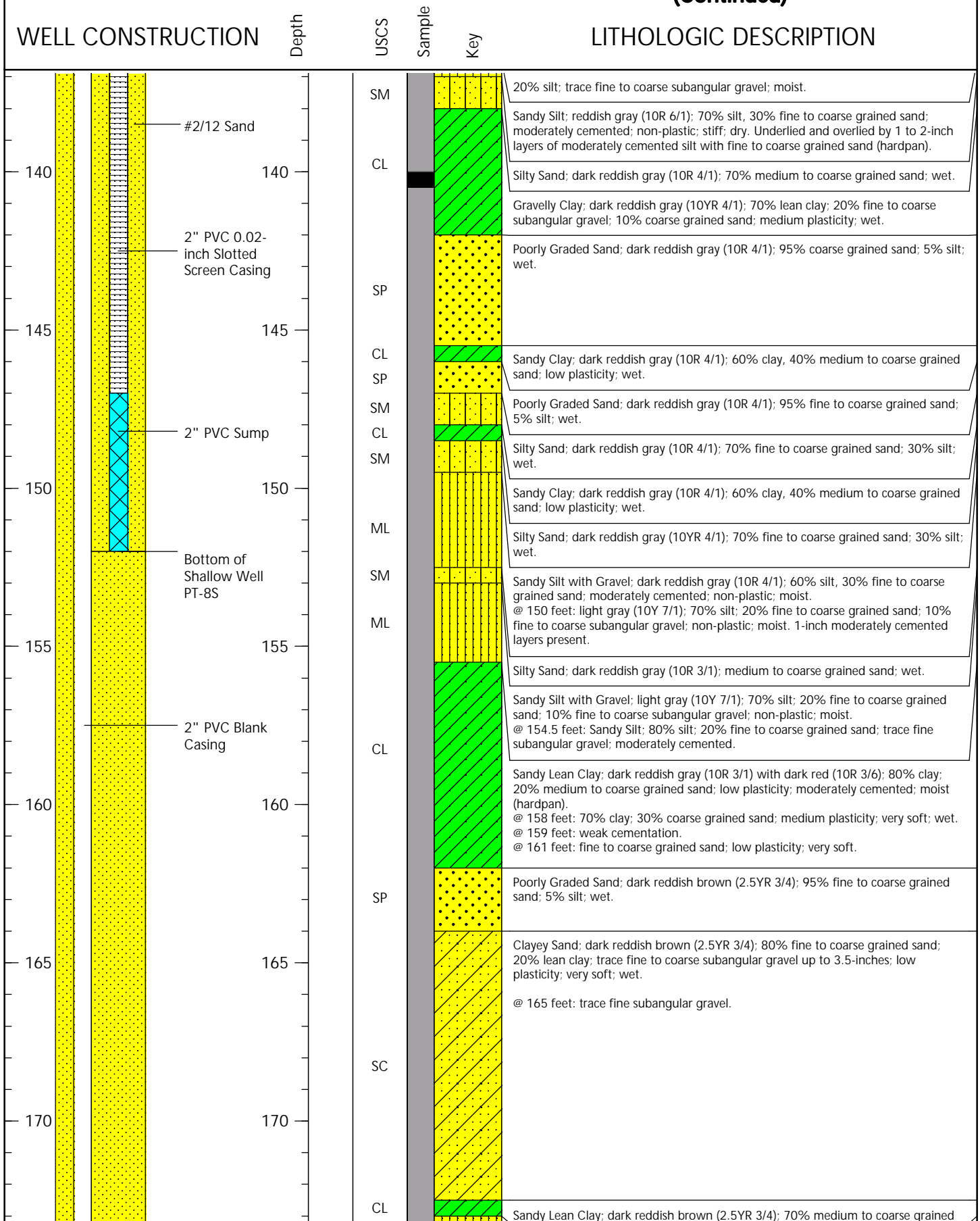
# LOG OF BORING PT-8 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
	65				
	65	CL			Sandy Clay; dark reddish gray (2.5YR 3/1); 70% clay, 20% medium to coarse grained sand; trace subangular fine gravel; low plasticity; very soft; wet.  @ 68 feet: dark greenish (GLEYS 4/1) to light greenish gray (GLEYS 7/1) seam (0.5-inch thick)
	70	SM			Silty Sand with Gravel; dark reddish gray (2.5YR 3/1); 60% fine to medium grained sand; 25% silt; 15% fine to coarse subangular gravel; moist.
	75	ML			Sandy Silt with Gravel; light reddish gray (2.5YR 7/1); 70% silt, 20% medium to coarse grained sand; 10% fine subangular gravel; non-plastic; very soft; dry. Alternating with weakly cemented stiff layers.
	75	SM			Silty Sand with Gravel; light gray (10R 7/2); 55% fine to coarse grained sand; 25% silt; 15% fine to coarse subangular gravel; dry.
	80	ML			Sandy Silt with Gravel; light gray (10R 7/2); 70% silt, 25% fine to coarse grained sand; 15% fine to coarse subangular gravel; non-plastic; dry.
	85	CL			Lean Clay with Gravel; dark grayish brown (10YR 4/2); 90% lean clay; 10% fine subangular gravel; medium plasticity; medium stiff; moist.
	85	ML			Silt with Gravel; light reddish gray (2.5YR 7/1); 90% silt; 10% fine subangular gravel; non-plastic; dry.  @ 87 feet: 70% silt; 30% fine subangular gravel.
	90	GW			Sandy Gravel; light reddish gray (2.5YR 7/1); 60% fine to coarse subangular gravel; 35% fine to coarse grained sand; 5% silt; moist.
	90	SM			Silty Sand with Gravel; light reddish gray (2.5YR 7/1); 60% fine to coarse grained sand; 20% silt; 20% fine to coarse subangular gravel; dry.  @ 93 feet: moderately cemented 2-inch layers.  @ 95 feet: dark grayish brown (10YR 4/2); wet.
	95	CL			Lean Clay with Gravel; dark brown (10YR 3/3); 90% clay; 10% fine to coarse subangular gravel; low to medium plasticity; moist.
	100	ML			Sandy Silt; light reddish gray (2.5YR 7/1); 70% silt, 25% fine to coarse grained sand; 5% fine subangular gravel; non-plastic; 1-inch layers that are weakly cemented; stiff; dry, alternating with layers that are non-cemented and soft.

# LOG OF BORING PT-8 S/D (Continued)

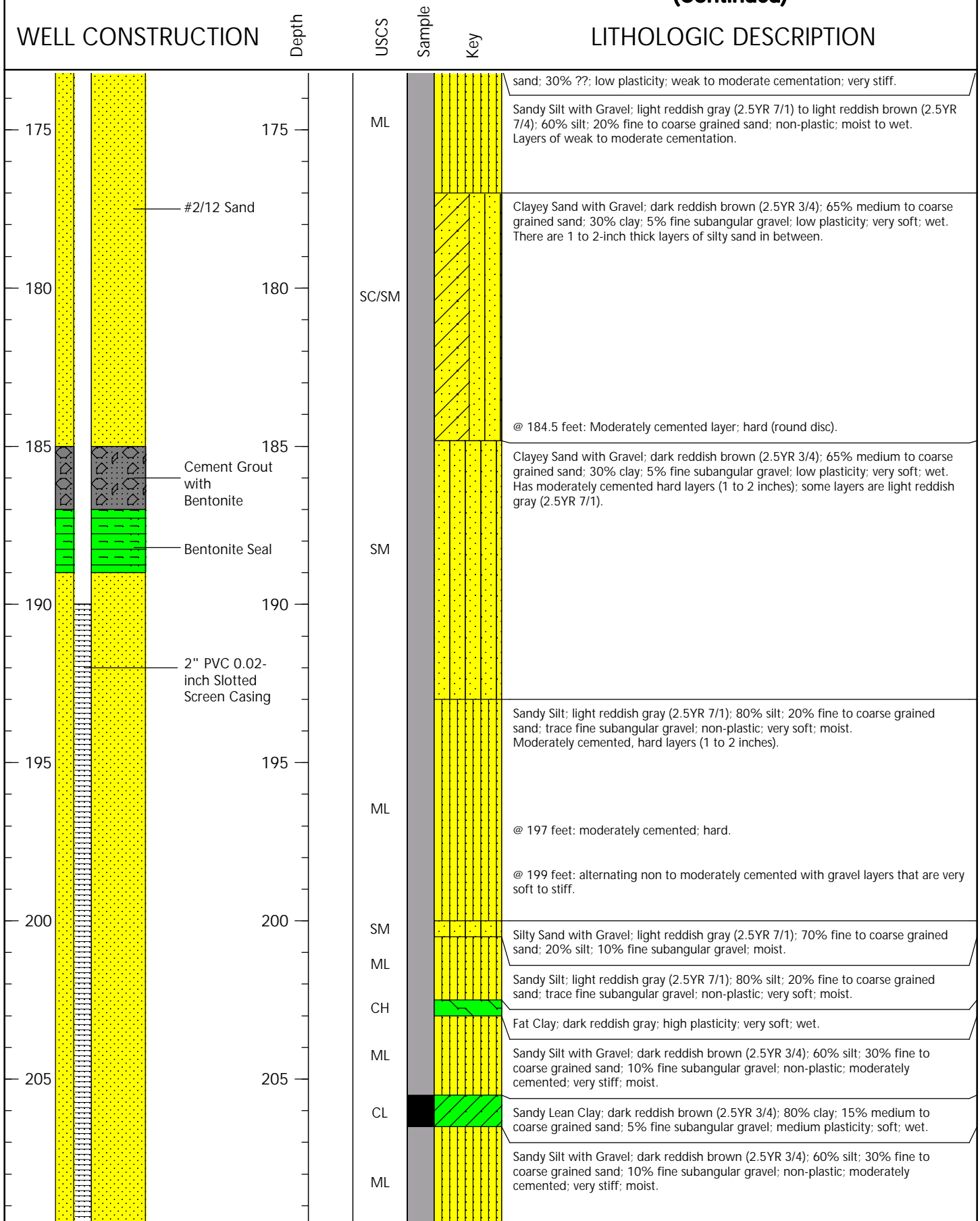
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
<p>Cement Grout with Bentonite</p> <p>2" PVC Blank Casing</p> <p>Bentonite Seal</p> <p>#2/12 Sand</p> <p>2" PVC 0.02-inch Slotted Screen Casing</p>	105	ML			<p>@ 101 feet: light gray (5YR 7/1).</p> <p>@ 103 feet: light reddish gray (2.5YR 7/1); 80% silt; 20% fine to coarse grained sand; weak cementation; very stiff; dry.</p>
	105	SM			<p>Silty Sand with Gravel; light gray (5YR 7/1); 60% fine to coarse grained sand; 25% silt; 15% fine subangular gravel; dry.</p> <p>There are layers that are weak to moderately cemented.</p>
	110	ML			<p>Sandy Silt; light gray (5YR 7/1); 80% silt; 20% fine to coarse grained sand; non-plastic; weakly cemented; stiff; moist.</p> <p>@ 113 feet: very stiff.</p>
	115	SM			<p>Silty Sand with Gravel; dark reddish gray (5YR 4/2); 60% fine to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; moist.</p>
	115	ML			<p>Sandy Silt; light gray (5YR 7/1); 80% silt; 20% fine to coarse grained sand; non-plastic; weakly cemented; stiff; moist.</p>
	120	SM			<p>Silty Sand with Gravel; dark reddish gray (5YR 4/2); 60% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; moist.</p>
	125	SM			<p>@ 125 feet: Silty Sand; dark reddish brown (5YR 3/2); 80% medium to coarse grained sand; 20% silt; trace fine to coarse subangular gravel; wet.</p>
	130	SP			<p>Poorly Graded Sand; dark reddish brown (5YR 3/2); 95% medium to coarse grained sand; 5% silt; wet.</p>
	130	SM/SC			<p>Silty Sand; dark reddish brown (5YR 3/2); 80% medium to coarse grained sand; 20% silt; trace fine to coarse subangular gravel; wet.</p> <p>0.5-inch seams of Clayey Sand; dark reddish brown (5YR 3/2); 70% medium to coarse grained sand; 30% lean clay; low to medium plasticity; wet.</p>
	135	ML			<p>Sandy Silt; reddish gray (10R 6/1); 70% silt, 30% fine to coarse grained sand; moderately cemented; non-plastic; stiff; dry.</p>
	135	SM ML			<p>Silty Sand; dark reddish brown (5YR 3/2); 80% medium to coarse grained sand;</p>

# LOG OF BORING PT-8 S/D (Continued)

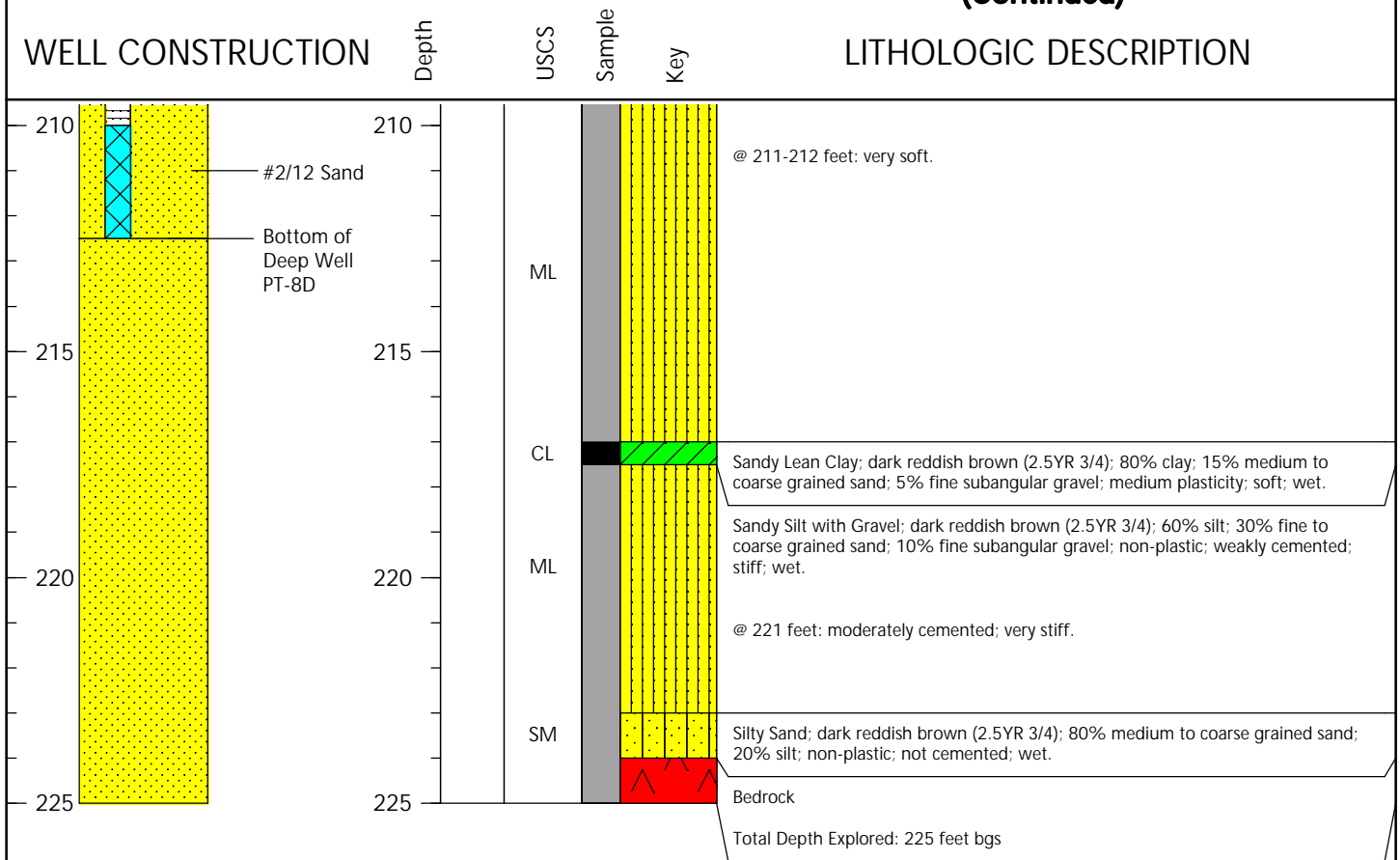


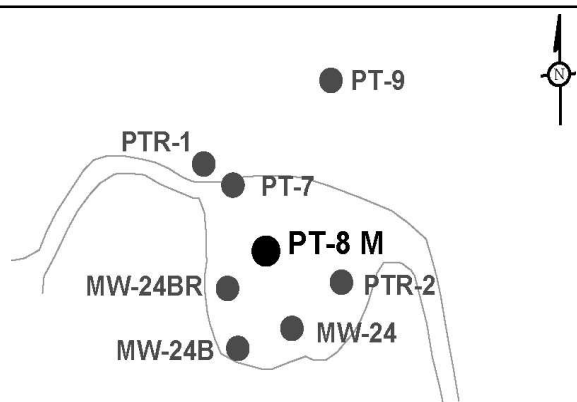


# LOG OF BORING PT-8 S/D (Continued)



# LOG OF BORING PT-8 S/D (Continued)





# LOG OF BORING PT-8 M

## PG&E Topock Site Needles, California

Project No.: RC000689.0004

Date Started: 12 May 2007

Logged by: Brett Bardsley

Date Completed: 21 May 2007

Drilling Co.: WDC

Drilling Method: Rotosonic/Mud Rotary

Drillers: Rivera, West, Sakioka, Villegas

Sample Method: 4" x 6" Core Rod

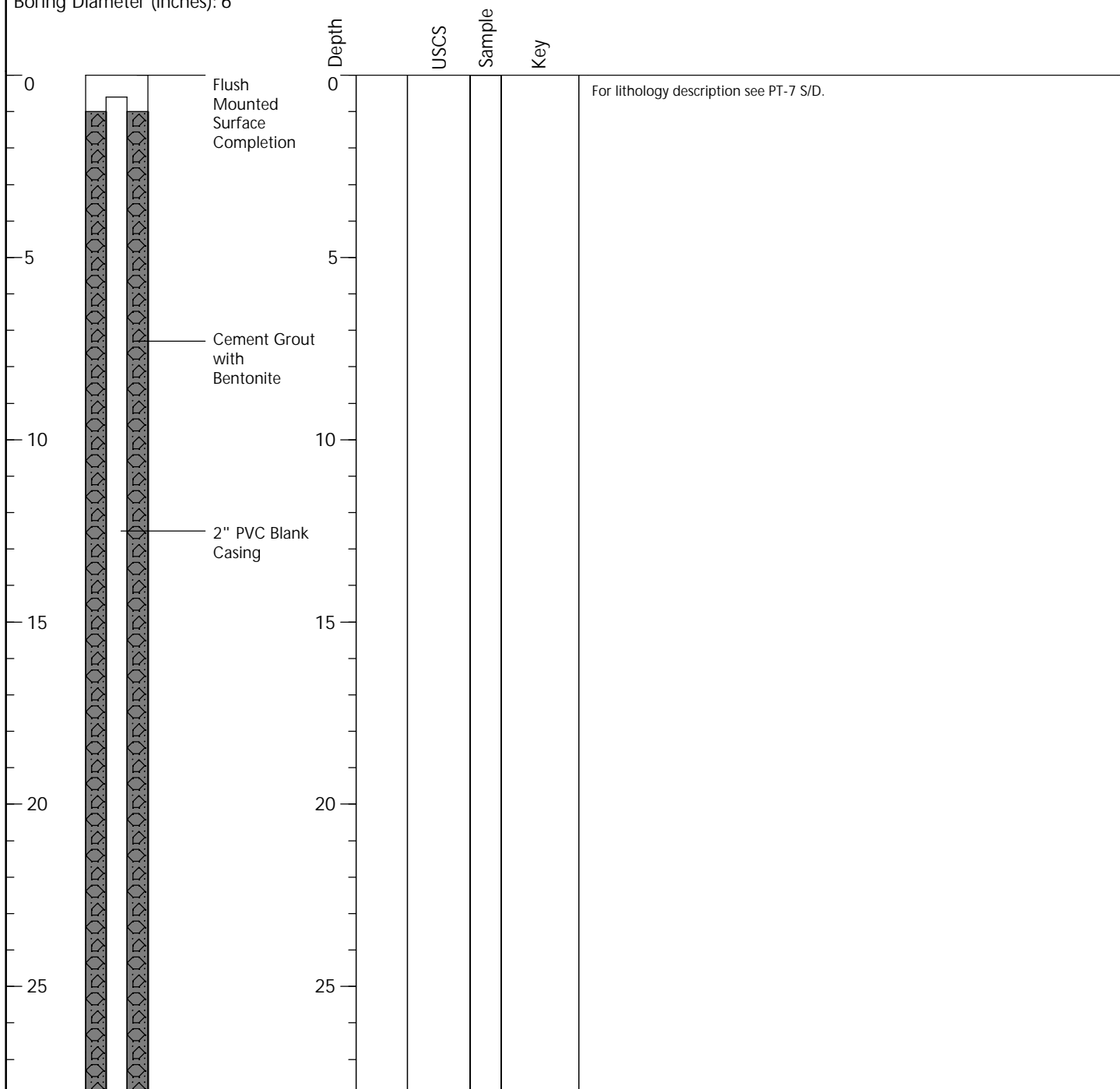
Well Permit #:2007040404

Driller's License: C57-283326

## WELL CONSTRUCTION

## LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 6



# LOG OF BORING PT-8 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

30					
35					
40					
45					
50					
55					
60					

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

# LOG OF BORING PT-8 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

65		65				
70		70				
75		75				
80		80				
85		85				
90		90				
95		95				
100		100				

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

## LITHOLOGIC DESCRIPTION

ARCADIS	Boring PT-8 M	Sheet 4 of 6
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# LOG OF BORING PT-8 M (Continued)

## WELL CONSTRUCTION

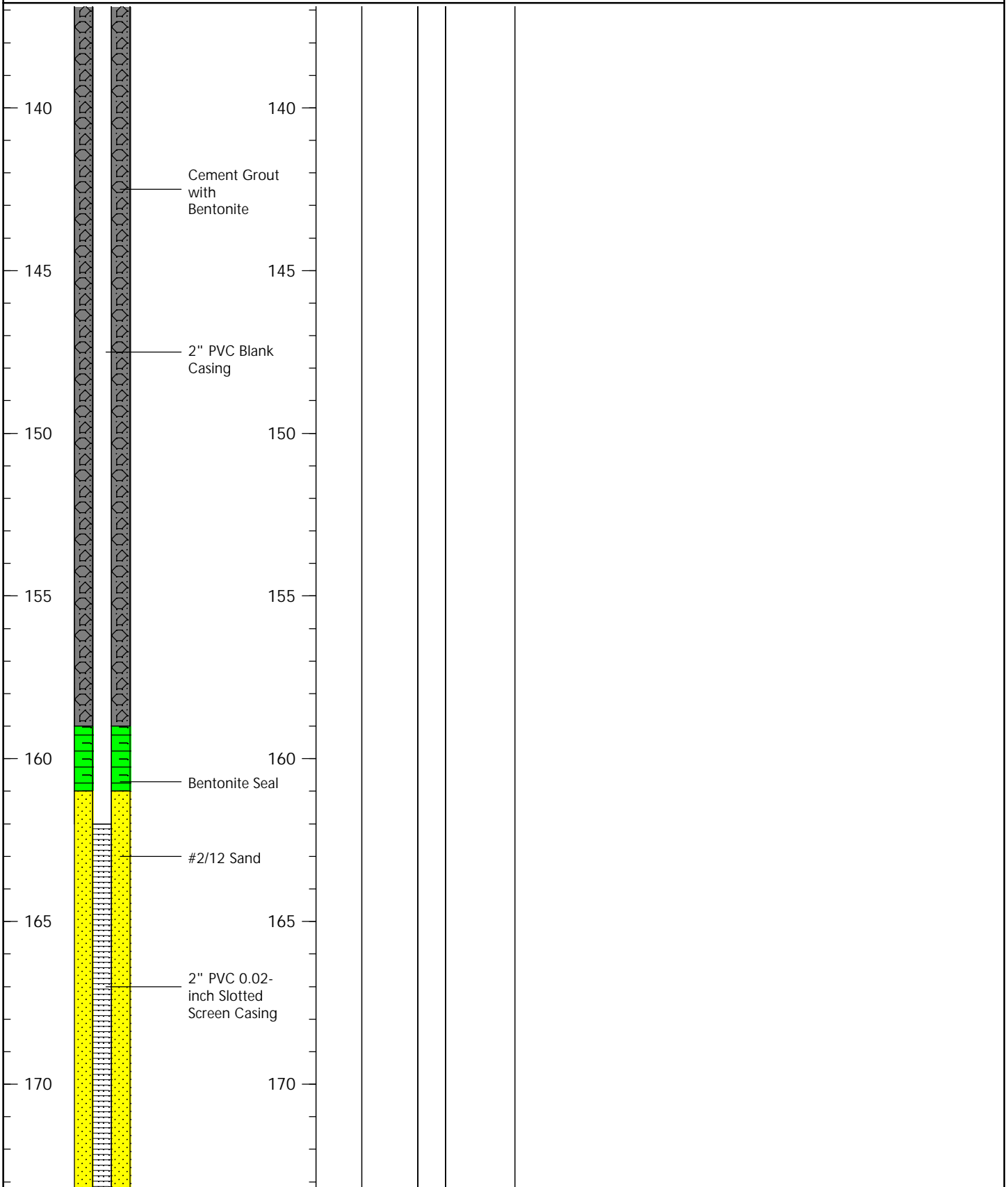
Depth

USCS

Sample

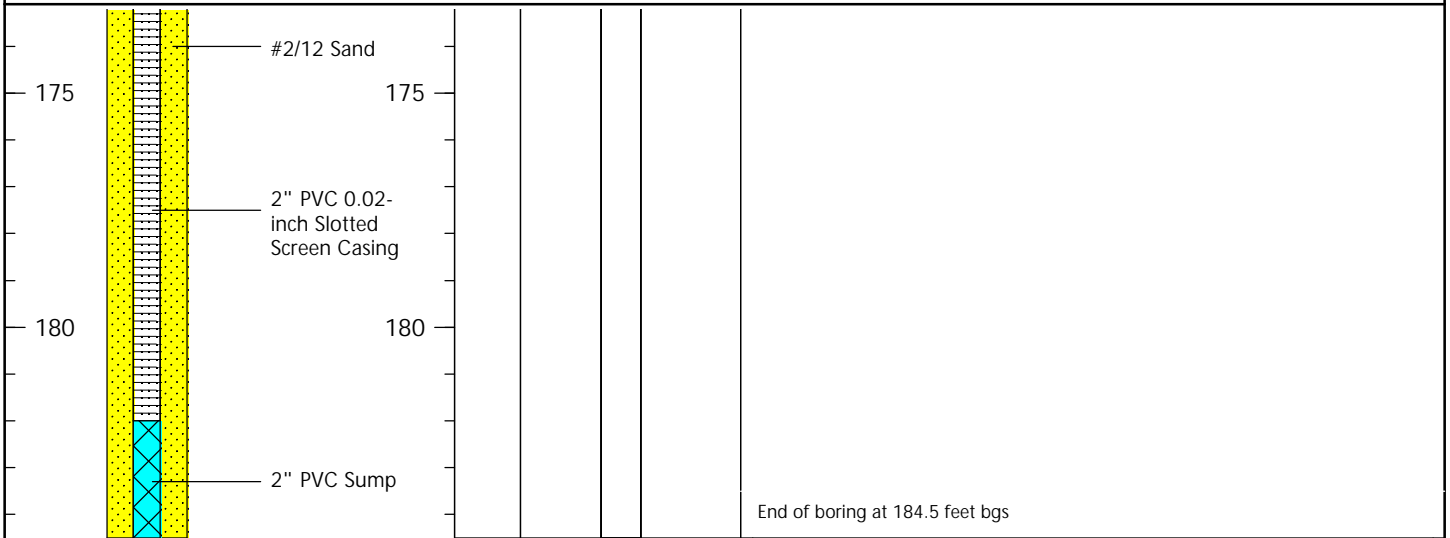
Key

## LITHOLOGIC DESCRIPTION

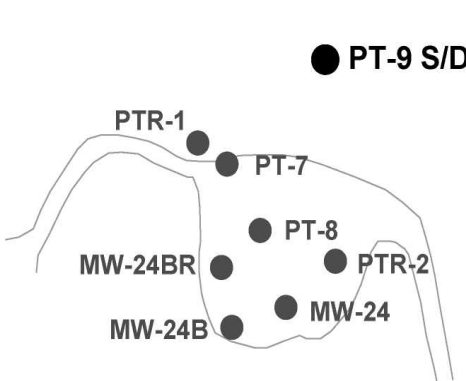


# LOG OF BORING PT-8 M (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
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**PT-9 S/D**

## LOG OF BORING PT-9 S/D

### PG&E Topock Site

### Needles, California

Project No.: RC000689.0004

Logged by: Brett Bardsley

Drilling Co.: WDC

Drillers: Rivera, West, Sakioka, Villegas

Well Permit #2007040408, 2007040406

Date Started: 4 June 2007

Date Completed: 6 June 2007

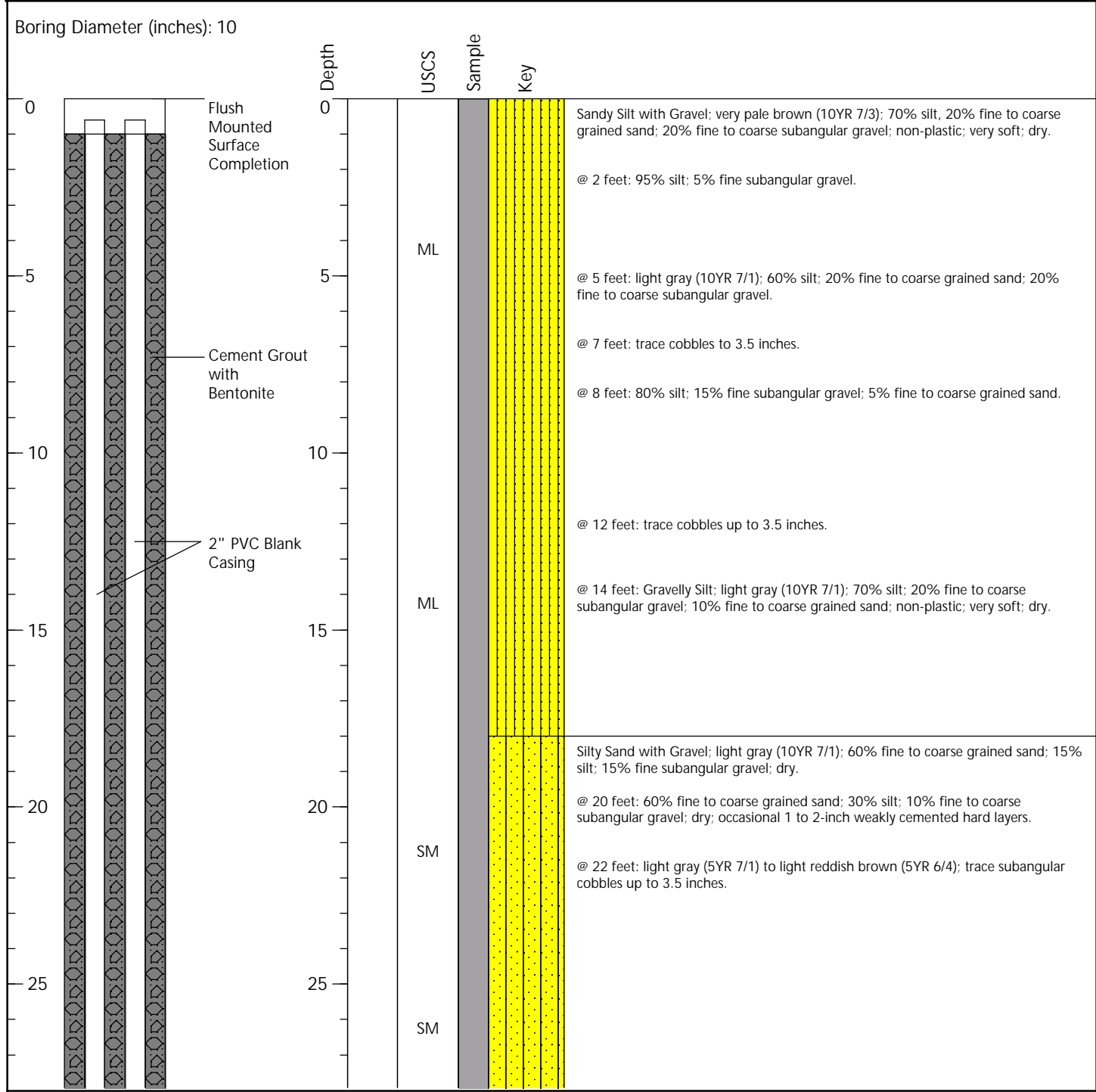
Drilling Method: Rotasonic/Mud Rotary

Sample Method: 4" x 6" Core Rod

Driller's License: C57-283326

## WELL CONSTRUCTION

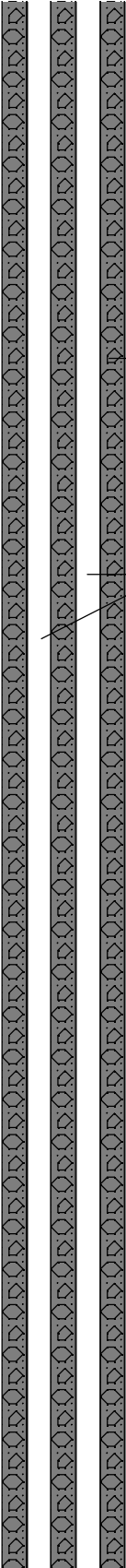
## LITHOLOGIC DESCRIPTION



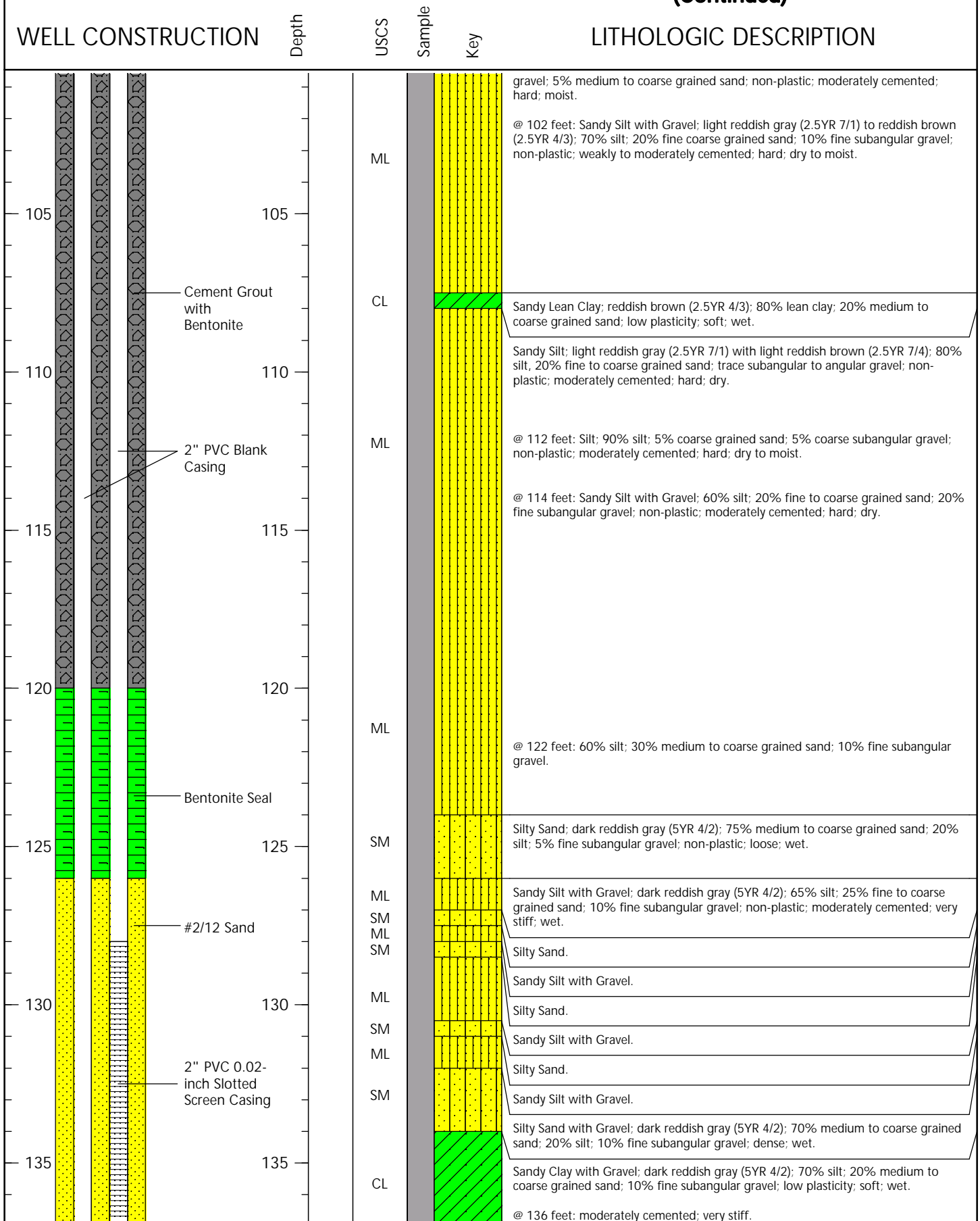
# LOG OF BORING PT-9 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
<p>Cement Grout with Bentonite</p> <p>2" PVC Blank Casing</p>	30	SM			
	30	ML			Sandy Silt with Gravel; light gray (5YR 7/1) to light reddish brown (5YR 6/4); 60% silt, 20% fine to coarse grained sand; 20% fine subangular gravel; non-plastic with alternating layers ranging from non-cemented very soft to moderately cemented hard material.
	35				
	35	ML			@ 36 feet: moderately cemented layers; hard; dense; up to 2.5-inches thick.
	40				
	40	SM			Silty Sand with Gravel; light gray (10YR 7/1); 60% fine to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; hard; dry; occasional 1 to 2-inch weakly cemented hard layers.  @ 40 feet: Alternating layers ranging from soft, non-cemented to moderately cemented.
	45				
	45	SM			@ 46 feet: reddish gray (10R 6/1) to light red (10R 6/6); 60% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; non-cemented to moderately cemented; soft to hard; dry.
	50				
	50	SM			
	55				
	55	ML			Silt with Gravel; light gray (5YR 7/1); 85% silt, 10% fine subangular gravel; trace fine to coarse grained sand; non-plastic; soft; dry.
	60	SM			Silty Sand with Gravel.
	60	ML			Sandy Silt with Gravel; light reddish brown (5YR 6/3); 60% silt, 20% fine to coarse grained sand; 20% fine subangular gravel; non-cemented; soft; dry. Occasional 2 to 3-inch hard, moderately cemented layers.  @ 62 feet: 70% silt; 30% fine to coarse grained sand; 10% fine subangular gravel.

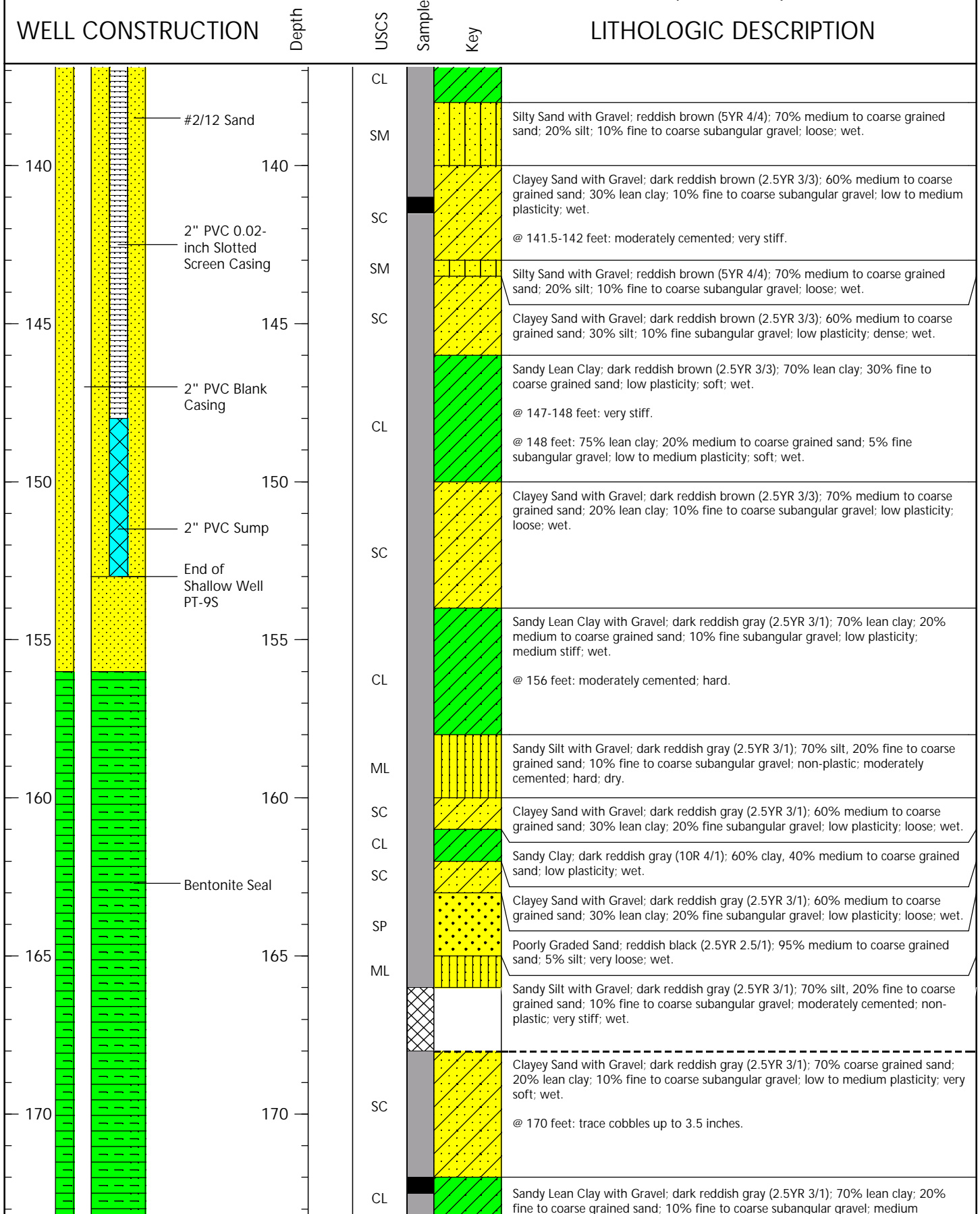
# LOG OF BORING PT-9 S/D (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
	65				
	70				
	75				
	80				
	85				
	90				
	95				
	100				
	65	ML			
	70				
	75	ML			<p>@ 72 feet: reddish brown (2.5YR 4/4) to reddish gray (2.5YR 6/1); 60% silt, 30% fine to coarse grained sand; 10% fine subangular gravel; weak to moderate cementation; non-plastic; dense; very stiff to hard; dry to moist.</p> <p>@ 74 feet: One cemented layer was 6-inches thick.</p>
	80	SC			Clayey Sand; dark reddish gray (10R 4/1); 70% medium to coarse grained sand; 25% lean clay; 5% fine subangular gravel; low plasticity; soft; wet.
	85	CL			Sandy Lean Clay; dark reddish gray (10R 4/1); 80% lean clay; 20% medium to coarse grained sand; low to medium plasticity; very stiff; dense; moist.
	90	ML			<p>Sandy Silt with Gravel; greenish gray (GLE2 6/1) with pale red (10R 6/4); 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel; non-plastic; weak to moderately cemented; hard; dry.</p> <p>@ 90 feet: trace cobbles up to 3.5 inches.</p> <p>@ 92 feet: no cobbles; occasional layers of moderately cemented, very stiff material (1 to 2-inches). The majority is very soft, dry.</p>
	95	SM			Silty Sand; reddish gray to light red (10R 6/6); 55% fine to coarse grained sand; 45% silt; trace fine subangular gravel; dry with occasional moderately cemented, very stiff layers.
	100	ML			<p>Sandy Silt with Gravel; reddish gray (10R 6/1) with light red (10R 6/6); 70% silt, 20% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; soft; dry. Alternating with moderately cemented, very stiff layers.</p> <p>@ 100 feet: Gravelly Silt; reddish brown (2.5YR 4/3); 75% silt; 20% fine subangular</p>

# LOG OF BORING PT-9 S/D (Continued)



# LOG OF BORING PT-9 S/D (Continued)



# LOG OF BORING PT-9 S/D (Continued)

## WELL CONSTRUCTION

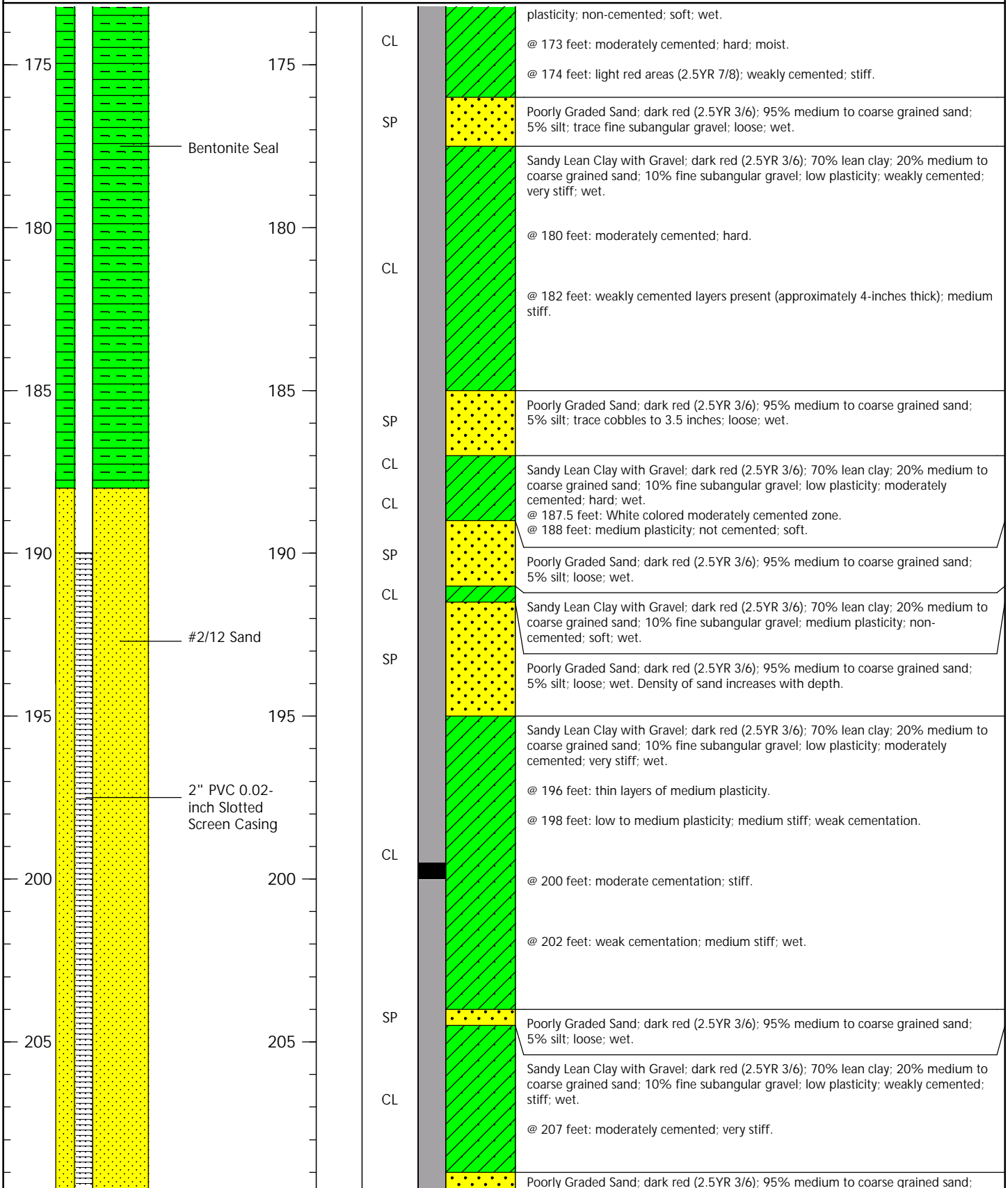
Depth

USCS

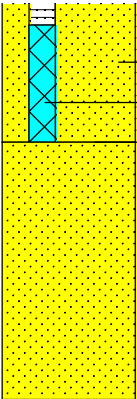

Sample

Key

## LITHOLOGIC DESCRIPTION



# LOG OF BORING PT-9 S/D (Continued)

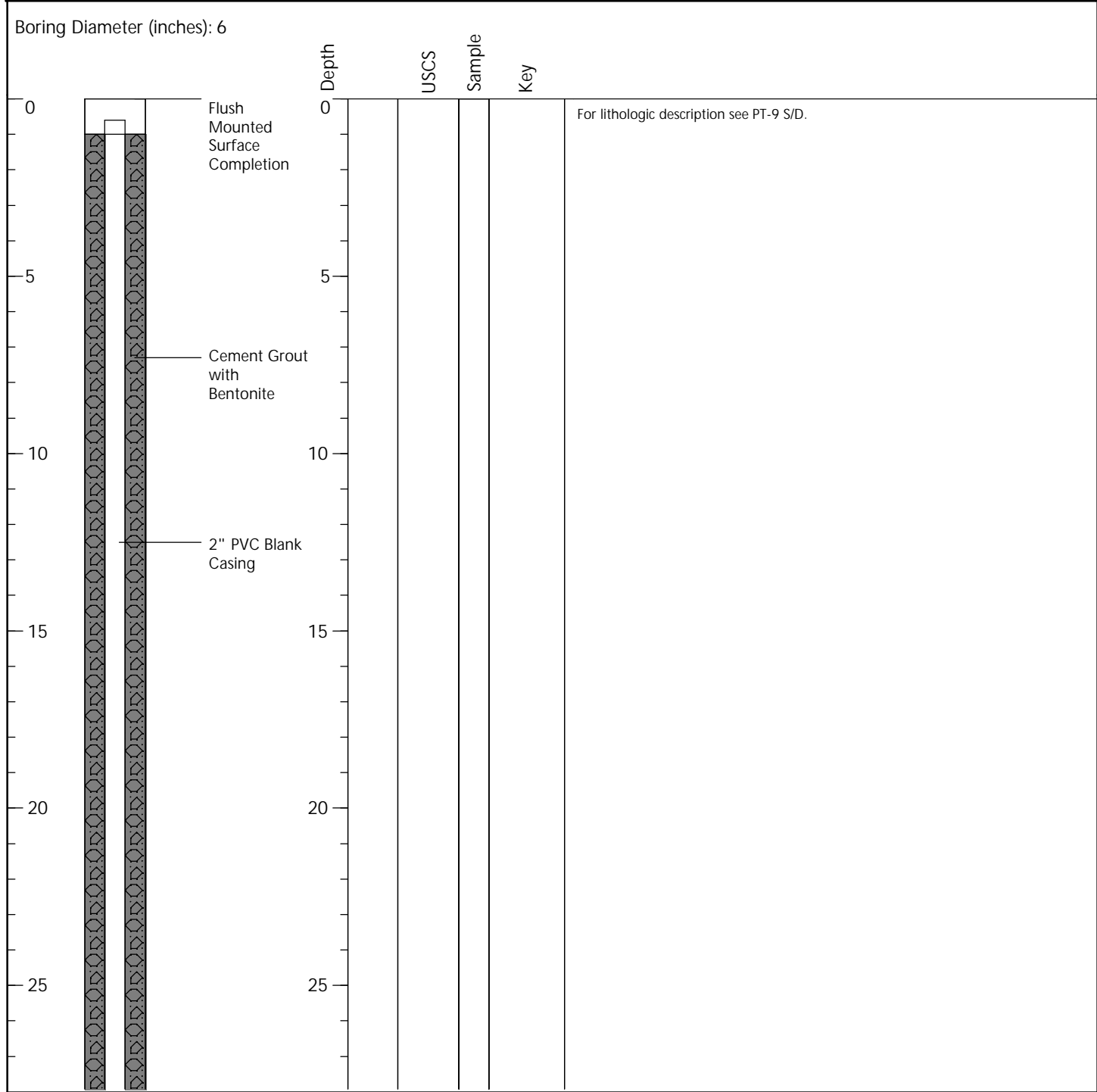
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
 <p>#2/12 Sand</p> <p>2" Sump</p> <p>End of Deep Well PT-9D</p>	<p>210</p> <p>215</p>	<p>SP</p>		<p>5% silt; loose; wet.</p> <p>Bedrock encountered at 218 feet bgs.</p> <p>Total Depth Explored: 218 feet bgs</p>	

## LOG OF BORING PT-9 M

### PG&E Topock Site Needles, California

Project No.: RC000689.0004 Logged by: Brett Bardsley Drilling Co.: WDC Drillers: Rivera, West, Sakioka, Villegas Well Permit #2007040407	Date Started: 4 June 2007 Date Completed: 6 June 2007 Drilling Method: Rotosonic/Mud Rotary Sample Method: 4" x 6" Core Rod Driller's License: C57-283326
--	---

WELL CONSTRUCTION
LITHOLOGIC DESCRIPTION





# LOG OF BORING PT-9 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

30					
35					
40					
45					
50					
55					
60					

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

# LOG OF BORING PT-9 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

65		65				
70		70				
75		75				
80		80				
85		85				
90		90				
95		95				
100		100				

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

# LOG OF BORING PT-9 M (Continued)

WELL CONSTRUCTION

Depth

USCS

Sample

Key

LITHOLOGIC DESCRIPTION

105					
110					
115					
120					
125					
130					
135					

Cement Grout  
with  
Bentonite

2" PVC Blank  
Casing

# LOG OF BORING PT-9 M (Continued)

WELL CONSTRUCTION

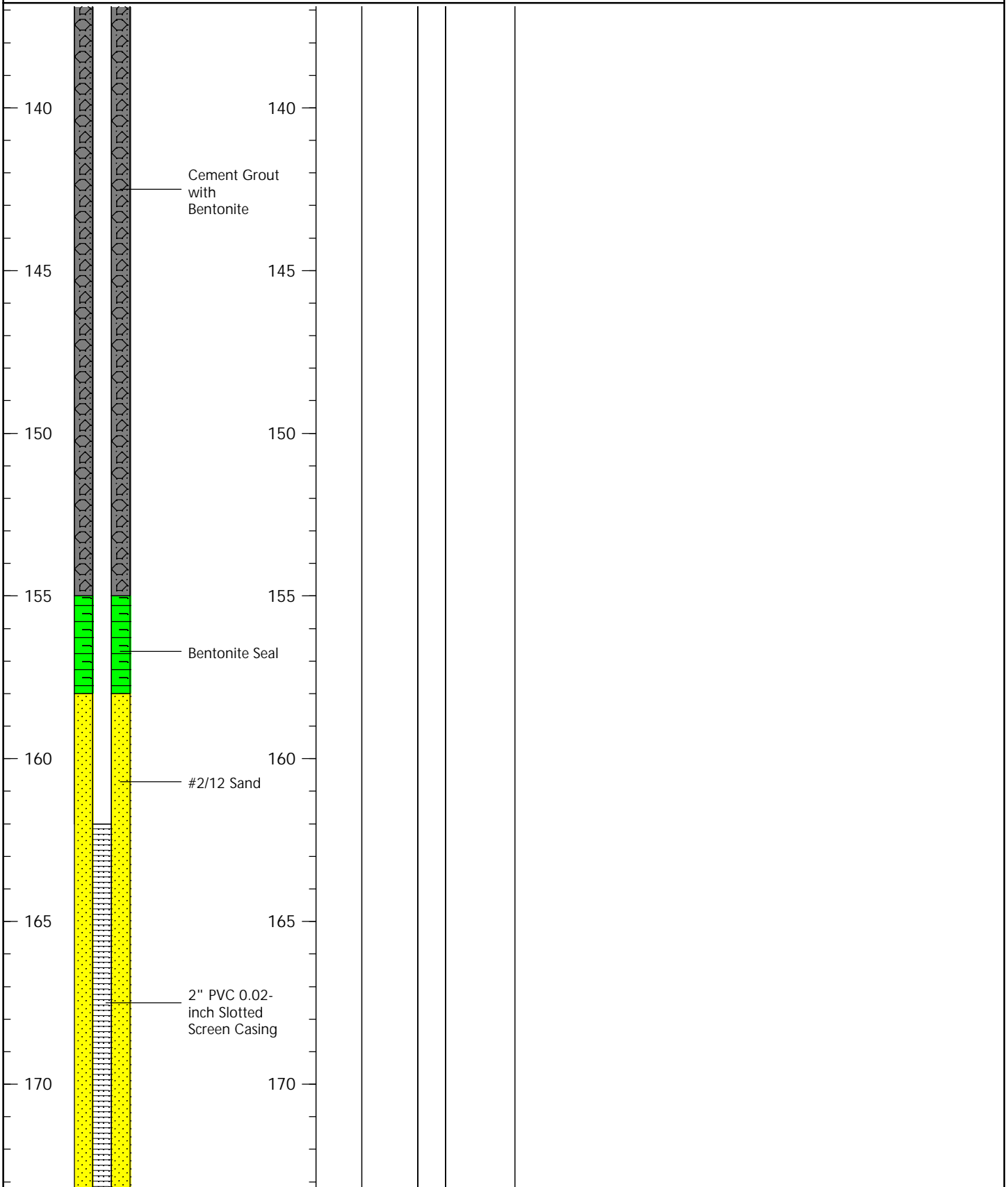
Depth

USCS

Sample

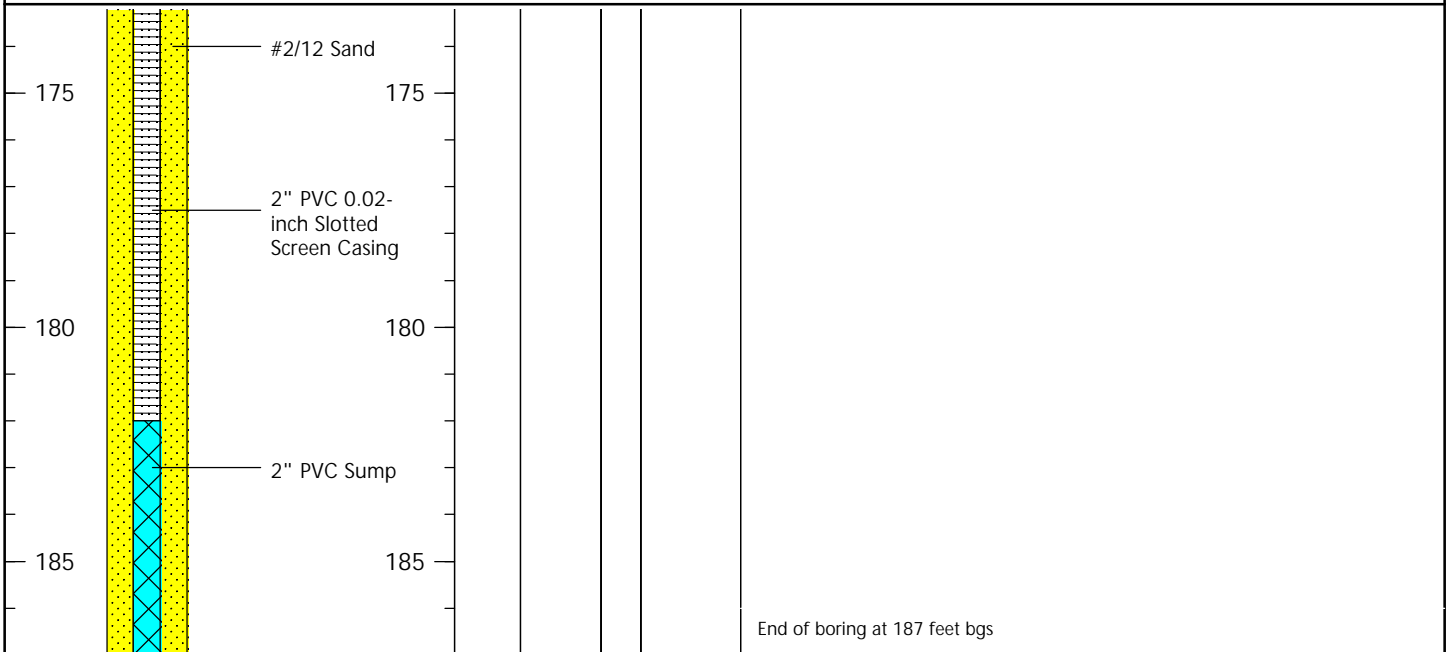
Key

LITHOLOGIC DESCRIPTION



# LOG OF BORING PT-9 M (Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
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# APPENDIX C

## TW-01 Well Redevelopment and Specific Capacity Evaluation Procedures



## **TW-01 Well Redevelopment and Specific Capacity Evaluation Procedures**

NOTE: Redevelopment of TW-01 installed prior to the Phase 1 GW Remedy. Well redeveloped in preparation for aquifer testing. Baseline sampling in preparation for aquifer testing is required.

- Drillers to Provide:
  - Up to 200 ft of conveyance piping/hose to connect to CM-provided hosing and containers/tanks to hold removed water as described in the WCS Specification.
  - Sample port at wellhead for Engineer to obtain samples and water for measuring water quality parameters.
  - Pump capable of delivering water to the temporary storage tanks provided by the CM at a minimum of 30 gallons per minute (gpm) and a maximum of 90 gpm.
  - All piping and accessories (PVC or stainless steel) necessary to hold pump to a total depth of ~268' below ground surface (bgs) (example: 20', 10' and 5' piping and couplers).
  - Flow manifold with flow meter/totalizer capable of reading flowrates as low as 30 gpm and as high as 90 gpm.
  - 5-gallon buckets – for confirmation flow rate measurements. Secondary containment (plastic) for this confirmation is needed.
  - Turbidity meter
- Arcadis to Provide:
  - Water level meter to track water level and drawdown in the well.
  - Imhoff cone
  - YSI water quality meter
  - Sample bottles and filter
- Prior to Well Redevelopment, record:
  - Clarity of water using measured turbidity levels in nephelometric turbidity units (NTU).
  - Date, time, and depth to water level in the well.
  - Depth to bottom of well, name of project and site, well identification number, and date of development.
  - Name and job title of individual developing the well.
  - Method used for development, to include size, type, and make of equipment, bailer, jetting equipment (if used), surge block device (if used), swab, and/or pump used during development.
  - Ensure all hosing and IDW storage tanks have secondary containment.
- During Well Redevelopment, record:
  - Time spent developing the well by each method and totalized water removed.
  - Depth to water and total depth before and after each method.
  - Pumping rates during pumping.
  - Volume and physical character of water removed to include changes during development in clarity, color, particulates/sand content, and odor.
  - Volume of water added to the well, if any.
  - Volume of sediment removed at various stages of development using an Imhoff cone
  - Physical character of sediment removed, to include changes during development in color and odor.
  - Source of any water added to the well.
  - Water quality readings collected approximately every 5 minutes.

- Engineer shall measure:
  - Turbidity
  - Specific conductance
  - pH
  - ORP
  - DO
- Record Intake depths of each setting of the pump.
- Record packer depths.

### **Well Redevelopment Records**

- A well development record shall be prepared by Cascade and reviewed by the Arcadis oversight for each well installed and shall include the following:
  - Date, time, and elevation of water level in the well before development.
  - At various times, photo document water clarity/appearance using representative samples in clear bottles. Use a white board or paper and a sharpie.
    - At a minimum, document
      - Before first bail
      - After last bail
      - Start of pumping
      - End of development (end of pumping)
  - Depth to bottom of well, name of project and site, well identification number, and date of development.
  - Method used for development, to include size, type, and make of equipment, bailer, and/or pump used during development.
  - Time spent developing the well by each method, to include typical pumping rate if pump is used in development.
  - If discrete intervals are developed such as swabbing – indicate interval being developed.
  - Volume and physical character of water removed to include changes during development in clarity, color, particulates, and odor.
  - Volume of water added to the well, if any.
  - Volume and physical character of sediment removed (Measured with Imhoff Cone), to include changes during development in color and odor.
  - Source of any water added to the well.
  - Clarity of water before, during, and after development using measured turbidity levels in NTU.
  - Total depth of well and the static water level as per ASTM D4750 from top of the casing, immediately after pumping/development, **and 24 hours after development.**
  - Name and job title of individual developing the well.

### **Well Redevelopment Procedures**

**Step 1** Bail – until settled solids are removed or as directed by the Engineer.

**Step 2** Swab well for at least 5 minutes per ft of wetted screen or as directed by the Engineer.

- The screen (100 feet long) is located from 168-268 feet below ground surface (bgs).
  - Swab in ~5 feet of screen intervals @ 25 minutes/5 ft feet of wetted screen.
  - Minimum of 500 total minutes of swabbing



**Step 3** Bail – until settled solids are removed or as directed by the Engineer.

**Step 4** Repeat **Step 2** and **Step 3**.

**Step 5a – Open Hole Pump**

Pump open hole with a pump capable of producing pumping rates:

- 65 gpm or higher\*
  - A. Provide sample port at wellhead for Engineer to obtain samples and water for measuring water quality parameters.
  - B. Collect field parameters every 5 minutes when possible.
  - C. With the pump at ~1 foot above the sump, complete 5 cycles of pumping and allowing purged water to surge back into the well.
  - D. After completing pump and surge, pump until turbidity is below 50 NTU.
  - E. Raise pump in increments of a maximum of 10 feet within all wetted screen intervals and complete Step C and Step D.
  - F. After Step E is complete, pull pump up to top of water column and pump until turbidity is below 50 NTU.
  - G. After Step E is complete, drop pump down where pump sits ~ 1 ft above the sump and pump until turbidity is below 50 NTU. Pumping complete after 3 consecutive readings under 50 NTU are achieved.

\* Pumping can be conducted at maximum sustainable pumping rate.

**Specific Capacity Evaluation**

1. Leaving submersible pump and material downhole, ensure that pump is stopped, and water level is within 10% of static.
2. Install pressure transducer within pumping well and collect a manual depth to water.
3. Program pressure transducers within the testing well with ID and set to record as an 'Event' using the data collection frequency of 30 seconds.
4. Hookup hose from pumping outlet to discharge pumped water to the frac/poly wastewater tank. This could be up to ~200 feet from the well to the intake up the storage tank(s). Ensure that fire hose has secondary containment underneath all hose connections.
5. Provide sample port at wellhead for Engineer to obtain samples and water for measuring water quality parameters.
6. Begin Specific Capacity Evaluation:
  - 30 gpm respectfully (or as adjusted based on the initial specific capacity evaluation) for 1 hour.
    - Record pumping rate (gpm), manual DTW measurements in all screens (feet btoc), and totalizer values as specified in above table.
    - Program the transducer in the pumping well using the "event" feature. See frequency above.
    - Collected parameters (Temp, pH, Sp conductivity, DO, ORP, Turbidity) at end of step.
  - 60 gpm respectfully (or as adjusted based on the initial specific capacity evaluation) for 1 hour.

- Record pumping rate (gpm), manual DTW measurements in all screens (feet btoc), and totalizer values as specified in above table.
  - Program the transducer in the pumping well using the “event” feature. See frequency above.
  - Collected parameters (Temp, pH, Sp conductivity, DO, ORP, Turbidity) at end of step.
- 90 gpm respectfully (or as adjusted based on the initial specific capacity evaluation) for 1 hour.
  - Record pumping rate (gpm), manual DTW measurements in all screens (feet btoc), and totalizer values as specified in above table.
  - Program the transducer in the pumping well using the “event” feature. See frequency above.
  - Collected parameters (Temp, pH, Sp conductivity, DO, ORP, Turbidity) at end of step.

**Note: Pumping durations may be longer than 1 hours at each pumping rate as directed by the engineer to confirm groundwater stabilization.**

7. Check with QC Geologist to ensure test has been fully completed prior to stopping submersible pump. Once QC geologist has approved completion, collect sample from sampling port.
  8. Stop submersible pump and monitor water levels (recharge) manually and every minute until water level is within 10% of static water level (based on the final amount of observed drawdown) or otherwise directed by the engineer.
  9. Download pressure transducers within testing well screen zone.
  10. Remove pump and piping.
  11. Download baro pressure transducer located at transwestern bench.
- At the end of the specific capacity evaluation, but while the pumping continues, collect groundwater samples for laboratory analysis. The sample nomenclature will be, for example, IRZ-33-XX-MMDDYY, where XX is the bottom of the screen being pumped and sampled and the MMDDYY will be the date in Month/Day/Year. Analysis includes:
    - Cr6 by method E218.6 (Field Filtered) in 250 mL poly preserved W/Buffer. Confirm date of buffer is appropriate.
    - Cr (Total) by Method 6020A (Field Filtered) in 500 mL poly preserved with nitric acid
    - Fluorescent Dye: Eosine, Rhodamine WT and Fluorescein (**keep out of direct sunlight AT ALL TIMES**)
  - Once well redevelopment and specific capacity evaluation is complete, record:
    - Total depth of well and static water level as per ASTM D4750 from top of casing.
  - **24 hours after development, record:**
    - Total depth of well and static water level as per ASTM D4750 from top of casing.

# APPENDIX D

TW-01 Spinner Log and Downhole Video Camera Survey Data



PACIFIC SURVEYS

2.13-INCH SPINNER  
DOWN RUNS  
PUMPING CONDITION

Job No.  
27300

Company  
CASCADE DRILLING

Well  
TW-01

Field  
TOPOCK

County  
SAN BERNARDINO

State  
CA

File No.

Location:  
  
145453 NATIONAL TRAILS HWY  
GPS: 34.7156 -114.4936

Other Services:  
  
VIDEO SURVEY  
STATIC UP & DOWN RUN  
STOP COUNTS  
SPINNER ANALYSIS

Sec.

Twp.

Rge.

Permanent Datum  
Log Measured From  
Drilling Measured From

G.L.  
T.O.C. 0'  
G.L.

Elevation  
above perm. datum

Elevation  
K.B.  
D.F.  
G.L.

Date  
Run Number  
Depth Driller  
Depth Logger  
Bottom Logged Interval  
Top Log Interval  
Pump Set @  
Time Pumping Prior to Survey  
Pumping Water Level  
Max. Recorded Temp.  
Pump Rate (GPM)  
Time Well Ready  
Time Logger on Bottom  
Equipment Number  
Location  
Recorded By  
Witnessed By

10/14/2020  
ONE  
268'  
265'  
263'  
185'  
173.5'  
9:50 AM  
167.3'  
N/A  
62.5 GPM  
10:30 AM  
10:30 AM  
PS-9  
LA  
E. AFOH  
E. REDNER

Perforation Record

Type  
HORIZONTAL

Slot Size  
N/A

From  
168'

To  
268'

Type

Slot Size

From

To

Casing Record  
Surface String  
Camera Tube  
Production String  
Liner

Size  
4.75" ID

Wgt/Ft  
PVC

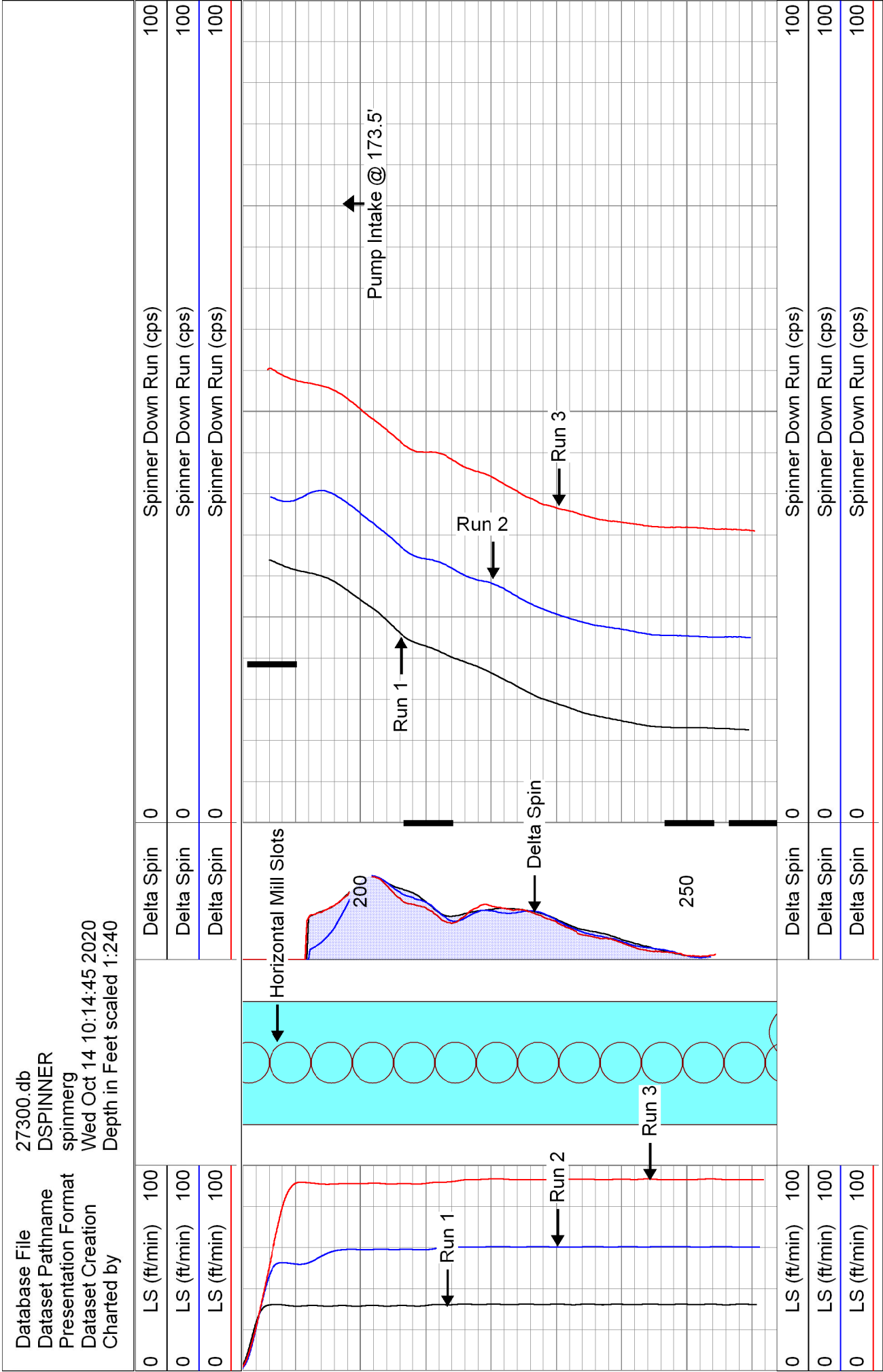
Top  
0'

Bottom  
268'

<<< Fold Here >>>

All interpretations are opinions based on inferences from electrical or other measurements and Pacific Surveys cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to Pacific Surveys' general terms and conditions set out in our current Price Schedule.

Comments



Filter Report		
Database File	27300.db	
Dataset Pathname	DSPINNER	
Dataset Creation	Wed Oct 14 10:14:45 2020	
Filter Name		Filter Type
LSPD		Gaussian
LTEN		Gaussian
LSPDRT		None
FLOWP		Triangle
FLOWN		Triangle
		Filter Length (ft)
		6.00
		6.00
		8.00
		8.00





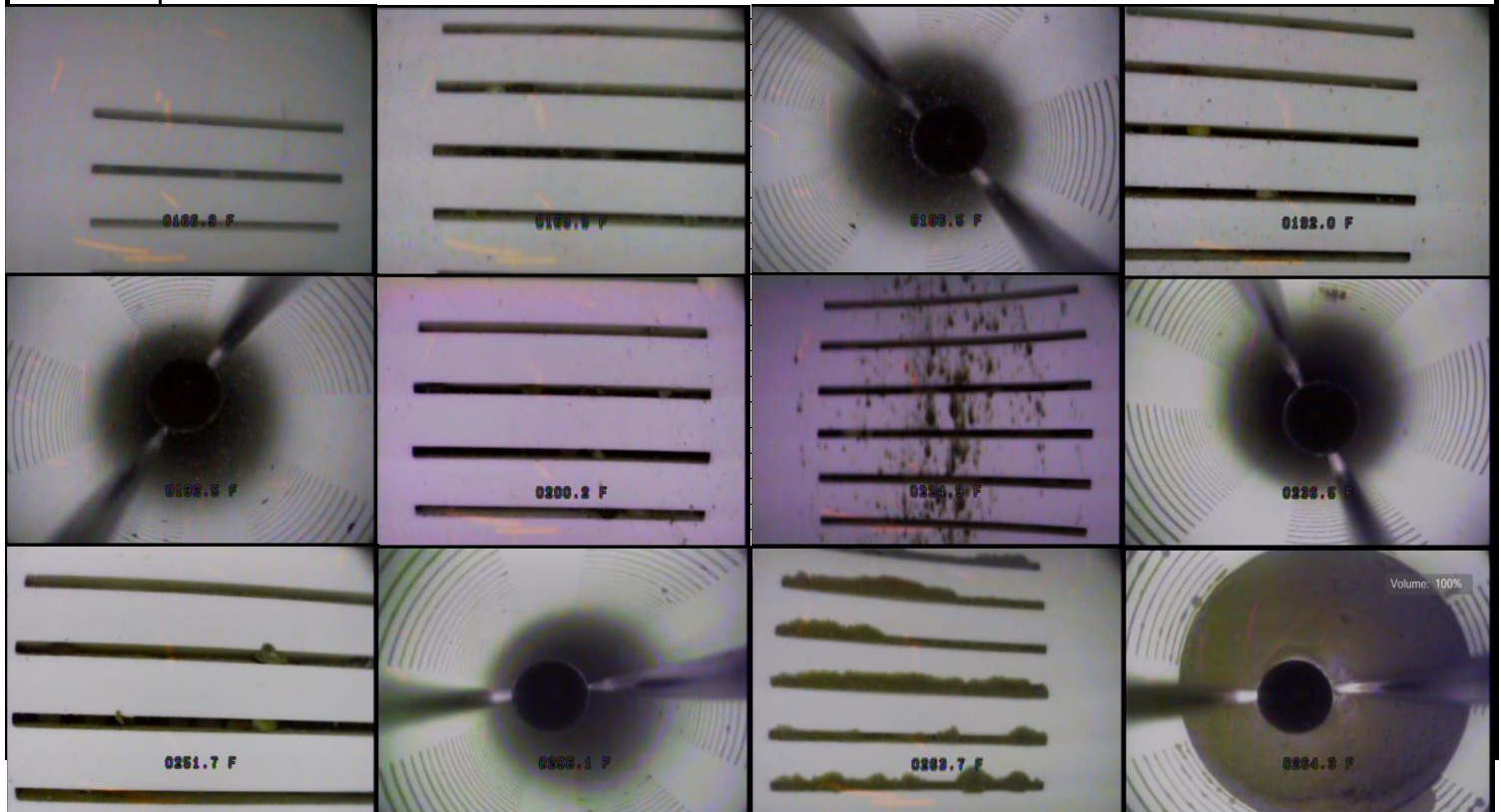
# Pacific Surveys

a full service geophysical well logging company

## Video Survey Report

<b>Company:</b>	Cascade Drilling	<b>Date:</b>	13-Oct-20
<b>Well:</b>	TW-01	<b>Run No.</b>	One
<b>Field:</b>	Topock	<b>Job Ticket:</b>	27300
<b>State:</b>	California	<b>Total Depth:</b>	266.3 ft
<b>Location:</b>	145453 National Trails Hwy	<b>Water Level:</b>	164.0 ft
		<b>Oil on Water:</b>	No
		<b>Operator:</b>	Afoh
<b>GPS:</b>	34.7156 -114.4936	<b>Amount:</b>	N/A
<b>Zero Datum:</b>	Top of CSG	<b>Dead Space</b>	1.25 ft
<b>Reason for Survey:</b>	General Inspection	<b>Guides Set @</b>	3.5 inches
<b>Truck</b>	PS-9		

Depth	Observations	Well Details	
0.0 ft	Begin survey from top of casing.	<b>Perforation:</b>	<b>As-Built</b>
164.0 ft	SWL: water is slightly cloudy. Visibility is fair.	Horizontal Mill Slot	168.0 ft to 268.0 ft
166.9 ft	Top of Horizontal mill slots: open with some minor bio-material inside the slots.		
184.4 ft	No flow observed.		
191.0 ft	Horizontal mill slots are open with some bio-material inside the slots.		
239.0 ft	Casing color becomes dark from 239 ft to 243 ft.		
251.0 ft	No flow observed.		
263.7 ft	Horizontal mill slots are open with some accumulation of bio-material inside the slots.		
265.3 ft	Top of fill, still in slots.		
266.3 ft	Camera enters into soft fill through the side view lens. End survey.		
		<b>Casing Size (in):</b>	<b>As-Built</b>
		<b>O.D.</b>	<b>I.D.</b>
		5.50	4.75
			0 ft to 268.0 ft
		<b>Casing Material</b>	PVC
		<b>Screen Material</b>	PVC



# APPENDIX E

## MW-38D Well Redevelopment Logs and Well Survey Report



T.O.C. - Top of Casing  
VOLUME: GAL. PER  
LIN./FT.

2 IN.=0.17      6 IN.=1.5  
3 IN.=0.38      8 IN.=2.51  
4 IN.=0.66

# CASCADE DRILLING

## Development / Purge Record

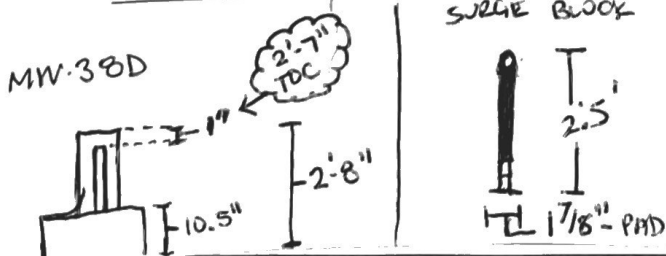
Date 11-23-2020 Project # 112-18-1232 Site PG+E TOPOCK / ARCADIS

Well I.D. # MW-38D Water Level T.O.C. 70.56 Ft. Total Depth 185.25 Ft.

Set Up \_\_\_\_\_ Well Dia. 2 In. Water Column Height 114.69 Ft. Casing Volume 18.71 Gal.  
PVC

TIME	GAL. PURGED	TEMP	COND. X	pH	TURB.	T.D. TOC	DTW TOC	OTHER
MW-38D 8:00	SET UP ON WELL #MW-38D							
8:35	PULL TRANSDUCER FROM WELL #MW-38D							
8:50	TAG WELL #MW-38D				SOFT →	183.50	70.56	
9:00	BAIL BOTTOM CLEAR (3 GAL) SLUDGE / SILTS							
10:00	TAG WELL #MW-38D				HARD →	185.25	70.75	
10:10	SET UP SURGE BLOCK 2.5" x 0.875"							
10:35	SURGE	163-168	X					
11:00	"	168-173	X					
11:25	"	173-178	X					
11:50	"	178-183	X					
12:15	TAG WELL #MW-38D				HARD →	185.25	70.70	
12:30	LUNCH BREAK							
1:00	SURGE	183-178	X					
1:15	"	178-173	X					
1:30	"	173-168	X					
1:45	"	168-163						
2:00	TAG WELL #MW-38D				SOFT →	184.98	70.52	
2:10	BAIL WELL #MW-38D / 2 GAL.				SILTS			
2:45	TAG WELL				HARD →	185.25	70.60	
2:50	INSTALL PUMP TO 180'							
3:00	CALIBRATE WATER QUALITY METERS							
180' 3:15	START PUMP @ 2 GPM / INTAKE @ 180' TDC				ORPmV		70.55	NO mg/L
180' 3:20	2 GPM	29.28	24.1	7.49	OVER	202	70.85	1.43
175' 3:25	2 GPM	30.89	24.0	7.55	OVER	163	70.86	1.00
170' 3:30	2 GPM	31.40	24.0	6.26	683	136	70.84	.80
165' 3:35	2 GPM	31.40	23.9	6.39	OVER	125	70.81	.81
165' 3:40	2 GPM	31.56	24.1	6.68	250	112	70.83	.95

Comments: MW-38D SCREEN 163'-183' BGS



Data Collected By: DOM G.

Pg. 1



2 IN.=0.17	6 IN.=1.5
3 IN.=0.38	8 IN.=2.51
4 IN.=0.66	

Date 11-23-2020 Project # 112-18-1232 Site PG+E TOPPOCK / ARCADIS  
Well I.D. # MW-380 Water Level T.O.C. 70.56 Ft. Total Depth 185.25 Ft.  
Set Up \_\_\_\_\_ Well Dia. 2 In. Water Column Height 114.69 Ft. Casing Volume 18.71 Gal.  
PVC



# CASCADE DRILLING

Date 11-24-2020 Project # 112-18-1232 Site PG+E TOPOCK / ARCADIOS  
Well I.D. # MW-38D Water Level T.O.C. 70.65 Ft. Total Depth 185.25 Ft.  
Set Up \_\_\_\_\_ Well Dia. 2 In. Water Column Height 114.6 Ft. Casing Volume 19.482 Gal.

Data Collected By: \_\_\_\_\_



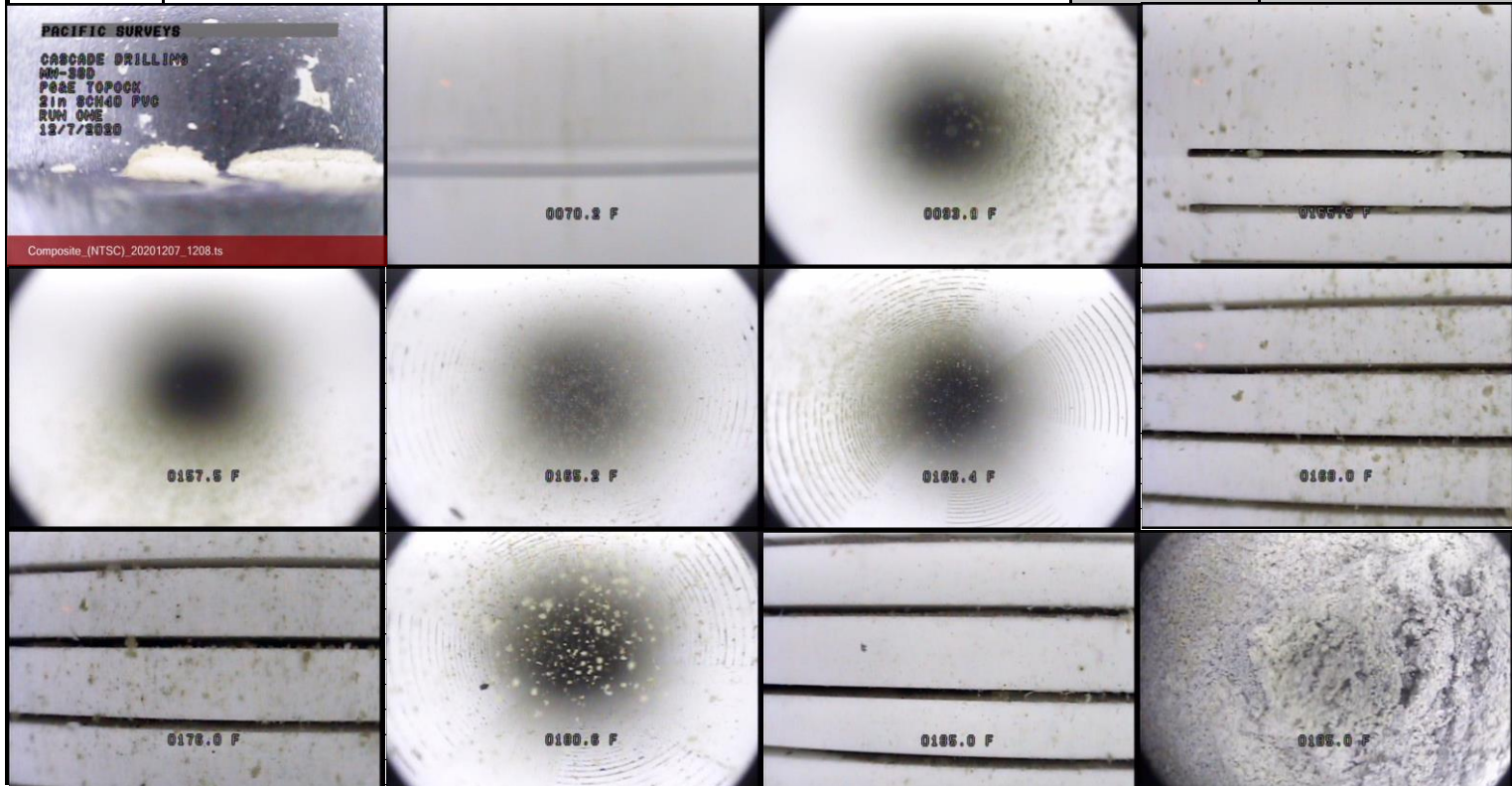
# Pacific Surveys

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## Video Survey Report

<b>Company:</b>	Cascade Drilling	<b>Date:</b>	07-Dec-20
<b>Well:</b>	MW-38D	<b>Run No.</b>	One
<b>Field:</b>	Topock	<b>Job Ticket:</b>	27408
<b>State:</b>	Arizona	<b>Total Depth:</b>	186.1 ft
<b>Location:</b>	Havas National Wildlife Refuge	<b>Water Level:</b>	70.2 ft
		<b>Oil on Water:</b>	No
<b>GPS:</b>	34.715740 -114.494649	<b>Operator:</b>	ABREAU
<b>Zero Datum:</b>	Top of CSG	<b>Amount:</b>	N/A
<b>Reason for Survey:</b>	General Inspection	<b>Dead Space</b>	0"
		<b>Guides Set @</b>	N/A

Depth	Observations	Well Details	
0.0 ft	Begin survey from top of casing.	<b>Perforation:</b>	<b>As-Built</b>
20.0 ft	Casing appears normal and in good condition.	Horizontal Mill Slot	163.3 ft to 183.3 ft
70.2 ft	SWL: water clear. Visibility good.		
76.0 ft	Light bio material on low side of casing.		
92.0 ft	Bio material on casing wall increasing slightly with depth.		
130.0 ft	Casing appears normal and in good condition.		
165.2 ft	Casing joint: begin perforated casing.		
165.5 ft	Top of perforations: All appear open and in good condition.		
166.0 ft	Perforations appear open with light bio material on low side of casing.		
176.0 ft	Perforations appear open with light bio material on low side of casing.		
185.0 ft	Bottom of perforations: All appear open and in good condition.		
185.1 ft	Top of soft fill.	<b>Casing Size (in):</b>	<b>As-Built</b>
186.0 ft	Camera hits hard bottom: End survey.	<b>O.D.</b>	<b>I.D.</b>
		N/A	2.00
			0 ft to 188.3 ft
		<b>Casing Material</b>	PVC
		<b>Screen Material</b>	PVC



# APPENDIX F

Safety Data Sheets for Tracer Dye





SAFETY DATA SHEET (SDS)  
REVISION DATE: 03/03/2016

# HUE CORPORATION

*Color your everything, may your Hue come true*

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## SECTION I. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

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### PRODUCT IDENTIFIER:

PRODUCT NAME ..... **HUE EOSINE EX CONC**  
 PRODUCT NUMBER ..... 1-C6-087-XPC  
 COLOR INDEX NAME ..... ACID RED 087  
 COLOR INDEX NO ..... 45380  
 C. A. S. # ..... 17372-87-1  
 CHEMICAL FAMILY..... XANTHENE DYE

### INTENDED USE OF THE PRODUCT:

FELT TIP, MARKER INKS, WATER BASED COATINGS AND SPECIALTY INKS, PRINTING ON NYLON, SILK AND WOOL.

### NAME, ADDRESS AND TELEPHONE OF RESPONSIBLE PARTY:

HUE CORPORATION	TELEPHONE	714-389-3130
P.O. BOX 509	FAX	714-389-9731
TUSTIN, CA 92781	EMAIL	<a href="mailto:SUPPORT@HUECORPORATION.COM">SUPPORT@HUECORPORATION.COM</a>

### EMERGENCY TELEPHONE NUMBER:

CHEMTREC (USA)	1-800-424-9300
CHEMTREC (OUTSIDE USA)	1-703-527-3887

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## SECTION 2. HAZARD(S) IDENTIFICATION

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### CLASSIFICATION OF THE SUBSTANCE OR MIXTURE:

GHS-US  
 ACUTE TOX. - INHALATION (CATEGORY 5)  
 EYE DAM./IRRITATION (CATEGORY 2B)  
 SKIN CORR./IRRITATION (CATEGORY 3)

### GHS LABELING:

HAZARD PICTOGRAMS (GHS-US): NO SYMBOL

SIGNAL WORD WARNING

HAZARD STATEMENT(S)	H333 - MAY BE HARMFUL IF INHALED H320 - CAUSES EYE IRRITATION H316 - CAUSES MILD SKIN IRRITATION
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PRECAUTIONARY STATEMENTS	P305 + 351 + P338 - IF IN EYES: RINSE CAUTIOUSLY WITH WATER FOR
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SEVERAL MINUTES. REMOVE CONTACT LENSES IF PRESENT AND EASY TO DO. CONTINUE RINSING.

P337 + P313 - IF EYE IRRITATION OCCURS/PERSISTS:  
GET MEDICAL ADVICE AND ATTENTION.

P261 - AVOID BREATHING DUST/FUMES/GAS/MIST/VAPORS/SPRAY

P264 - WASH FACE THOROUGHLY AFTER HANDLING.

P322 + P313 - IF SKIN IRRITATION OCCURS: GET MEDICAL ADVICE/  
ATTENTION.

P304 + 312 - IF INHALED: CALL A POISON CENTER/DOCTOR/PHYSICIAN  
IF YOU FEEL UNWELL

P501 - DISPOSE OF CONTENTS/ CONTAINER IN ACCORDANCE WITH  
LOCAL/ REGIONAL/ NATIONAL INTERNATIONAL REGULATIONS.

OTHER HAZARDS  
UNKNOWN ACUTE TOXICITY

NO DATA AVAILABLE  
NO DATA AVAILABLE

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### SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

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DESCRIPTION OF MIXTURE: PROPRIETARY MIXTURE OF DYES.

#### SUBSTANCE:

NAME	C.A.S.#	WEIGHT 100%	GHS-US CLASSIFICATION
ACID RED 087	17372-87-1	100%	ACUTE TOX. - INHALATION (CATEGORY 5) EYE DAM./IRRITATION (CATEGORY 2B) SKIN CORR./IRRITATION (CATEGORY 3)

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### SECTION 4. FIRST AID MEASURES

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#### FIRST AID MEASURES GENERAL:

INHALATION: REMOVE TO FRESH AIR. IF BREATHING IS DIFFICULT, GIVE OXYGEN AND GET IMMEDIATE MEDICAL ATTENTION.

SKIN: WASH WITH MILD SOAP AND WATER. IF IRRITATION OCCURS GET MEDICAL ATTENTION.  
IF CLOTHING IS CONTAMINATED, RE-MOVE AND WASH BEFORE REUSE.

EYES: FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES, HOLDING EYELIDS APART  
FOR THOROUGH IRRIGATION. GET IMMEDIATE MEDICAL ATTENTION.

INGESTION: INDUCE VOMITING - SEEK IMMEDIATE MEDICAL ATTENTION.

#### MOST IMPORTANT SYMPTOMS AND EFFECTS, ACUTE AND DELAYED:

THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY HAZARDOUS COMMUNICATION STANDARD. HOWEVER,  
AS WITH ALL CHEMICAL; HANDLE WITH CARE, AVOID EYE AND SKIN CONTACT, AVOID INHALATION OF DUSTS  
OR VAPORS. WASH THOROUGHLY AFTER HANDLING. KEEP CONTAINERS CLOSED.

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### SECTION 5. FIRE-FIGHTING MEASURES

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#### EXTINGUISHING MEDIA:

WATER, DRY CHEMICAL, CARBON DIOXIDE, FOAM.

SPECIAL HAZARDS ARISING FROM SUBSTANCE OR MEDIA:

FIREFIGHTERS SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS TO GUARD AGAINST POTENTIALLY TOXIC AND IRRITATING FUMES. AVOID DUSTING. DUST CAN FORM EXPLOSIVE MIXTURES WITH AIR.

PROTECTION/ADVICE FOR FIREFIGHTER(S):

BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING.

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## SECTION 6. ACCIDENTAL RELEASE MEASURES

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PERSONAL PRECAUTIONS:

REMOVE PERSONS FROM DANGER AREA.

ENVIRONMENTAL PRECAUTIONS:

AVOID ANY UNCONTROLLED RELEASE OF MATERIAL. DO NOT EMPTY INTO DRAINS OR THE AQUATIC ENVIRONMENT.

EMERGENCY PROCEDURES:

NO ADDITIONAL INFORMATION

METHODS AND MATERIALS FOR CONTAMINANT AND CLEANING UP:

WHERE SPILLS ARE POSSIBLE, A COMPREHENSIVE SPILL RESPONSE PLAN SHOULD BE DEVELOPED AND IMPLEMENTED. AVOID ANY UNCONTROLLED RELEASE OF MATERIAL.

UTILIZE RECOMMENDED PROTECTIVE CLOTHING AND EQUIPMENT (SEE SECTION 8). SPILLS SHOULD BE SWEEPED UP USING AN ABSORBENT DUST CONTROL PRODUCT AND PLACED IN CONTAINERS. SPILL AREA CAN BE WASHED WITH WATER. COLLECT WATER FOR APPROVED DISPOSAL. IN THE EVENT OF UNCONTROLLED RELEASE OF THIS MATERIAL, THE USER SHOULD DETERMINE IF THE RELEASE IS REPORTABLE UNDER APPLICABLE LAWS AND REGULATIONS.

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## SECTION 7. HANDLING AND STORAGE

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PRECAUTIONS FOR SAFE HANDLING:

HANDLE WITH CARE. AVOID OVER EXPOSURE. USE NIOSH/OSHA APPROVED RESPIRATOR, WORK GLOVES, AND CLOTHING. WASH AFTER HANDLING. SENSITIVE INDIVIDUALS MAY EXPERIENCE RESPIRATORY ALLERGIES. MAY CAUSE SKIN IRRITATION. USE WITH LOCAL VENTILATION.

CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES:

USE PROCESS ENCLOSURES, LOCAL EXHAUST VENTILATION OR OTHER ENGINEERING CONTROLS TO KEEP AIRBORNE LEVELS BELOW RECOMMENDED EXPOSURE LIMITS.

KEEP AWAY FROM HEAT. KEEP AWAY FROM SOURCES OF IGNITION.

KEEP AWAY FROM STRONG OXIDIZING AND REDUCING AGENTS.

## SPECIFIC END USES:

FELT TIP, MARKER INKS, WATER BASED COATINGS AND SPECIALTY INKS, PRINTING ON NYLON, SILK AND WOOL.

## SECTION 8. EXPOSURE CONTROLS /PERSONAL PROTECTION

## CONTROL PARAMETERS:

INGREDIENTS WITH LIMIT VALUES THAT REQUIRE MONITORING AT THE WORKPLACE - NOT REQUIRED

## EXPOSURE CONTROLS:

APPROPRIATE ENGINEERING CONTROLS - THE USUAL PRECAUTIONARY MEASURES ARE TO BE ADHERED TO WHEN HANDLING CHEMICALS.

## PERSONAL PROTECTIVE EQUIPMENT:



## HAND PROTECTION

## EYE PROTECTION

## SKIN AND BODY

WEAR IMPERMEABLE RUBBER OR PLASTIC GLOVES

TIGHTLY SEALED SAFETY GOGGLES OR FULL FACE SIDE SHIELDS.

APRON, COVERALLS AND NON-LEATHER SOLED WORK SHOES.

WASH DYE CONTAMINATED CLOTHES AND SKIN WITH MILD SOAP AND DETERGENTS.

## RESPIRATORY

## HYGIENE MEASURES

WEAR OSHA/NIOSH APPROVED DUST MASK/RESPIRATOR

HANDLE IN ACCORDANCE WITH GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES. WASH HANDS AFTER HANDLING MATERIAL.

## OTHER PROTECTION

DELUGE SAFETY SHOWER AND EYE WASH STATION SHOULD BE LOCATED NEAR WORK AREA.

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

## INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES :

APPEARANCE, COLOR, ODOR

POWDER, NO ODOR

pH

7.0 - 8.5

MELTING POINT/FREEZING POINT

ND

INITIAL BOILING POINT/BOILING RANGE

0.00

FLASHPOINT

NOT APPLICABLE

EVAPORATION RATE

NO DATA

FLAMMABILITY (SOLID,GAS)

NORMALLY STABLE, NOT COMBUSTIBLE NOR FLAMMABLE

UPPER EXPLOSIVE LIMITS

NA

LOWER EXPLOSIVE LIMITS

NA

VAPOR PRESSURE

NA

VAPOR DENSITY

NA

RELATIVE DENSITY

NA



SOLUBILITY IN WATER	SOLUBLE
PARTITION COEFFICIENT N-OCTANOL/WATER	NO DATA
AUTO-IGNITION TEMPERATURE	NO DATA
DECOMPOSITION TEMPERATURE	NO DATA
VISCOSITY, DYNAMIC	NO DATA
VISCOSITY, CINEMATIC	NO DATA
EXPLOSIVE PROPERTIES	N/A
OXIDIZING PROPERTIES	NA
OTHER INFORMATION	NA

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#### SECTION 10. STABILITY AND REACTIVITY

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CHEMICAL STABILITY	STABLE UNDER NORMAL STORAGE AND HANDLING CONDITIONS.
CONDITIONS TO AVOID	OXIDIZING & REDUCING AGENTS MAY DESTROY COLOR.
INCOMPATIBLE MATERIALS	OXIDIZING & REDUCING AGENTS MAY DESTROY COLOR.
HAZARDOUS DECOMPOSITION PRODUCTS	- CO, CO <sub>2</sub> , OXIDES OF NITROGEN AND OTHER POTENTIALLY TOXIC FUMES.

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#### SECTION 11. TOXICOLOGICAL INFORMATION

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##### TOXICOLOGICAL EFFECTS :

ORAL (ANIMAL)	GREATER THAN 2000 MG/KG - RAT
DERMAL (ANIMAL)	NO DATA AVAILABLE
EFFECTS TO EYES (ANIMAL)	NO DATA AVAILABLE
SKIN IRRITATION (ANIMAL)	NO DATA AVAILABLE
SKIN CORROSION/IRRITATION	NOT CLASSIFIED
SERIOUS EYE DAMAGE/IRRITATION	CAUSES SERIOUS EYE IRRITATION
RESPIRATORY OR SKIN SENSITIZATION	NOT CLASSIFIED
GERM CELL MUTAGENICITY	NOT CLASSIFIED
CARCINOGENICITY	NOT CLASSIFIED
REPRODUCTIVE TOXICITY	NOT CLASSIFIED
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE)	MAY CAUSE DROWSINESS OR DIZZINESS.
ASPIRATION HAZARD	NOT CLASSIFIED
INHALATION	MAY CAUSE DROWSINESS OR DIZZINESS.
EYE CONTACT	CAUSES SERIOUS EYE IRRITATION.
INGESTION	INGESTION MAY CAUSE NAUSEA, VOMITING AND DIARRHEA

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#### SECTION 12. ECOLOGICAL INFORMATION

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TOXICITY	NA
PERSISTENCE AND DEGRADABILITY	NA
BIOACCUMULATIVE POTENTIAL	NA
MOBILITY IN SOIL	NA
OTHER ADVERSE EFFECTS	NA

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#### SECTION 13. DISPOSAL CONSIDERATION

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TSCA STATUS	IN COMPLIANCE
E C CLASSIFICATION	(67/548/EEC - 88/379/EEC) N/A
EINECS NUMBER	
REACH CLASSIFICATION	
R PHRASES	
ADDITIONAL REGULATORY INFORMATION	CONTAINS:
	<11PPM BENZENE, (CAS#71-43-2)
	<11PPM TOLUENE, (CAS#108-88-3)
	<11PPM XYLENES, (CAS#1330-20-7)

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 SECTION 16. OTHER INFORMATION  
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INDICATION OF CHANGES:

NA

OTHER INFORMATION:

NA

GHS FULL TEXT PHRASES:

MAY BE HARMFUL IF INHALED	H333
CAUSES EYE IRRITATION	H320
CASUES MILD SKIN IRRITATION	H316

	HEALTH	FLAMMABILITY	REACTIVITY	PERSONAL PROT
H. M. I. S. CLASSIFICATION:	1	0	0	D
HMIS CODE: 4 - SEVERE HAZARD, 3 - SERIOUS HAZARD, 2 - MODERATE HAZARD, 1 - SLIGHT HAZARD, 0 - MINIMAL HAZARD				

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 ALL INFORMATION AND DATA APPEARING ON THIS SDS ARE BELIEVED TO BE RELIABLE AND ACCURATE.  
 HOWEVER, IT IS THE USER' S RESPONSIBILITY TO DETERMINE THE SAFETY, TOXICITY, AND SUITABILITY  
 FOR USE OF THE PRODUCT DESCRIBED. SINCE THE ACTUAL USE BY OTHERS IS BEYOND OUR CONTROL,  
 NO GUARANTEE, EXPRESSED OR IMPLIED, IS MADE BY HUE CORPORATION.  
 USER ASSUMES ALL RISK AND RESPONSIBILITY.  
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## Safety Data Sheet

### INTRACID RHODAMINE WT LIQUID

Safety Data Sheet dated: 5/13/2015 - version 1

Date of first edition: 5/13/2015

## 1. IDENTIFICATION

### Product identifier

Mixture identification:

Trade name: INTRACID RHODAMINE WT LIQUID

### Other means of identification:

Trade code: A45171566

### Recommended use of the chemical and restrictions on use

Recommended use: Industrial color additive

Restrictions on use: Not Determined

### Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Sensient Colors LLC

2515 N. Jefferson

63106 St. Louis, MO (USA)

Phone: 1 800-325-8110

Emergency Number(CHEMTREC): 1-800-424-9300

## 2. HAZARD(S) IDENTIFICATION

The identity of the individual components of this product is proprietary information and is considered a trade secret pursuant to 29 CFR 1910.1200

Hazardous components as defined in the OSHA Hazard Communication Standard: components with a HEALTH hazard (carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, etc..) and/or a PHYSICAL hazard (a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive, etc.)



### Classification of the chemical

Skin Irrit. 2 Causes skin irritation.

Eye Irrit. 2B Causes eye irritation

### Label elements

#### Symbols:



Warning

Code	Description
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H315	Causes skin irritation.
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H320	Causes eye irritation
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Code	Description
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P264	Wash ... Thoroughly after handling.
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P280	Wear protective gloves/protective clothing/eye protection/face protection.
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P302+P352	IF ON SKIN: Wash with plenty of water/...
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P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
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P321	Specific treatment (see ... On this label).
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P332+P313	If skin irritation occurs: Get medical advice/attention.
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P337+P313	If eye irritation persists: Get medical advice/attention.
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P362+P364 Take off contaminated clothing and wash it before reuse.

**Ingredient(s) with unknown acute toxicity:**

None

**Hazards not otherwise classified identified during the classification process:**

None

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### 3. COMPOSITION/INFORMATION ON INGREDIENTS

**Substances**

Not Determined

**Mixtures**

Hazardous components within the meaning of 29 CFR 1910.1200 and related classification:

**List of components**

Qty	Name	Ident. Numb.	Classification	Registration Number
10-12.5 %	RHODAMINE LIQUID	CAS:65392-81-6 EC:265-730-6	Skin Irrit. 2, H315; Eye Irrit. 2B, H320	
10-12.5 %	RHODAMINE LIQUID	CAS:75701-30-3 EC:278-292-6	Skin Irrit. 2, H315; Eye Irrit. 2B, H320	
1-3 %	TRIMELLITIC ACID	CAS:528-44-9 EC:208-432-3	Skin Irrit. 2, H315; Eye Irrit. 2A, H319; STOT SE 3, H335	

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### 4. FIRST AID MEASURES

**Description of first aid measures**

In case of skin contact:

- Immediately take off all contaminated clothing and shoes.
- Immediately remove any contaminated clothing, shoes or stockings.
- After contact with skin, wash immediately with soap and plenty of water.

In case of eye contact:

- Wash immediately and thoroughly with running water, keeping eyelids regularly raised, for at least 15 minutes. Cold water may be used. Check for and remove any contact lenses at once. OBTAIN A MEDICAL EXAMINATION.
- Protect the eyes with a sterile gauze or a clean, dry handkerchief.

In case of ingestion:

- Do not induce vomiting, get medical attention showing the MSDS and label hazardous.

In case of inhalation:

- Remove casualty to fresh air and keep warm and at rest.

**Most important symptoms/effects, acute and delayed**

Eye irritation  
Eye damages  
Skin Irritation  
Erythema

**Indication of any immediate medical attention and special treatment needed**

In case of accident or unwellness, seek medical advice immediately (show directions for use or safety data sheet if possible).

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### 5. FIRE-FIGHTING MEASURES

**Extinguishing media**

Suitable extinguishing media:

- Water, CO<sub>2</sub>, foam, chemical powders, according to the materials involved in the fire.
- In case of fire, use foam, dry chemical, CO<sub>2</sub>.

**Unsuitable extinguishing media:**

None in particular.

**Specific hazards arising from the chemical**

- Do not inhale explosion and combustion gases.
- Burning produces heavy smoke.
- Hazardous combustion products: Not Determined
- Explosive properties: Not Determined
- Oxidising properties: Not Determined

**Special protective equipment and precautions for fire-fighters**

- Use suitable breathing apparatus .
- Collect contaminated fire extinguishing water separately. This must not be discharged into drains.
- Move undamaged containers from immediate hazard area if it can be done safely.

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### 6. ACCIDENTAL RELEASE MEASURES

## **Personal precautions, protective equipment and emergency procedures**

Wear personal protection equipment.  
Remove persons to safety.  
See protective measures under point 7 and 8.

## **Methods and material for containment and cleaning up**

Suitable material for taking up: dry and inert absorbing material (e.g. vermiculite, sand, earth).  
Wash with plenty of water.

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## **7. HANDLING AND STORAGE**

### **Precautions for safe handling**

Avoid contact with skin and eyes, inhalation of vapours and mists.  
Don't use empty container before they have been cleaned.  
Before making transfer operations, assure that there aren't any incompatible material residuals in the containers.  
Contaminated clothing should be changed before entering eating areas.  
Do not eat or drink while working.  
See also section 8 for recommended protective equipment.

### **Conditions for safe storage, including any incompatibilities**

Storage temperature: Not Determined

Incompatible materials:

None in particular.

Instructions as regards storage premises:

Adequately ventilated premises.

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## **8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

### **Control parameters**

No Data Available

Appropriate engineering controls: Not Determined

### **Individual protection measures**

Eye/face protection:

Use close fitting safety goggles, don't use eye lens.

Skin protection:

Use clothing that provides comprehensive protection to the skin, e.g. cotton, rubber, PVC or viton.

Hand protection:

Use protective gloves that provide comprehensive protection, e.g. P.V.C., neoprene or rubber.

Respiratory protection:

Not Determined

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## **9. PHYSICAL AND CHEMICAL PROPERTIES**

### **Information on basic physical and chemical properties**

Physical State Liquid  
Appearance: Liquid,  
Odour: Not Determined  
Odour threshold: Not Determined  
pH: 10.50  
Melting point/ range: Not Determined  
Boiling point/ range: Not Determined  
Flash point: > 100°C / 212°F  
Evaporation rate: Not Determined  
Upper/lower flammability or explosive limits: Not Determined  
Vapour density: Not Determined  
Vapour pressure: Not Determined  
Density: Not Determined  
Water solubility: Not Determined  
Lipid solubility: Not Determined  
Partition coefficient (n-octanol/water): Not Determined  
Auto-ignition temperature: Not Determined  
Decomposition temperature: Not Determined  
Viscosity: Not Determined  
Explosive properties: Not Determined  
Oxidising properties: Not Determined  
Flammability (Solid, Gas): Not Determined

## Other information

Substance group relevant properties: Not Determined

Miscibility: Not Determined

Fat Solubility: Not Determined

Conductivity: Not Determined

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## 10. STABILITY AND REACTIVITY

### Reactivity

Stable under normal conditions.

### Chemical stability

Data not Available.

### Possibility of hazardous reactions

Burning produces carbon monoxide and/or carbon dioxide.

### Conditions to avoid

Stable under normal conditions of temperature and pressure.

### Incompatible materials

Avoid strong oxidizing agents, peroxides, acids, alkali metals.

### Hazardous decomposition products

Burning produces carbon monoxide and/or carbon dioxide.

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## 11. TOXICOLOGICAL INFORMATION

### Information on toxicological effects

Toxicological information of the product: No Data Available

### Substance(s) listed on the IARC Monographs:

None

### Substance(s) listed as OSHA Carcinogen(s):

None

### Substance(s) listed as NIOSH Carcinogen(s):

None

### Substance(s) listed on the NTP report on Carcinogens:

None

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## 12. ECOLOGICAL INFORMATION

### Toxicity

Adopt good working practices, so that the product is not released into the environment.

Eco-toxicity:

### List of Eco-Toxicological properties of the product

No Data Available

### Persistence and degradability

Not Determined

### Bioaccumulative potential

Not Determined

### Mobility in soil

Not Determined

### Other adverse effects

Not Determined

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## 13. DISPOSAL CONSIDERATIONS

### Waste treatment methods

Recover if possible. In so doing, comply with the local and national regulations currently in force.

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## 14. TRANSPORT INFORMATION

### UN number

ADR-UN number: N/A

DOT-UN Number: N/A

IATA-Un number: N/A

IMDG-Un number: N/A

**UN proper shipping name**

ADR-Shipping Name: N/A  
DOT Proper Shipping Name: N/A  
IATA-Technical name: N/A  
IMDG-Technical name: N/A

**Transport hazard class(es)**

ADR-Class: N/A  
DOT Hazard Class: N/A  
IATA-Class: N/A  
IMDG-Class: N/A

**Packing group**

ADR-Packing Group: N/A  
Exempted for ADR: N/A  
IATA-Packing group: N/A  
IMDG-Packing group: N/A

**Environmental hazards**

Marine pollutant: No  
Environmental Pollutant: Not Determined

**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**

Not Determined

**Special precautions**

Department of Transportation (DOT):

DOT-Special Provision(s): N/A  
DOT Label(s): N/A  
DOT Symbol: N/A  
DOT Cargo Aircraft: N/A  
DOT Passenger Aircraft: N/A  
DOT/TDG Bulk: N/A  
DOT Non-Bulk: N/A

Road and Rail (ADR-RID):

ADR-Label: N/A  
ADR-Upper number: N/A  
ADR Tunnel Restriction Code: N/A

Air (IATA):

IATA-Passenger Aircraft: N/A  
IATA-Cargo Aircraft: N/A  
IATA-Label: N/A  
IATA-Sub Risk: N/A  
IATA-Erg: N/A  
IATA-Special Provisioning: N/A

Sea (IMDG):

IMDG-Stowage Code: N/A  
IMDG-Stowage Note: N/A  
IMDG-Sub Risk: N/A  
IMDG-Special Provisioning: N/A  
IMDG-Page: N/A  
IMDG-Label: N/A  
IMDG-EMS: N/A  
IMDG-MFAG: N/A

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**15. REGULATORY INFORMATION****USA - Federal regulations****TSCA - Toxic Substances Control Act****TSCA inventory:**

All the components are listed on the TSCA inventory

**TSCA listed substances:**

RHODAMINE LIQUID	is listed in TSCA Section 8b
RHODAMINE LIQUID	is listed in TSCA Section 8b
TRIMELLITIC ACID	is listed in TSCA Section 8b, Section 5



**SARA - Superfund Amendments and Reauthorization Act**

**Section 302 - Extremely Hazardous Substances:**

no substances listed

**Section 304 - Hazardous substances:**

no substances listed

**Section 313 - Toxic chemical list:**

no substances listed

**CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act**

**Substance(s) listed under CERCLA:**

no substances listed

**CAA - Clean Air Act**

**CAA listed substances:**

no substances listed

**CWA - Clean Water Act**

**CWA listed substances:**

no substances listed

**USA - State specific regulations**

**California Proposition 65**

**Substance(s) listed under California Proposition 65:**

no substances listed

**Massachusetts Right to know**

**Substance(s) listed under Massachusetts Right to know:**

no substances listed

**Pennsylvania Right to know**

**Substance(s) listed under Pennsylvania Right to know:**

no substances listed

**New Jersey Right to know**

**Substance(s) listed under New Jersey Right to know:**

no substances listed

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**16. OTHER INFORMATION**

Code	Description
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H320	Causes eye irritation
H335	May cause respiratory irritation.

Safety Data Sheet dated: 5/13/2015 - version 1

The information contained herein is based on our state of knowledge at the above-specified date. It refers solely to the product indicated and constitutes no guarantee of particular quality. The information relates only to the specific material and may not be valid for such material used in combination with any other material or in any process.

This document was prepared by a competent person who has received appropriate training.

It is the duty of the user to ensure that this information is appropriate and complete with respect to the specific use intended.

This MSDS cancels and replaces any preceding release.

**Legend to abbreviations and acronyms used in the safety data sheet:**

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.

RID: Regulation Concerning the International Transport of Dangerous Goods by Rail

IMDG: International Maritime Code for Dangerous Goods

IATA: International Air Transport Association

IATA-DGR: Dangerous Goods Regulation by the "International Air Transport Association" (IATA)

ICAO: International Civil Aviation Organization

ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)

GHS: Globally Harmonized System of Classification and Labeling of Chemicals  
CLP: Classification, Labeling, Packaging  
EINECS: European Inventory of Existing Commercial Chemical Substances  
INCI: International Nomenclature of Cosmetic Ingredients  
CAS: Chemical Abstracts Service (division of the American Chemical Society)  
GefStoffVO: Ordinance on Hazardous Substances, Germany  
LC50: Lethal concentration, for 50 percent of test population  
LD50: Lethal dose, for 50 percent of test population  
DNEL: Derived No Effect Level  
PNEC: Predicted No Effect Concentration  
TLV: Threshold Limiting Value  
TWATLV: Threshold Limiting Value for the Time Weighted Average 8 hour day.(ACGIH Standard)  
STEL: Short Term Exposure limit  
STOT: Specific Target Organ Toxicity  
WGK: German Water Hazard Class  
KSt: Explosion coefficient  
y for the damage.



SAFETY DATA SHEET (SDS)  
REVISION DATE: 03/03/2016

# HUE CORPORATION

*Color your everything, may your Hue come true*

## SECTION I. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

### PRODUCT IDENTIFIER:

PRODUCT NAME ..... **HUE URANINE CONC** (Also known as Fluorescein)  
 PRODUCT NUMBER ..... 1-C8-073PC  
 COLOR INDEX NAME ..... ACID YELLOW 073  
 COLOR INDEX NO ..... 45350  
 C. A. S. # ..... 518-47-8  
 CHEMICAL FAMILY..... XANTHENE

### INTENDED USE OF THE PRODUCT:

FELT TIP, MARKER INKS, WATER BASED COATINGS AND LEAK DETECTION

### NAME, ADDRESS AND TELEPHONE OF RESPONSIBLE PARTY:

HUE CORPORATION	TELEPHONE	714-389-3130
P.O. BOX 509	FAX	714-389-9731
TUSTIN, CA 92781	EMAIL	<a href="mailto:SUPPORT@HUECORPORATION.COM">SUPPORT@HUECORPORATION.COM</a>

### EMERGENCY TELEPHONE NUMBER:

CHEMTREC (USA)	1-800-424-9300
CHEMTREC (OUTSIDE USA)	1-703-527-3887

## SECTION 2. HAZARD(S) IDENTIFICATION

### CLASSIFICATION OF THE SUBSTANCE OR MIXTURE:

GHS-US  
 ACUTE TOX. - INHALATION (CATEGORY 5)  
 EYE DAM./IRRITATION (CATEGORY 2B)  
 SKIN CORR./IRRITATION (CATEGORY 3)

### GHS LABELING:

HAZARD PICTOGRAMS (GHS-US): NO SYMBOL

SIGNAL WORD WARNING

HAZARD STATEMENT(S) H333 - MAY BE HARMFUL IF INHALED  
 H320 - CAUSES EYE IRRITATION  
 H316 - CAUSES MILD SKIN IRRITATION

PRECAUTIONARY STATEMENTS P305 + 351 + P338 - IF IN EYES: RINSE CAUTIOUSLY WITH WATER FOR SEVERAL MINUTES. REMOVE CONTACT LENSES IF PRESENT AND EASY

TO DO. CONTINUE RINSING.  
 P337 + P313 - IF EYE IRRITATION OCCURS/PERSISTS:  
 GET MEDICAL ADVICE AND ATTENTION.  
 P261 - AVOID BREATHING DUST/FUMES/GAS/MIST/VAPORS/SPRAY  
 P264 - WASH FACE THOROUGHLY AFTER HANDLING.  
 P322 + P313 - IF SKIN IRRITATION OCCURS: GET MEDICAL ADVICE/  
 ATTENTION.  
 P304 + 312 - IF INHALED: CALL A POISON CENTER/DOCTOR/PHYSICIAN  
 IF YOU FEEL UNWELL

OTHER HAZARDS NO DATA AVAILABLE  
 UNKNOWN ACUTE TOXICITY NO DATA AVAILABLE

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### SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

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DESCRIPTION OF MIXTURE: PROPRIETARY MIXTURE OF DYES.

#### SUBSTANCE:

NAME	C.A.S.#	WEIGHT 100%	GHS-US CLASSIFICATION
ACID YELLOW 073	518-47-8	100%	ACUTE TOX. - INHALATION (CATEGORY 5) EYE DAM./IRRITATION (CATEGORY 2B) SKIN CORR./IRRITATION (CATEGORY 3)

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### SECTION 4. FIRST AID MEASURES

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#### FIRST AID MEASURES GENERAL:

INHALATION: REMOVE TO FRESH AIR. IF BREATHING IS DIFFICULT, GIVE OXYGEN AND GET IMMEDIATE MEDICAL ATTENTION.

SKIN: WASH WITH MILD SOAP AND WATER. IF IRRITATION OCCURS GET MEDICAL ATTENTION. IF CLOTHING IS CONTAMINATED, RE-MOVE AND WASH BEFORE REUSE.

EYES: FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES, HOLDING EYELIDS APART FOR THOROUGH IRRIGATION. GET IMMEDIATE MEDICAL ATTENTION.

INGESTION: INDUCE VOMITING - SEEK IMMEDIATE MEDICAL ATTENTION.

#### MOST IMPORTANT SYMPTOMS AND EFFECTS, ACUTE AND DELAYED:

THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY HAZARDOUS COMMUNICATION STANDARD. HOWEVER, AS WITH ALL CHEMICAL; HANDLE WITH CARE, AVOID EYE AND SKIN CONTACT, AVOID INHALATION OF DUSTS OR VAPORS. WASH THOROUGHLY AFTER HANDLING. KEEP CONTAINERS CLOSED.

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### SECTION 5. FIRE-FIGHTING MEASURES

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#### EXTINGUISHING MEDIA:

WATER, DRY CHEMICAL, CARBON DIOXIDE, FOAM.

SPECIAL HAZARDS ARISING FROM SUBSTANCE OR MEDIA:

FIREFIGHTERS SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS TO GUARD AGAINST POTENTIALLY TOXIC AND IRRITATING FUMES. AVOID DUSTING. DUST CAN FORM EXPLOSIVE MIXTURES WITH AIR.

PROTECTION/ADVICE FOR FIREFIGHTER(S):

BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING.

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SECTION 6. ACCIDENTAL RELEASE MEASURES

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PERSONAL PRECAUTIONS:

REMOVE PERSONS FROM DANGER AREA.

ENVIRONMENTAL PRECAUTIONS:

AVOID ANY UNCONTROLLED RELEASE OF MATERIAL. DO NOT EMPTY INTO DRAINS OR THE AQUATIC ENVIRONMENT.

EMERGENCY PROCEDURES:

NO ADDITIONAL INFORMATION

METHODS AND MATERIALS FOR CONTAMINANT AND CLEANING UP:

WHERE SPILLS ARE POSSIBLE, A COMPREHENSIVE SPILL RESPONSE PLAN SHOULD BE DEVELOPED AND IMPLEMENTED. AVOID ANY UNCONTROLLED RELEASE OF MATERIAL.

UTILIZE RECOMMENDED PROTECTIVE CLOTHING AND EQUIPMENT (SEE SECTION 8).  
SPILLS SHOULD BE SWEEPED UP USING AN ABSORBENT DUST CONTROL PRODUCT AND PLACED IN CONTAINERS. SPILL AREA CAN BE WASHED WITH WATER. COLLECT WATER FOR APPROVED DISPOSAL. IN THE EVENT OF UNCONTROLLED RELEASE OF THIS MATERIAL, THE USER SHOULD DETERMINE IF THE RELEASE IS REPORTABLE UNDER APPLICABLE LAWS AND REGULATIONS.

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SECTION 7. HANDLING AND STORAGE

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PRECAUTIONS FOR SAFE HANDLING:

HANDLE WITH CARE. AVOID OVER EXPOSURE. USE NIOSH/OSHA APPROVED RESPIRATOR, WORK GLOVES, AND CLOTHING. WASH AFTER HANDLING. SENSITIVE INDIVIDUALS MAY EXPERIENCE RESPIRATORY ALLERGIES. MAY CAUSE SKIN IRRITATION. USE WITH LOCAL VENTILATION.

CONDITIONS FOR SAFE STORAGE, INCLUDING ANY INCOMPATIBILITIES:

USE PROCESS ENCLOSURES, LOCAL EXHAUST VENTILATION OR OTHER ENGINEERING CONTROLS TO KEEP AIRBORNE LEVELS BELOW RECOMMENDED EXPOSURE LIMITS.

KEEP AWAY FROM HEAT. KEEP AWAY FROM SOURCES OF IGNITION.

KEEP AWAY FROM STRONG OXIDIZING AND REDUCING AGENTS.

## SPECIFIC END USES:

FELT TIP, MARKER INKS, WATER BASED COATINGS AND LEAK DETECTION

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 SECTION 8. EXPOSURE CONTROLS /PERSONAL PROTECTION
 

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## CONTROL PARAMETERS:

INGREDIENTS WITH LIMIT VALUES THAT REQUIRE MONITORING AT THE WORKPLACE - NOT REQUIRED

## EXPOSURE CONTROLS:

APPROPRIATE ENGINEERING CONTROLS - THE USUAL PRECAUTIONARY MEASURES ARE TO BE ADHERED TO WHEN HANDLING CHEMICALS.

## PERSONAL PROTECTIVE EQUIPMENT:



## HAND PROTECTION

## EYE PROTECTION

## SKIN AND BODY

WEAR IMPERMEABLE RUBBER OR PLASTIC GLOVES

TIGHTLY SEALED SAFETY GOGGLES OR FULL FACE SIDE SHIELDS.

APRON, COVERALLS AND NON-LEATHER SOLED WORK SHOES.

WASH DYE CONTAMINATED CLOTHES AND SKIN WITH MILD SOAP AND DETERGENTS.

## RESPIRATORY

## HYGIENE MEASURES

WEAR OSHA/NIOSH APPROVED DUST MASK/RESPIRATOR

HANDLE IN ACCORDANCE WITH GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES. WASH HANDS AFTER HANDLING MATERIAL.

## OTHER PROTECTION

DELUGE SAFETY SHOWER AND EYE WASH STATION SHOULD BE LOCATED NEAR WORK AREA.

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 SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES
 

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## INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES :

APPEARANCE, COLOR, ODOR

YELLOW POWDER, NO ODOR

pH

8.0 - 9.0

MELTING POINT/FREEZING POINT

ND

INITIAL BOILING POINT/BOILING RANGE

0.00

FLASHPOINT

NORMALLY STABLE, NOT COMBUSTIBLE NOR FLAMMABLE

EVAPORATION RATE

NO DATA

FLAMMABILITY (SOLID,GAS)

NORMALLY STABLE, NOT COMBUSTIBLE NOR FLAMMABLE

UPPER EXPLOSIVE LIMITS

NA

LOWER EXPLOSIVE LIMITS

NA

VAPOR PRESSURE

NA

VAPOR DENSITY

NA

RELATIVE DENSITY

NA

SOLUBILITY IN WATER

SOLUBLE

PARTITION COEFFICIENT N-OCTANOL/WATER

NO DATA

AUTO-IGNITION TEMPERATURE	NO DATA
DECOMPOSITION TEMPERATURE	NO DATA
VISCOSITY, DYNAMIC	NO DATA
VISCOSITY, CINEMATIC	NO DATA
EXPLOSIVE PROPERTIES	N/A
OXIDIZING PROPERTIES	NA
OTHER INFORMATION	NA

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#### SECTION 10. STABILITY AND REACTIVITY

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CHEMICAL STABILITY	STABLE UNDER NORMAL STORAGE AND HANDLING CONDITIONS.
CONDITIONS TO AVOID	OXIDIZING & REDUCING AGENTS MAY DESTROY COLOR.
INCOMPATIBLE MATERIALS	OXIDIZING & REDUCING AGENTS MAY DESTROY COLOR.
HAZARDOUS DECOMPOSITION PRODUCTS	CO, CO <sub>2</sub> , OXIDES OF NITROGEN AND OTHER POTENTIALLY TOXIC FUMES.

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#### SECTION 11. TOXICOLOGICAL INFORMATION

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##### TOXICOLOGICAL EFFECTS :

ORAL (ANIMAL)	GREATER THAN 7,000 MG/KG - RAT
DERMAL (ANIMAL)	NA
EFFECTS TO EYES (ANIMAL)	EYES - RABBIT, NOT IRRITATING
SKIN IRRITATION (ANIMAL)	SKIN - RABBIT, SLIGHT IRRITANT
SKIN CORROSION/IRRITATION	NOT CLASSIFIED
SERIOUS EYE DAMAGE/IRRITATION	CAUSES EYE IRRITATION
RESPIRATORY OR SKIN SENSITIZATION	NOT CLASSIFIED
GERM CELL MUTAGENICITY	NOT CLASSIFIED
CARCINOGENICITY	NOT CLASSIFIED
REPRODUCTIVE TOXICITY	NOT CLASSIFIED
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE)	MAY CAUSE DROWSINESS OR DIZZINESS.
ASPIRATION HAZARD	NOT CLASSIFIED
INHALATION	MAY CAUSE DROWSINESS OR DIZZINESS.
EYE CONTACT	CAUSES SERIOUS EYE IRRITATION.
INGESTION	INGESTION MAY CAUSE NAUSEA, VOMITING AND DIARRHEA

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#### SECTION 12. ECOLOGICAL INFORMATION

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TOXICITY	NA
PERSISTENCE AND DEGRADABILITY	NA
BIOACCUMULATIVE POTENTIAL	NA
MOBILITY IN SOIL	LC-50 (LETHAL CONCENTRATION) UG = MICROGRAMS/LITER CHANNEL CATFISH - 2,267,000 UG/LITER RAINBOW TROUT - 1,372,000 UG/LITER BLUEGILL - 3,433,000 UG/LITER
OTHER ADVERSE EFFECTS	NA

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#### SECTION 13. DISPOSAL CONSIDERATION

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TSCA STATUS  
E C CLASSIFICATION  
EINECS NUMBER  
REACH CLASSIFICATION  
R PHRASES  
ADDITIONAL REGULATORY INFORMATION

IN COMPLIANCE  
(67/548/EEC - 88/379/EEC) N/A

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SECTION 16. OTHER INFORMATION

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INDICATION OF CHANGES:

NA

OTHER INFORMATION:

NA

GHS FULL TEXT PHRASES:

MAY BE HARMFUL IF INHALED	H333
CAUSES EYE IRRITATION	H320
CASUES MILD SKIN IRRITATION	H316

	HEALTH	FLAMMABILITY	REACTIVITY	PERSONAL PROT
H. M. I. S. CLASSIFICATION:	1	0	0	D
HMIS CODE: 4 - SEVERE HAZARD, 3 - SERIOUS HAZARD, 2 - MODERATE HAZARD, 1 - SLIGHT HAZARD, 0 - MINIMAL HAZARD				

SAFETY DATA SHEET (SDS)  
REVISION DATE: 03/03/2016

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ALL INFORMATION AND DATA APPEARING ON THIS SDS ARE BELIEVED TO BE RELIABLE AND ACCURATE. HOWEVER, IT IS THE USER' S RESPONSIBILITY TO DETERMINE THE SAFETY, TOXICITY, AND SUITABILITY FOR USE OF THE PRODUCT DESCRIBED. SINCE THE ACTUAL USE BY OTHERS IS BEYOND OUR CONTROL, NO GUARANTEE, EXPRESSED OR IMPLIED, IS MADE BY HUE CORPORATION. USER ASSUMES ALL RISK AND RESPONSIBILITY.

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# APPENDIX G

## Baseline Sample Results for Tracer Dye



## Certificate of Analysis

**Date of certificate:** November 10, 2020

**Client:** ARCADIS U.S., Inc.

**Project name/location:** PG&E Topock Compressor Station  
Needles, CA

**Project number:** 30035275.4QGW

**Contact person:** Laura.Madsen@arcadis.com  
Craig.Prunier@arcadis.com

**Samples collected by:** Ellen Redner

**Date samples shipped:** November 5, 2020

**Date samples rec'd at OUL:** November 6, 2020

**Date analyzed by OUL:** November 9, 2020

**Included with certificate:** Table of results and copy of  
sample collection data sheet

**Results for a water sample analyzed for the presence of fluorescein, eosine and rhodamine WT (RWT) dyes.**

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Name	Date/Time Collected	Fluorescein Results		Eosine Results		RWT Results	
			Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
E8619	TW-01-1120	11/4/20 1145	ND		ND		ND	
E8620	Laboratory control water blank							

**Note:** Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

**Footnotes:** ND = No dye detected

**Thomas J. Aley, PHG and RG**



**1572 Aley Lane Protem, MO 65733 (417) 785-4289 fax (417) 785-4290 email: [contact@ozarkundergroundlab.com](mailto:contact@ozarkundergroundlab.com)**

Project PG+E TOPOCK - Arcadis Week No:            Samples Collected By: Elien Redner  
 Samples Shipped By: Elien Redner Samples Received By: C. Blaylock  
 Date Samples Shipped: 11/5/2020 Date Samples Received: 11-6-20 Time Samples Received: 1730 Return Cooler? Yes ☐ No ☒  
 Bill to: Arcadis U.S. Send Results to: Laura Madsen, Laura.madsen@arcadis.com, Craig Prunier  
 Analyze for: ☒ Fluorescein ☒ Eosine ☒ Rhodamine WT ☐ Other            Ship cooler to:            craig.prunier@arcadis.com

[illegible]

COMMENTS wasn't sure if each analyte needed its own vial which is why y'all got 3 just in case

This sheet filled out by OUL staff? Yes No Charts for samples on this page proofed by OUL: CA  
OUL Project No. 711 Date Analyzed: 11/9/20 Analyzed By: RD/OUL

ES620 OUL Blank



## Certificate of Analysis

**Date of certificate:** November 2, 2020

**Client:** ARCADIS U.S., Inc.

**Project name/location:** PG&E Topock Compressor Station  
Needles, CA

**Project number:** 30035275.4QGW

**Contact person:** Laura.Madsen@arcadis-us.com

**Samples collected by:** Matt Trainetti, Jecte Boyd

**Date samples shipped:** October 7, 2020

**Date samples rec'd at OUL:** October 8, 2020 and archived

**Date of analysis request:** October 27, 2020

**Date analyzed by OUL:** October 29, 2020

**Included with certificate:** Table of results and copy of  
sample collection data sheet

**Results for water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.**

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

OUL Number	Station Name	Date/Time Collected	Fluorescein Results		Eosine Results		RWT Results	
			Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
E8375	MW-24A-1020	10/5/20 1502	509.4 **	0.023	ND		575.3	43.1
E8376	MW-24B-1020	10/5/20 1524	507.6 **	0.023	ND		ND	
E8377	MW-38D-1020	10/5/20 1414	ND		ND		ND	
E8378	MW-67-185-1020	10/6/20 1416	ND		ND		ND	
E8379	PT7D-1020	10/6/20 0946	508.2	31.3	ND		ND	
E8380	Laboratory control water blank							
E8381	PT7M-1020	10/6/20 0841	507.8	414	ND		ND	
E8382	PT7S-1020	10/6/20 1121	ND		ND		ND	
E8383	PT8D-1020	10/6/20 1059	508.2	0.173	ND		ND	
E8384	PT8M-1020	10/6/20 0920	508.7	0.657	ND		ND	
E8385	PT8S-1020	10/6/20 1132	508.6	0.037	ND		ND	
E8386	PT9D-1020	10/6/20 1326	ND		ND		ND	
E8387	PT9M-1020	10/6/20 1231	507.9	1.08	ND		539.4 (1)	3.31
E8388	PT9S-1020	10/6/20 1240	509.4	0.223	ND		ND	

**Note:** Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

**Footnotes:** ND = No dye detected

(1) = The fluorescence peak in this sample is interpreted as degraded rhodamine WT dye. The concentrations are based upon non-degraded rhodamine WT dye. We have no standards for degraded rhodamine WT dye, so the concentration should be used only as a relative value.

\*\* = A fluorescence peak is present that does not meet all the criteria for this dye. However, it has been calculated as a positive dye result.

Thomas J. Aley, PHG and RG



# OZARK UNDERGROUND LABORATORY, INC.

1572 Aley Lane Protom, MO 65733 (417) 785-4289 fax (417) 785-4290 email: contact@ozarkundergroundlab.com

## SAMPLE COLLECTION DATA SHEET for FLUORESCENCE ANALYSIS

Project PGE Topock Week No: \_\_\_\_\_ Samples Collected By: Matt Trainotti, Jette Boyd  
 Samples Shipped By: Matt Trainotti Samples Received By: C. Aley / OUL  
 Date Samples Shipped: 10/7/20 Date Samples Received: 10-8-20 Time Samples Received: 1332 Return Cooler? Yes ☒ No ☐  
 Bill to: Laura Madsen, Arcadis U.S. Send Results to: Laura Madsen, Laura.Madsen@arcadis.com  
 Analyze for: ☒ Fluorescein ☒ Eosine ☒ Rhodamine WT ☐ Other \_\_\_\_\_ Ship cooler to: \_\_\_\_\_

OUL use only		<i>Please indicate stations where dye was visible in the field</i> for field technician use - use black ink only						OUL use only	
# CHAR REC'D	LAB NUMBER <u>Water</u>	STATION NUMBER	STATION NAME	PLACED		COLLECTED		# WATER REC'D	
				DATE	TIME	DATE	TIME		
0	E8375		MW-24A - 1020						
0	E8376		MW-24B - 1020			10/5/20	1502	1	
0	E8377		MW-38D - 1020				1524	1	
0	E8378		MW-67-185-1020				1414	1	
0	E8379		PT7D - 1020			10/6/20	1416	1	
0	E8381		PT7M - 1020				0946	1	
0	E8382		PT7S - 1020				0841	1	
0	E8383		PT8D - 1020				1121	1	
0	E8384		PT8M - 1020				1059	1	
0	E8385		PT8S - 1020				0920	1	
0	E8386		PT9D - 1020				1132	1	
0	E8387		PT9M - 1020				1326	1	
0	E8388		PT9S - 1020				1231	1	
			E8380 - OUL Water blank.				1240	1	

COMMENTS \_\_\_\_\_

This sheet filled out by OUL staff? Yes ☒ No ☐ Charts for samples on this page proofed by OUL: CA  
 OUL Project No. 711 Date Analyzed: 10/29/20 Analyzed By: Lisa Gilcrease

# APPENDIX H

## Response to Comments



## Response to Agency Comments on the TW-01 Aquifer Test Plan PG&E Topock Compressor Station Needles, California

Comment Number	Section No.	Page No.	Comment	Response
<b>DTSC, Aaron Yue, GSU Comments</b>				
1	1.2.2	1-2	The CSM should mention the conductivity stratification noted in the aquifer. It seems overlooked in this document but may assist data interpretation over the long-term pumping test.	A summary of the sitewide distribution of TDS has been added in Section 1.2. In addition, a summary of the specific conductivity at the compressor station is provided, highlighting that the specific conductivity in the shallow groundwater where Cr(VI) is elevated at MW-68 is less salty than the deeper groundwater and indicating that the Cr(VI) at MW-68-180 is likely not associated with elevated TDS/specific conductivity.
2	1.2.3	1-3	Paragraph 1- The section mentions highest hexavalent chromium (Cr(VI)) concentrations occurring at the TCS at PT-9D and MW-68-180. For completeness, the high Cr(VI) concentrations at the MW-20 well cluster by the floodplain that ranged historically from maximums of 13,000 to 14,000 ug/L should be mentioned. Also, a new Cr(VI) maximum around 61,000 ug/L was recently obtained from well MW-68-180 from a December 16, 2020 sample.	Cr(VI) data has been updated for MW-68-180 to include the new Cr(VI) maximum. Cr(VI) data from the MW-20 and MW-50 clusters to recognize historical concentrations greater than 10,000 mg/L has also been added.
3	1.2.3	1-3	Paragraph 1, Last sentence- The sentence states, <b>“A small portion of the plume extends into the bedrock near the East Ravine; however, the bedrock beneath the central portion of the TCS does not contain Cr(VI) (CH2M Hill 2014, 2015a, b).”</b> A CSM should be proposed and documented to explain why the East Ravine bedrock is impacted, yet TCS bedrock and other bedrock areas are not impacted.	<p>At the time of the RFI Volume 2 (circa 2014-2015), chromium was not detected in bedrock well samples in areas where there is significant alluvium overlying the bedrock. The East Ravine has been exposed to surface weathering throughout recent geologic time, and the weathering promotes more extensive priority. There is a mapped fault running through the East Ravine area, which likely produced more extensive fracturing.</p> <p>A potential explanation is that historical chromium-containing discharges to the East Ravine came into direct contact with the Miocene conglomerate and pre-tertiary metadiorite bedrock formations; whereas at the TCS, any chromium-containing releases would have reached the Alluvial Aquifer first.</p>



## Response to Agency Comments on the TW-01 Aquifer Test Plan PG&E Topock Compressor Station Needles, California

Comment Number	Section No.	Page No.	Comment	Response
4	1.2.3	1-3	Paragraph 2- The paragraph appropriately states that waste discharges to Bat Cave Wash are the primary cause of the Cr(VI) groundwater plume. However, for completeness, discharges to East Ravine should be mentioned.	In addition, runoff from TCS, the access road to TCS, and AOC 9, historical incidental overflows of chromium-containing wastewater via the former trench drain at the top of the TCS access road, as well as discharge from stormwater drain pipes were documented for AOC 10 (East Ravine). These discharges would have pooled in the drainage depressions identified as AOC Subareas 10b, 10c, and 10d. In these subareas, contaminants could potentially be driven deeper and could potentially reach groundwater (Jacobs 2019).
5	1.2.3	1-3	Paragraph 3, First sentence- The sentence states, <b>“Due to the restricted access to the subsurface on TCS, current knowledge of chromium mass in soil below 10 feet bgs on the station is limited to MW-66, MW-67 and MW-68 borings.”</b> The following language is suggested to be inserted following this sentence, “Due to the limited access, these three deeper borings could not be placed at locations where the greatest likelihood of a Cr(VI) release would have occurred such as directly underneath the former hot well sump or underneath cooling tower basins.”	The following sentence has been added to the text, “Due to the limited access, these three deeper borings could not be placed at locations where the greatest likelihood of a Cr(VI) release would have occurred such as directly underneath the former hot well sump or underneath cooling tower basins.”
6	1.2.3	1-3	Paragraph 3, Second sentence- Minor revision needed. Change “two” to “three” if appropriate.	Text has been changed to refer to three boring instead of two (MW-66, MW-67 and MW-68).
7	1.2.3	1-3	Paragraph 3, Second half of paragraph- The paragraph mentions certain potential units that could have caused Cr(VI) contamination in groundwater. Have these or other units been identified as sources of groundwater contamination at the PG&E Hinkley or Kettleman stations? Finally, the paragraph mentions <b>“cooling tower A (AOC 6)”</b> which should be revise to tower “B”.	These potential sources were not based on experience at Hinkley and Kettleman. They were based on historical observations of releases at AOC15 and plausible inferences on potential contribution from other AOCs. We do not have evidence of similar releases at other stations.

## Response to Agency Comments on the TW-01 Aquifer Test Plan PG&E Topock Compressor Station Needles, California

Comment Number	Section No.	Page No.	Comment	Response
8	2	2-1	Please include an evaluation of any interrelationships between the Alluvial Aquifer and Bedrock Aquifer. Unanticipated hydraulic responses in bedrock should be identified.	The planned network of monitoring wells for the TW-01 Aquifer Test includes wells in the bedrock. Data analyses will include an evaluation of drawdown in the alluvium and the bedrock. Any observed hydraulic responses in the bedrock will be identified as part of the TW-01 aquifer test data reporting.
9	2	2-2	Last Paragraph- A new sentence (see underlined text) is suggested to follow the cited sentence, <b>“Based on the results of the first 3 to 6 months of data, the duration of constant-rate aquifer test and tracer study may be extended, with approval from the agencies.”</b> <u>It may also be shortened if additional data are not anticipated to provide any further value.</u>	Agreed- the duration of the test should be driven by the data. Language has been added to Section 2 to acknowledge that the test may end if sufficient data has been collected to fulfill objectives or extended if the data trends warrant and there are options available for managing extracted groundwater. Section 4.5.4 has been edited to provide details on tracer and Cr(VI) data trends that will guide the duration of the test.
10	3.2	3-3	First Paragraph- A sentence begins with, <b>“Evaluation of the MW-38D data shows that...”</b> Please show the data and evaluation. Time-series plots containing both water levels and Cr(VI) concentrations are requested. Relationships and additional plots may be appropriate to assess chemical constituents such as oxidation reduction potential (ORP) or conductivity. The sentence continues by stating, “...but that Cr(VI) concentrations have been consistently lower than before the repair.” The Work Plan should postulate why the chemistry may have changed. This should not affect the wells ability to monitor hydraulic responses but should be completed to assess its ability to accurately monitor groundwater constituents.	Section 3.2 has been updated with trend graphs and a discussion of changes in water quality prior to and after the repair along with a discussion of the potential explanation of the data trends.
11	3.2	3-3	Second Paragraph- The paragraph indicates that well redevelopment was completed on November 23, 2020. Please discuss pre- and post-development results. Did hydraulic properties improve or degrade compared to past development records.	Hydraulic properties were not collected prior to redevelopment of MW-38D and historical development results have not been obtained for comparison. Post-development data is provided in Appendix E.

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12	3.2	3-3	Third Paragraph, First Sentence- The sentence states, <b>“During downhole video logging of MW-38D, a slight bend or bulge in the blank casing above the screen was observed at approximately 79 feet btoc and a minor crack was also observed at the top of the screen between the joint of the blank and screened PVC.”</b> However, none of these findings are documented in the Well Survey Report contained in the Appendix E. Please clarify.	Field observations listed in the third paragraph, first sentence were captured by the field geologist during video logging but were not captured on the well survey report. The sentence was revised to read “During downhole video logging of MW-38D, the field geologist noted a slight bend or bulge in the blank casing above the screen at approximately 79 feet btoc and a minor crack in the casing at the top of the screen between the joint of the blank and screened PVC.” Additionally, the third paragraph, second sentence was also revised to read “These observations do not appear to pose significant issues to well integrity and were not included in the video survey log attached in Appendix E.”.
13	3.3	3-3	The following additional datalogger monitoring locations are suggested: MW-09 and MW-11D to monitor potential effects of storm infiltration. Monitoring for storm infiltration could be extended if needed.	MW-09 and MW-11D will be instrumented by a Levellogger 5 LTC to further observe storm infiltration within BCW.
14	3.3	3-3	First Paragraph, Second Sentence- The sentence states, <b>“Dataloggers have been installed as of November 6, 2020 in all wells listed in Table 1, except for MW-66BR- 270...”</b> However, Table 1 lists six dataloggers currently installed in one column and also lists 30 proposed/newly installed in a second datalogger column. Please modify Table 1 to list only installed and proposed/not installed columns and ensure it correlates with text in the Work Plan.	Table 1 has been updated to show two columns for dataloggers currently installed and dataloggers that are proposed to be installed prior to the start of the TW-01 test. Section 3.3 has been updated to reflect well locations instrumented with dataloggers and well locations that are projected to be instrumented with dataloggers.
15	3.3	3-3	First paragraph, last sentence- The sentence states, <b>“Data collection started immediately after deployment, collecting data readings every 30 minutes, and will continue until the start of the constant-rate aquifer test”.</b> Please report and summarize the three months of data collected to date in the Work Plan. Are there any significant findings or potential problems that could impact aquifer test interpretation? If	A summary of the data collected to date will be prepared under separate cover for review and discussion.

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			needed, the detailed data analysis could be reported outside the Work Plan to expedite its approval, but a summary would still be required.	
16	4.1	4-2	First Paragraph- The sentence states, <b>“TW-01 is approximately 280 feet from the former pilot area, and extraction is not expected to hydraulically influence this area.”</b> The cited sentence does not seem supported by Figure 12 (TW-01 Drawdown Modeling) which shows that 1 to 1.5 feet of drawdown would occur around the pilot area/former tracer injection area. Please clarify/revise text. Additionally, particle tracking with an appropriate time increment marked along each track is requested to be added to Figure 12 or a new figure for clarity. The tracks should emanate from the wells where new tracers are added as well as those wells from the uplands pilot test area with elevated concentrations of residual tracer. The tracks and text should provide an estimated time for arrival of the tracer at TW-01.	Text was edited to recognize the potential flow from the Uplands pilot test area. Particle tracking was added to Figure 12.
17	4.1	4-2	Second Paragraph, Last Sentence- The sentence states, <b>“Hydrasleeve™ samplers will be deployed at tracer injection well locations MW-38D and MW-67-185, along with the tracer observation wells used during the 2009 pilot test, to capture additional trace dye data while conducting the extended constant-rate aquifer test.”</b> Conventional low flow sampling is requested in place of Hydrasleeve samplers due to inferior performance during past sampling trials conducted at the PG&E Topock site.	Low-flow sampling will be conducted in replacement of Hydrasleeve samplers at tracer injection well locations MW-38D and MW-67-185, along with the tracer observation wells used during the 2009 pilot test. The sentence referring to Hydrasleeve sampling has been deleted.
18	4.3.1	4-4	Second paragraph, last sentence- The sentence states, <b>“This analysis indicates that there is a minimal risk for transport of contaminants towards the Colorado River in the vicinity during the hydraulic testing at TW-01.”</b> The Work Plan should acknowledge that excessive transport of contaminants towards the Colorado River during the test	The following sentences has been added at the conclusion of section 4.3.2: If monitoring indicates a potential risk of significant concentrations of contaminants reaching the Colorado River then the TW-01 aquifer test will either be terminated, or flow rates will be adjusted at TW-01 and the

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			may require the test to be shut down early or that flow rates be adjusted at TW-01 and IM-3 extraction wells to resolve contaminant migration concerns.	IM-3 extraction wells to accommodate for contaminate migration.
19	4.3.2	4-4	First Paragraph, Last Sentence- The sentence states, <b>“During the TW-01 aquifer test, in addition to gradient monitoring at the IM3 designated well pairs, the following well locations will be monitored biweekly for Cr (VI), and transducer data will be collected monthly;”</b> The Work Plan should indicate that these data will be evaluated promptly and reported to agencies as soon as possible. A reporting schedule should be included in the revised Work Plan.	The following was added to Section 4.3.2:  The data will be evaluated biweekly and agencies will be notified if a concern with migrating contaminants is identified.
20	4.4	4-5/4-6	<p>Exhibit 4.4:</p> <ul style="list-style-type: none"> <li>Baseline Sampling: The one-time sampling should be conducted at all the specified wells within a one or two-day time period. Laboratory based specific conductivity and/or total dissolved solids should be added to the analyte list. Caprolactam should also be added as well. The MW-68 cluster and MW-10D should be added to the baseline locations.</li> <li>Cr(VI) Concentration Monitoring: Laboratory based specific conductivity and/or total dissolved solids should be added to the analyte list.</li> <li>Additional Tracer Sampling: Hydrasleeve™ sampling should be replaced with low flow sampling. Wells MW-38S and MW-67-225 should be added to the sample locations to check for cross communication or vertical migration of injected tracer. Can different dye types also be added to MW-38S and MW-67-225 to assess shallow versus deep arrival times to TW-01.</li> </ul>	<ul style="list-style-type: none"> <li>Baseline sampling will be completed before the start of the test and will be performed within a one to two-day time period. Specific conductivity and total dissolved solids have been added to the analyte list.</li> <li>Specific conductivity and total dissolved solids has been added to the TW-01 Cr(VI) concentration monitoring section of Exhibit 4.4.</li> <li>Hydrasleeve™ sampling has been replaced with low flow sampling for additional tracer sampling and MW-38S and MW-67-225 has been added to the sampling plan. Potential tracer injection locations, including MW-38S were discussed on the comment clarification call on February 23, 2021. It was agreed that tracer injections will be conducted at MW-38, MW-67-185, and MW-68-180.</li> <li>Solute transport monitoring will be performed within a one to two-day time period and specific conductivity and total dissolved solids has been added to the analyte list. The MW-68 well cluster and MW-10D was added to the sampling plan for solute transport monitoring.</li> </ul>

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			<ul style="list-style-type: none"> <li>Solute Transport Monitoring: The sampling events should be conducted at all the specified wells within a one or two-day time period. Laboratory based specific conductivity and/or total dissolved solids should be added to the analyte list. The MW-68 cluster and MW-10D should be added to the sample locations.</li> </ul>	
21	4.4	4-6	<p>Exhibit 4.4, Footnote: The footnote states, <b>“* In addition to Cr(T), Cr(VI), and tracers, to evaluate water quality for treatment at IM-3, TW-01 was sampled and analyzed for pH, specific conductance, oil and grease, total dissolved solids (TDS), total suspended solids (TSS), total organic carbon (TOC), Title 22 metals, ammonia, fluoride, nitrate/nitrite, and sulfate.”</b></p> <p>It is requested that these analyses be repeated periodically to continue to assess water quality for IM-3 treatment. The Work Plan should be revised to address this issue. The data collected previously should also be reported in the Work Plan.</p>	Water quality sampling will be conducted monthly at TW-01 as requested and has been added to Exhibit 4.4. Table 2 has been added to the work plan to provide analytical data from TW-01 as requested.
22	4.4	4-6	<p>Last Two Paragraphs: These paragraphs are lacking information or are not clear. For example, it is stated that tracers will be collected in plastic vials, but then it is immediately stated that samples will be collected in amber bottles. Groundwater samples collected for chromium will be collected within standard preserved polypropylene bottles, but bottle types for other analyses are not discussed. The revised Work Plan should contain a table specifying bottle types and preservatives for all analytes. Text should be revised for clarity.</p>	A new table (Table 3) has been added to the work plan that specifies sample parameters accompanied by preparation methods, analytical methods, containers, handling/preservation, and holding times for each parameter. Text in section 4.4 has been revised to reference Table 3.
23	4.5	4-7	<p>A separate section on datalogger analysis should be included in the Work Plan. Assessment of water level fluctuations over time and groundwater flow variations prior to, during</p>	Section 4.5.5 was added to provide detail on the proposed analysis of datalogger data. In addition, a section on pre-test background data collection was added as Section 4.2.1

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			and after pumping should be evaluated. Data visualization software should be considered to depict changing flow dynamics.	describing the methods and types of data that will be collected prior to conducting the test and a section on background data analysis was added as 4.5.1 describing how the background data would be analyzed and used to make corrections to the water level data.
24	4.5.1	4-7	The Work Plan should comment if enhanced monitoring and analysis will be conducted when TW-01 pumping is shut down or terminated. Data and data evaluations should be provided to agencies at least every month.	Data transfer reports will be provided monthly during the pumping portion of the test. Transducers will remain in wells following shutdown as needed to continue the data collection for the trends analysis discussed in Section 4.5.5.
25	4.5.2	4-7	Last Paragraph: Text in this paragraph needs to be revised for clarity. It appears there are a couple of typos. Groundwater parameters (e.g., flow velocity, mobile porosity, hydraulic conductivity) currently used in the TW-1 area should be stated to document current baseline conditions and assumptions.	Text has been edited and current model values for porosity and hydraulic conductivity added.
26	4.5.4	4-8	Data and data evaluations should be provided to agencies at least every month with more frequent reporting at the beginning of the test. The revised Work Plan should include a reporting schedule.	This section has been revised to note that data transfers reports will be provided monthly during the pumping portion of the test. Data evaluations will be presented at TWG meetings.
27	5.1	5-1	The revised Work Plan should contain an updated figure (Exhibit 5.1) that also includes PG&E's preferred new alignment that was walked on January 28, 2021. Alignment designations were in error on this page and should be corrected.	Temporary pipeline alignment has been updated in Drawing C1 and the figure (Exhibit 5.1) has been revised to reflect the final alignment.
28	Exhibit 6.1	6-4	The schedule should be updated in the revised Work Plan. The extended test is proposed to be performed from March 2021 to March 2022 according to the exhibit, yet section 4.3.1 of the Work Plan indicates that, "The planned aquifer test will take place between February and August 2021, so	The schedule has been updated to reflect the current anticipated schedule. The text in 4.3.1 has been updated to read the following: "The planned aquifer test will take place starting in April 2021 and is estimated to conclude in October 2021 depending on the results observed, so the

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			the December-January period of lowest river levels will be avoided.” Please clarify. The pagination should also be corrected	December-January period of lowest river levels will be avoided.”
29		Table 1	Table 1: Request adding bedrock well MW-74-240 to the Monitoring Well Area 2 locations to see if any hydraulic effects are noted in this southernmost location.	MW-74-240 has been added to Monitoring Well Area 2 and is now shown in Table 1 and Figure 10.
30		Figure 2	If at all possible, wells MW-83 and MW-85 should be included on this figure as they are either discussed in text or presented in cross-section F-F’ on Figure 3.	Figure 2 has been updated to include MW-83 and MW-85.
31		Figure 10	Figure 10, Datalogger and Tracer Injection Location Map: Well MW-11, MW-26, MW-40S, MW-40D, and MW-51 should be highlighted according to Table 1.	Monitoring well locations MW-26, MW-40S, MW-40D and MW-51 have been or will be instrumented with the Levellogger Edge or Levellogger 5 as specified by Table 1 and will be highlighted in Figure 10. Monitoring well location MW-11 and MW-11D will be instrumented with the Levellogger 5 LTC and has been highlighted.
Pam Innis DOI, on behalf of BLM, comments from AZ SHPO				
1			<p>Thank you for the opportunity to review the TW-01 Aquifer Test Plan.</p> <p>We have few comments, as follows:</p> <ol style="list-style-type: none"> <li>1. Regarding the temporary pipeline alignment options, we recommend there should be a figure showing the alignments in relation to known historic properties.</li> <li>2. We recognize that water is sacred to tribes, and that tribal knowledge and expertise is most relevant to the implementation of this plan.</li> <li>3. Please keep our office informed of tribal concerns.</li> </ol>	Comment acknowledged.



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<b>Pam Innis DOI, on behalf of BLM, comments from CA SHPO</b>				
1			Please keep SHPO apprised of any Tribal concerns or comments and post- review discoveries of course.	SHPO has been kept apprised of any Tribal concerns or comments and post-review discoveries.
<b>Pam Innis DOI, on behalf of BLM, comments from Quechan Tribe</b>				
1			The Quechan Tribe Historic Preservation on Office concurs with the Tech Memo prepared by the Technical Review Committee submitted by the Cocopah Tribe in regard to the TW-01 Work Plan. We look forward to continuing consultation on this project.	Response acknowledged.
<b>Pam Innis DOI, on behalf of BLM, comments from the Hualapai Tribe</b>				
1			We appreciate the thorough consideration on given to the TW-01 Work Plan by the Technical Review Committee. The Hualapai Tribe concurs with the analysis and recommendations provided by the TRC. Thank you for the opportunity to review and comment on the document.	Response acknowledged.
<b>Pam Innis DOI, on behalf of BLM, comments from the Yavapai-Presco Tribe</b>				
1			I checked with Linda and we don't have any comments on the TW-01 work plan. Thank you for checking in with us - Greg Glassco (Yavapai-Presco )	Response acknowledged.
<b>Pam Innis DOI, on behalf of BLM, comments from the Chemehuevi Tribe</b>				
e			I looked it over and at this time we don't have any comments, however if we have any, we will submit them	Response acknowledged.

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			inwriting to you. Thank you for following up on this - Ron Escobar	
<b>Pam Innis DOI, on behalf of BLM, comments from the Cocopah Tribe</b>				
1			<p>We believe the proposed aquifer testing represents an important step towards better characterizing and conceptualizing important flow and fate/transport of CrVI in the critical source area(s) associated with the compressor station, south of US Highway 95. The Tribes and the TRC have promoted further study of this area for several reasons, including:</p> <ol style="list-style-type: none"> <li>1) This area represents the primary source area of CrVI. At least two sources have been identified in the area, though the exact locations and configurations (i.e., unsaturated/saturated zone) of sources remain unclear.</li> <li>2) Source area concentrations remain consistently the highest over the entire plume.</li> <li>3) The currently proposed Phase II injection/extraction configuration is based on older, limited data, and limited characterization/conceptualization of sources/pathways to the IM-3 area plume. We believe more robust and less impactful alternative Phase II designs/operations may be possible, but would require: <ol style="list-style-type: none"> <li>a. Further characterization of the specific source area near MW-68 is complicated, but our concern remains that this could still be source within the unsaturated zone, that would not be cleaned up by the current proposed BOD remedy, which focuses only on CrVI within the groundwater system (not above the water). This study will help better understand the hydraulic behavior of this area (i.e., the continuous transducer data), which may better reveal the nature of the source area.</li> </ol> </li> </ol>	PG&E agrees that this is an important area of the site to characterize. See response to comment 2 for details on how the work plan is revised to clarify how the work will fulfill these needs.

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			<ul style="list-style-type: none"> <li>b. Updating and refining calibration of the coupled flow and fate/transport models against newly collected data in this area.</li> <li>c. Assessing alternative configurations with updated/calibrated models.</li> </ul>	
2	2	2-1, 2-2	<p>Three major objectives of the TW-01 testing/source area monitoring appear to be missing:</p> <p>1.Characterization of Source Area Missing. Assessment/improved characterization of compressor station source area configuration (i.e., via continuous measurements, concentration variability etc.) is essential to assessing performance of the proposed Basis of Design (BOD) or alternative design/operations. Objectives should clearly show how proposed aquifer hydraulic testing, tracer testing and/or continuous monitoring will help confirm/define the source of persistent/even increasing high concentrations of CrVI near well MW-68 (i.e., confirm/support source area configurations provided in slides 13, 17 and 18 in the July 7, 2020 TWG presentation by Arcadis).</p> <p>Another related objective should be to better define the 3-D source area concentration distributions, and therefore total mass of CrVI currently in place - a key baseline benchmark needed PRIOR to implementing Phase I and 2 system startup. Its needed to provide real-time performance of remedy in reducing overall CrVI concentrations/mass with time - and for ensuring one key Remedial Action Objective (RAO) is met (i.e., plume doesn't expand/move into clean areas.)</p> <p>2. Flow and Fate/Transport CSM updates unclear. A clearly defined flow and fate/transport Conceptual Site Model (CSM) should be a main goal of this work. A clear understanding of critical pathway from two main source areas (Bat Cave Wash [BCW] and MW-68) towards the</p>	<p>The first objective in Section 2 has been revised to more clearly state that the test is being conducted to support an update of the CSM and the flow and fate and transport model.</p> <p>With regard to characterization of the source area, the monitoring of water levels and other parameters with dataloggers and additional Cr(VI) concentration data collection will be used to evaluate the potential CSMs for the residual elevated and fluctuating concentrations at MW-68-180. The last objective in Section 2 has been edited to clarify this aspect of the characterization of source area objective (#1 in this comment), as well as to more clearly state that a CSM update is an objective of this work (#2 in this comment).</p> <p>Further characterization of the 3D source area concentration distribution is beyond the scope of this workplan. As agreed upon during the February 23, 2021 commetn clarification meeting, that item will be retained for future TWG discussions and assessment, in coordination with but not limited to resolutions reached as part of the Soil RFI/RI process, outside of this workplan.</p>

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			<p>River, north of highway and east should be shown. The way it's written, the last bullet indicates 'relationships between CrVI and other constituents will inform the CrVI plume CSM'. Yet, the TW-01 test is primarily a hydraulic aquifer test, supplemented with tracer testing and continuous monitoring, which primarily inform the CSM flow model, but also the CSM fate/transport model. It would be good to clearly state that both flow and fate/transport CSMs will be updated through this important testing (i.e., updated 3-D illustrations with flow/transport arrows, all important flow/fate/transport features, source areas etc.)</p> <p>3. Flow and Fate/Transport Model updates Missing. Though a key objective is to improve the CSM, we believe it is even more important to update/revise calibration of the coupled flow and fate/transport models against new data, to increase reliability/accuracy of predictions of proposed BOD and alternatives. This is a critical outcome of this work, if the models are to be used to assess/promote alternatives to the phase II BOD design/operation, as has been done based on recent TWG presentations</p>	
3	2	2-1, 2-2	<p><b>"Determine aquifer properties"</b></p> <p>This should state 'Determine effective aquifer properties. From proposed tests, derived properties will represent effective properties, or average values across the domain tested. We believe that these properties should vary spatially, based on lithologic texture variability, and that specific yield variations (drainable porosity) ought to mimic variations in mobile porosity for consistency.</p>	Objective has been edited to "effective aquifer properties"
4	2	2-1, 2-2	<p><b>"Evaluate the influence of boundary conditions, including Bat Cave Wash and the bedrock interface."</b> It's unclear how Bat Cave Wash represents a 'boundary condition', as it is not explicitly defined in the Arcadis GW</p>	The primary boundary condition being evaluated in this study is the bedrock interface. The objective has been edited to clarify and to recognize that a secondary objective of the testing is to look at the boundary condition at Bat

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			model (i.e., not included as a river, or focused streambed recharge feature), but should probably be done in both flow and fate/transport models.	<p>Cave Wash, if the opportunity of a storm event presents itself.</p> <p>It is correct that Bat Cave Wash is not an active boundary condition in the groundwater flow and solute transport model due to the infrequency of precipitation events resulting in the short-term active flow conditions in the wash. However, if a significant recharge event occurs during the datalogger collection period, data collected during this event will be useful in further understanding. The objective has been edited to clarify the evaluation of the Bat Cave Wash as a boundary condition and a datalogger has been added to MW-11/D as suggested in Tribes/TRC comment # 18.</p>
5	2	2-1, 2-2	<p><b>“Evaluate the hydraulic influence of extraction and effect on Cr(VI) concentrations in groundwater.”</b></p> <p>Isn't the broader objective here to use the dynamic drawdown response to calculate effective hydraulic properties that can be used to update model inputs?</p>	Yes, by observing the hydraulic response and potential effect on CrVI concentrations, hydraulic parameters can be refined, and the groundwater flow and solute transport model will be updated and recalibrated.
6	2	2-1, 2-2	<p><b>“Evaluate aquifer equilibrium under pumping conditions at TW-0.1”</b></p> <p>This is confusing. Though it is useful to provide what the current model (un-calibrated model in this area) shows as maximum drawdown - the new data should greatly help parameterize aquifer storage parameter values/distributions in the model, to better estimate the timing/magnitude (i.e., hydraulic dispersivity) of any/all induced stresses on the system (i.e., BOD system, but also natural perturbations like River fluctuations or recharge from Bat Cave Wash). We recommend also using the current model to simulate the transient pump test directly, to further calibrate the flow and fate/transport models. The main benefit of using the current model to simulate the aquifer test is that these models</p>	Agreed, modeling conducted prior to TW-01 testing was completed to show the potential hydraulic influence of the test based on the current calibrated groundwater flow model. The groundwater flow and solute transport model will be updated and recalibrated with data from the TW-01 test. Transient calibration of the flow model was added to the description of data analysis in Section 4.5.2.

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			include features (such as the variable bedrock surface) which aren't accounted for in the standard analytic/semi-analytic hydraulic aquifer test methods.	
7	2	2-1, 2-2	<p><b>"The extended test is anticipated to last until steady-state conditions are achieved and the extraction from TW-01 is in equilibrium with aquifer recharge, estimated to occur within 6-8 weeks."</b></p> <p>Aquifer recharge is dynamic and episodic (only occurring during large, infrequent periods – typically monsoons) and derives from multiple sources (i.e., BCW, Western bedrock runoff, distributed, but focused storm runoff on compressor station, highway runoff etc.). As a result, it's difficult to confirm 'steady-state' after only 6-8 weeks. The timing of the proposed 7-day or even 6-8 week 'extended' tests do not appear to line up with the timing of typical episodic BCW runoff/recharge events. Additionally, why does the schedule (Section 6) state the extended test goes for 1 year (March 2021 to March 2022), where it says 6-8 weeks here? Was this determined using the current transient flow model? We strongly recommend extending the aquifer test beyond 6 months and the monitoring as part of the tracer study to a minimum of 2 years. Ideally, the aquifer test should be extended through the months where the gradient is maintained with an inward flow (simulated through November). Additional monitoring suggestions are provided in section 4.4 below.</p>	<p>The 6-8 weeks was specifically an estimate for time to reach equilibrium based on experience with no episodic recharge and the bedrock boundary conditions. This has been clarified in the text for this objective. Other objectives will be met beyond the equilibrium phase, which is why there is an allowance for an extended test duration in Section 6. However, as detailed in RTC to Tribes/TRC comment 10 and DTSC comment 9, the actual duration of the test will be driven by data and the availability of options to manage extracted water. Text in objectives Section 2 and data analysis Section 4.5.4 have been updated to clarify.</p> <p>With regard to non-episodic recharge, the suggestion to add a sonde to MW-11/D in comment # 18 has been incorporated. That data collection can extend beyond the 6–8-week time period to attempt to capture a storm recharge event.</p>
8	2	2-1, 2-2	<p><b>"The 7-day test data will be used to estimate aquifer parameters including permeability and transmissivity."</b></p> <p>The 7-day test will only test a relatively small area around TW-01. Why does the 7-day test only provide permeability and transmissivity? What about the important storage</p>	<p>Agreed that additional aquifer parameters will be determined in the testing. The objectives in Section 2 have been updated to include storativity and anisotropy.</p>

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			terms? What about 3-dimensional K-tensor? What about determining hydraulic connectivity by depth?	
9	2	2-1, 2-2	<p><b>“Water level data collected during the extended test will be used to evaluate the potential influence of the boundary conditions within the TCS area including Bat Cave Wash, bedrock, and the Colorado river boundaries and to assess aquifer equilibrium.”</b></p> <ul style="list-style-type: none"> <li>As specified in the current flow model, only the river and ET are actually specified as boundary conditions. The Bat Cave Wash (BCW) feature is not defined as a boundary condition, nor even defined as a localized feature using specific hydraulic properties. Shouldn't the objective here be to utilize these long-term response data to determine if/how the current flow and fate/transport models should be updated to incorporate such features, if they affect predictions of currently proposed BOD designs/operations and/or alternatives to the BOD, to provide better predictions on performance, and associated decisions?</li> <li>The statement on assessing aquifer equilibrium is unclear. What is the objective of this? It is also not included in Exhibit 2.1.</li> <li>To assess BCW - you must collect continuous monitoring data over a whole year, and closely monitor infrequent but important runoff/high infiltration events (likely less than the 30-minute continuous measurement interval).</li> <li>It would be useful to continuously monitor surface and subsurface flows in BCW - at a much higher frequency than 30 minutes, to capture the complete dynamics of a hydrograph, likely during monsoon events. Ideally</li> </ul>	<p>With regards to the Bat Cave Wash boundary condition, see response to Tribes/TRC comment #4.</p> <p>Dataloggers will be added to MW-11/D as recommended here and in response to Tribes/TRC comment #18.</p> <p>With regard to equilibrium, see response to Tribes/TRC comment #7.</p>

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			shorter frequency readings (i.e., 5-minute intervals) should be collected in BCW for a full year duration to adequately capture these events.	
10	2	2-1, 2-2	<p><b>“The duration of the tracer study is anticipated to be approximately 3 to 6 months. Tracer data will also be collected from the injection wells and used in conjunction with Cr(VI) concentration data collected from monitoring wells during the extended test to evaluate the hydraulic effects of pumping on the aquifer and variations in Cr(VI) concentrations with distance and time. Based on the results of the first 3 to 6 months of data, the duration of constant-rate aquifer test and tracer study may be extended, with approval from the agencies. The extended data, beyond 6 months, would be used to further understand the response of the aquifer and site-specific transport of Cr(VI).”</b></p> <ul style="list-style-type: none"> <li>• We strongly recommend extending the continuous monitoring of tracers, including metals, cations and ions, in surrounding and downgradient wells beyond the proposed 3-6 months (i.e., years). This it will be an important way to monitor longer-term plume movement, from a known source area/concentration and provide better-defined pathways. This will help ongoing revisions and update of the models, and main source area plume, yet to be characterized. The recent detection of tracers that were injected 11 years ago at the In-Situ Pilot Test (ISPT) location in multiple wells shows this can be done for years. It would be an important remedy performance metric in the area of highest concentrations. Further details are provided in section 4.4 below. It’s unclear why extension of the aquifer tests/tracer study might be considered after 3 to 6 months, when steady state drawdowns will be achieved within 6-8 weeks. Also, if the TW-01 pumping and</li> </ul>	The consideration for extending the test will be based on trends in Cr(VI) and tracer data and whether or not options are available for treating the water. Section 4.5.4 has been edited to detail how the Cr(VI) and tracer data will be evaluated to guide the duration of the test, whether to end early or extend.



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			tracer tests start soon, won't it take longer than 3-6 months for BCW runoff events to occur and be reflected in groundwater response in monitored wells? Wouldn't this decision be better made after BCW events (i.e., at least 6-9 months) instead, or even one full annual river stage cycle to include assessment of the influence of this boundary condition on local source area flow, and fate/transport conditions?	
11	3.1	3-2	<p><b>"The results of the active spinner log showed that more than 50 percent of the flow was produced from the middle portion of the screen, suggesting a potential higher permeability zone on this portion of the aquifer."</b></p> <p>The TW-01 boring log reported a relatively coarse zone consisting of well graded sands with some gravels present from approximately 205 to 240 ft bgs. The log indicated more silt content above 205 ft bgs and significantly more fines (silt and clay) below 240 ft bgs. Therefore, the dynamic spinner log results appear consistent with the geologic description in the TW-01 boring log." After review of the lithologic log from TW-01 it appears there is a zone of coarse-grained materials above the bedrock that is not depicted on Figure 4 (CL from 261 – 266). This clay layer located near the bottom of the screen signifies a zone of lower hydraulic conductivity and is in line with the elevation of the screen interval at MW-38D. This could pose a challenge for effective extraction of water injected into the deep well MW-38D. See section 3.2 for further discussion regarding the use of MW-38D.</p>	Potential tracer injection locations, including MW-38S were discussed on the comment clarification call on February 23, 2021. It was agreed to inject at MW-38D and not MW-38S. Clarification and rationale for why the MW-38D well is recommended for tracer injection has been added to the Section 4.1.
12	3.2	3-2, 3-3	We strongly recommend injecting dye into MW-68. Even if the tracer isn't detected during the proposed TW-01 testing short-term (3 to 6 months). The steady state drawdown plot (figure 12) clearly shows notable drawdown could be attained, if TW-01 pumping continued for 1 year, though	An additional, distinct tracer injection at MW-68-180 for the purpose of long term flowpath evaluation has been added to the plan in response to this comment in Section 4.1. This tracer test will be conducted after the analysis of datalogger and groundwater analytical data from compressor station

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			a capture zone plot should also be shown at different times. Even if the current model doesn't show capture after a year, the storage terms in current model need to be updated to better reflect amplitude/phase compared to observed/river fluctuations. These changes to storage could result in much greater drawdown and capture zone extent within a year. Either way - even if tracer at MW-68 is not detected at TW-01 after a year, it could be detected at other wells. The fact that remnant tracer is still detected 11 years after the ISPT in most of these wells strongly suggests substantial benefits can be obtained by continued monitoring of the tracer at MW-68, beyond one year. This can be a useful way to monitor where this highest CrVI source area contamination travels before/during under influence of Phase I, and Phase II. A separate tracer (different than what is introduced in wells near TW-01) should be used to separately track long-term movement from the MW-68 area. This would require adding select wells in Monitoring Well Area II to the sample plan that would be sampled for tracers, metals, anions and cations. See section 4.4 for further details.	monitoring wells to allow for that dataset to be collected without interruption. As such, this injection is not likely to occur until 2022, after the TW-01 pump test is completed.
13	3.2	3-3	<b>“Evaluation of the MW-38D data shows that, since the repair, water levels have been consistent with historical ranges but that Cr(VI) concentrations have been consistently lower than before the repair.”</b> (Page 3-3) Because the repair is associated with damage due to a prior flood event (October 2012), is it possible lower concentrations in the well could be due to dilution caused by associated focused streambed recharge along BCW during this 2012 event?	The most likely explanation for the lower Cr6 concentrations being detected at well MW-38D post 2014 is that the plume has contracted slightly from the uplands area. This is consistent with observations in other wells and with the CSM. It is also possible that dilution from recharge caused the change in concentration, but there was not a change in specific conductance after the repair. In addition, the well has been thoroughly redeveloped and sampled recently confirming the low Cr6 concentration.
14	3.2	3-2, 3-3	This section lacks discussion on the rationale behind the injection wells selected, including the screen depths for injection. For well MW-67 the top screen interval (185) has been selected while the bottom screened interval at MW-	The rationale for the selection of MW-38D and MW-67-185 has been added to Section 4.1. Additional injection locations were considered and discussed at the February 23, 2021 comment clarification meeting. Given the

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			<p>38D has been proposed without any rationale presented in this work plan. Monitor well MW-38D is at and below the elevation of the bottom of TW-01. As previously discussed in comments to section 3.1, this configuration - in addition to the cross-gradient placement and slope of bedrock away from TW-01 - could be problematic in obtaining an effective capture of the tracer from MW-38D at TW-01. This is illustrated in Figure 4. Was there consideration for injection into MW-38S? The shallow well is a better placement for effective extraction at TW-01. The concentration is below the 32 ppb in both of the shallow and deep wells so what other factors determined this selection? The highest concentration of hexavalent chromium detected in MW-67 is in the middle screen, at 225 feet. This middle well screen is within a coarse-grained zone of sand, with silt dominating above and below. We believe this middle sandy zone is the predominant migration pathway for the contaminant mass at this location. What is the rationale behind injection into the upper screen at this well location rather than the middle screen? Since different dyes will be injected into the two well locations there is no concern over differentiating the source well. The rationale for injection depths and well locations should be included in the work plan. We'd appreciate consideration of the above points in the selection of injection depths.</p>	<p>availability of dyes suitable for this application and in consideration of the objectives for different locations, it was agreed to conduct the injections at MW-38D, MW-67-185, and MW-68-180, as the workplan now reflects.</p>
15	3.3	3-3	<p>We propose adding a local meteorological/precipitation gage station on compressor station (that collects data every 5 minutes) to use in evaluating event-level responses/influence detected in continuous monitoring data response. This will allow for later evaluation of event-level runoff effects on GW levels and concentrations and will greatly aid refinements of the CSM.</p>	<p>PG&amp;E will consider adding an automated precipitation gauge in the future. Staff are onsite continuously, so detailed knowledge of precipitation is available.</p>

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16	4.3	4-3	An important oversight in this proposed plan is that analysis of results doesn't appear to include any updates to the current flow and fate/transport models, nor any analysis of data collected during this proposed effort using these updated modeling tools, despite their being the best available tools for analysis (compared to simpler methods). The importance of updating/using these models in this effort can't be over-stated. These models must be shown to reproduce local source area conditions - so that any/all proposed modifications to the BOD (or updated projections of existing BOD) can provide more reliable/accurate/defensible projections of future responses.	Agreed that the fate and transport modeling was not explicitly explained in the draft workplan. Data collected from the TW-01 aquifer test will be used to update and recalibrate the groundwater flow and solute transport model to further evaluate predictive remedy scenarios. Edits to the workplan have been made in Sections 2 (objectives) and Section 4.5 (data analysis) to clarify.
17	4.3	4-3	<p><b>"...the groundwater flow model was run transiently to account for the variations in the Colorado River stage elevation."</b> (page 4-3)</p> <p>Though the river may dominate the observed seasonality in compressor station water levels, other seasonal 'recharge' dynamics may also contribute to this. This potential should be accounted for in the model rather than presuming total river dominance here.</p> <p>Importantly, the recent model performance assessment against 15 years of IM-3 operation (TWG, Dec 15, 2020) clearly showed poor transient calibration (phase and amplitudes) at wells with increasing distance from the river (such as in the compressor station). We recommend that transient calibration of this existing flow model be improved, before doing evaluations like those presented here. At a minimum, the model should be updated using:</p> <ul style="list-style-type: none"> <li>• TW-01 aquifer test results</li> <li>• Tracer testing</li> <li>• Continuous monitoring</li> </ul>	<p>Instantaneous events such as significant storm events potentially resulting in flow in Bat Cave Wash can be evaluated if they occur during the TW-01 aquifer testing and observation period.</p> <p>The groundwater flow and solute transport model will be updated and recalibrated with the findings from the TW-01 aquifer test and tracer study and text describing the transient model calibration has been added to the work plan.</p> <p>The gradient and well pairs are part of the standard performance monitoring program for the interim measure and were designed for that system outside of this workplan. This section is intended to set expectations for how the interim measure gradients near the river will be affected by the TW-01 pump test. Figure 1-4 from the Fourth Quarter 2020 and Annual Interim Measures Performance Monitoring and Site-wide Groundwater and Surface Water Monitoring Report shows the well pairs and is included as part of this work plan as Figure 13.</p>

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			We expect changes in hydraulic properties and storage terms will be required to reproduce these new observed data. In addition, other sources of local recharge should be included in the model. It would be helpful if the well pairs discussed in the second and third paragraph of section 4.3.1 were displayed on the figures and/or had a separate figure with the calculated gradients displayed for clarity. In addition, discussion on how these were determined as part of the simulation and/or calculated should be included. In addition, it would be helpful to display the well pairs in Section 4.3.2 that will be used during the aquifer test data evaluation on one of the figures.	
18	4.4	4-5, 4-6	<p>We strongly suggest the following additions and/or changes to the sampling &amp; analysis plan:</p> <ol style="list-style-type: none"> <li>1.Addition of unique tracer within MW-68-180. This well should be added to the baseline sampling event and the additional tracer sampling. In addition, this well should be sampled for CrVI at a higher frequency than quarterly (recommended monthly) due to the unexplained episodic concentration shifts and the upward concentration trend with time. CrVI concentrations in this well reported in the third quarter are some of the highest reported historically. The episodic nature of the concentrations in this well and the mechanisms causing it are not understood. This assessment should be addressed by way of additional monitoring and testing in this work plan. The information gathered during this test should be used to update the CSM and groundwater model to explain the source area contaminant migration pathways.</li> <li>2.Addition of Levellogger 5 LTC in well pair MW-11/D due to the runoff from the highway and location within BCW.</li> <li>3.The tracer study should be extended to include 1-year and 2-year sampling events at the wells included in the baseline</li> </ol>	<ol style="list-style-type: none"> <li>1. Tracer injection for MW-68-10 has been added to the workplan, planned for the future after the high frequency datalogger and Cr(VI) data collection at MW-68-180 is further along, likely 2022. Monthly sampling of MW-68-180 during this period has been added to Exhibit 4.4.</li> <li>2. Data logger has been added to MW-11/D on Table 1</li> <li>3. A monitoring plan for tracer injected into MW-68-180 will be set forth closer to the time of the injection, likely in 2022</li> </ol>

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			sampling, as well as the addition of MW-98 (aka MW-K), MW-59-100, MW-65-160 and MW-65-225, MW-69-195, and MW-70BR-225 (for 1- and 2-year events only)	
19	4.5	4-7, 4-8	Notably absent from the proposed data analyses here is the interpretation of continuous monitoring of head, conductance, temperature and CrVI data to help revise/improve the current CSM on source area/configuration and pathway dynamics - and influence of surface water runoff infiltration. It is strongly recommended that animations of interpolations of continuous data be developed to visualize how and where stresses propagate through the area monitored.	Section 4.5.5 has been added to the workplan to describe data analysis from the dataloggers in conjunction with Cr(I) data along with other parameters. Visualizations and animations will be developed where the data lends itself to such interpretation.
20	4.5	4-7	<p><b>“The corrected data plots will be analyzed using applicable standard published methods.”</b> (page 4-7)</p> <p>We strongly recommend not relying on overly simplistic, largely inapplicable analytic/semi- analytic aquifer test solutions that don't account for important influencing factors such as the variable bedrock surface. Rather, we suggest the aquifer test be evaluated using the current modflow model, which includes among other important features, the complex 3-D surface bedrock configuration, and variability of hydraulic properties within the unconsolidated material. Importantly - the model should be updated to match observed aquifer test results - to improve its ability to simulate local conditions. This is the one of the biggest benefits of conducting this hydraulic testing. In addition - any changes in CrVI concentrations, or plume shape observed during the testing could also be used to calibrate the fate/transport model in the TW-01 area.</p>	Preliminary assessment of the hydraulic parameters will be conducted using standard analytical tools. The groundwater flow model will also be updated and recalibrated using the hydraulic testing results including a transient simulation of the test to help guide hydraulic parameter values and distribution in the model as suggested.

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21	4.5.2	4-7	Use of these simple equations are misleading. We recommend Arcadis updating/calibrating their flow and fate/transport model to tracer response, which includes important properties/boundary conditions.	Agreed, the analytical equations will help in defining a potential range of hydraulic parameters to be incorporated and refined in the groundwater flow and solute transport model calibration.
22	4.5.3	4-8	It's unclear why this section makes no mention of the important analysis of data logger data and CrVI variations to help assess the CrVI source area near MW-68. Several CrVI source area configurations were presented in a TWG during the summer, which should be assessed through this field testing/evaluation.	This section did explicitly say that data analysis would be done but was not detailed in the TW-01 aquifer test workplan. To address this comment, additional detail has been added and broken out into new Section 4.5.5.
23		Figure 12	It's unclear whether this predicted drawdown was done with IM-3 active, or Phase I active/IM-3 off, or neither? Won't any of these stresses influence how the drawdown/capture plot develop in the simulation? The simulation was conducted for an entire year; however, the aquifer test is being proposed for only 8 weeks. For the purpose of determining the drawdown in the wells that will be influenced by the proposed length of pumping, it would be beneficial to have a figure that depicts this timeframe rather than a simulated timeframe that extends beyond the anticipated length of the test. Although the reason for the yearlong simulation is understood and valuable, the effect based on the proposed length (whether that is determined to be 3, 6, 9 or 12 months) should be provided.	The pumping conditions for the steady state model run were the same as for the transient model run: TW-01 pumping at 90 gpm and TW-03D (IM3 pumping well) at 45 gpm). These are the anticipated conditions during the test. The purpose of the modeling was to look at maximum influence of the extended test beyond 8 weeks. Reverse particle tracks have been added to the figure to provide information on groundwater flow with time.

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<b>DTSC, Aaron Yue, GSU General Comments – March 19, 2021</b>				
A	2	2-1	<p><u>2 Test Objectives and Overview, Page 2-1, Second Bullet:</u> The bullet states that, “...and a secondary objective of evaluating recharge at Bat Cave Wash in the event that a significant storm event occurs during the test.” It is recommended that transducer monitoring continue in select wells along Bat Cave Wash after the test should a significant storm event not occur during the test or if the data collected is inconclusive and could benefit from additional analysis. As a default, it is recommended that data be generated for on full year to monitor both summer floods and winter storms.</p>	<p>PG&amp;E acknowledges the desire to collect data in Bat Cave Wash during a significant precipitation event to better understand aquifer recharge.</p> <p>Section 2.0 (Test Objectives) has been modified as follows:</p> <p>“Evaluate the influence of boundary conditions, with a primary focus on the bedrock interface and a secondary objective of evaluating recharge at Bat Cave Wash during a significant precipitation event. Note that data collection to assess the effects of a significant precipitation event may extend beyond the duration of the TW-01 aquifer test (see Section 4.2.4).”</p> <p>Modified Section 4.2.4 as follows:</p> <p>“To assess the potential impacts to hydraulic gradients from a large storm event, the sampling frequency of select transducers located in wells near Bat Cave Wash will be programmed at the start of the test to measure water levels at 5-minute intervals. Specifically, transducers in wells MW-9, MW-10S, MW-10D, MW-11S, MW-11D, MW-38S, MW-38D, MW-84 (four screens) and MW-85 (control well located outside wash – three screens) will be programmed to collect water level data at a 5-minute frequency. This instrument data collection frequency will continue at least three months past the occurrence of a large precipitation event (i.e. greater than 0.35 inches in a 24-hour) even if it occurs past the end point of the TW-01 aquifer test. This will provide increased data resolution so that more detailed evaluations of the effects of flood conditions in the wash can be evaluated. These data will be analyzed, and the findings will be presented to the agencies and TWG during a forthcoming meeting. The instrument data collection frequency will not be changed in the above listed wells until</p>



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				the agencies provide concurrence that the goals of the infiltration study have been met.”
B	2	2.2	<u>2 Test Objectives and Overview, Page 2-2, Last Paragraph:</u> The sentence states, <i>“The duration of the TW-01 aquifer test will be based upon meeting the objectives described above including objectives that take longer periods of time to meet, such as well-defined trends in tracer arrival and consistent trends in Cr(VI) observed, as described in more detail section 4.5.5. If trends indicate the objectives have been fulfilled, the pumping can be stopped within an approximate 3-6 months timeframe.”</i> For completeness, it should be stated that the test could be stopped earlier should objectives be met early (e.g., early arrival of tracer). Using Cr(VI) trend analysis as a measurable objective could be subjective and may need to be clarified and justified.	The test may be stopped earlier if objectives are met and for completeness, the following text has been modified in section 2, second to last paragraph:  “If trends indicate the objectives have been fulfilled, the pumping can be stopped within an approximate 3-6 month timeframe or earlier should objectives be met earlier than the projected 3-6 month timeframe.”
C	4.2.1	4-3	<u>4.2.1 Background Data Collection, Page 4-3, Second Bullet:</u> PG&E/Arcadis should consider adding a few transducer data loggers to wells just outside the anticipated hydraulic influence of long-term TW-01 pumping to establish long-term background trends and help in assessing aquifer test data interpretation over the long-term.	Dataloggers will be placed at well clusters MW-75, MW-84, and MW-85, outside of the anticipated hydraulic influence of TW-01 to establish long-term background trends. The following text has been added to section 4.2.1 in the Revised TW-01 Aquifer Test Plan.  “In addition, during the test, water level data will be collected via transducers from wells MW-75, 84, and 85 to continue to assess background changes in aquifer water level. These wells are located outside the anticipated of hydraulic effect from test wells TW-01 and TW-03D.”  These 3 well locations have also been added to section 3.3 as being equipped with Levellogger 5s before the start of the TW-01 test, as well as added to Table 1 and Figure 10.

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D	4.3.2	4-6	<p><u>4.3.2 Proposed Monitoring Plan, Page 4-6, Last Paragraph:</u>  The following changes are suggested to meet the intent of IM-3 treatment, "If monitoring indicates <del>a potential risk of</del> significant concentrations of contaminants <del>are occurring in monitored wells, reaching the Colorado River</del> then the TW-01 aquifer test will either be terminated..." DTSC recommends setting the threshold for notification to agencies for evaluation at twice the "startup" concentration or 100 ug/L (whichever is less) just prior to initialing the pump test at all floodplain wells. Startup concentrations for all floodplain wells should be tabulated and provided to DTSC.</p>	<p>PG&amp;E acknowledges this suggestion to track contaminant concentrations and will notify DTSC accordingly as referenced in the proposed text modifications in Section 4.3.2. below.</p> <p>"If monitoring indicates significant concentrations of contaminants are occurring in monitoring wells listed above, then the TW-01 aquifer test will either be terminated, or flow rates will be adjusted at TW-01 and the IM-3 extraction wells to accommodate for contaminate migration. The monitoring data will be evaluated biweekly and agencies will be notified if concentrations exceed twice the concentrations observed at each well before the start of the TW-01 aquifer test or greater than or equal to a Cr(VI) concentration of 100 ug/L (whichever is less). In addition to the biweekly monitoring, other monitoring wells in the floodplain that are part of the IM-3 Performance Monitoring Program will continue to be sampled and results communicated under the existing threshold within that program."</p> <p>Concentrations in the floodplain wells will be tabulated and provided to DTSC before the start of the TW-01 test.</p>
<b>DTSC, Aaron Yue, GSU Specific Comments – March 19, 2021</b>				
1	1.2.3	1-4	<p><u>1.2.3 Cr(VI) Distribution and Trends, Page 1-4, Paragraph 1:</u>  The paragraph states that, "<i>Historical chromium-containing discharges to the East Ravine would have come into direct contact with the bedrock formations; whereas at the TCS, any chromium-containing releases would have reached the Alluvial Aquifer first, explaining the lack of Cr(VI) in bedrock under the TCS.</i>" This write up is too simplistic as bedrock groundwater contamination does exist under the TCS (e.g, MW-69-195) and that the mechanisms for preventing Alluvial</p>	<p>PG&amp;E acknowledges that MW-69-195, where bedrock is shallow in relation to the water table on the southern portion of the TCS, has a different CSM than the central portion of the TCS under the areas of concern that are being discussed as potential sources of Cr(VI) to groundwater in this section. The following edit was made to further clarify where the bedrock does not contain Cr(VI) under the central portion for the TCS,</p>

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			Aquifer contamination from migrating to the Bedrock Aquifer are not specified. Future reports and plans should address these issues and support an improved CSM.	<p>“A small portion of the plume extends into the bedrock near the East Ravine; however, the bedrock beneath the central portion of the TCS does not contain Cr(VI) at MW-66-BR-270 and MW-68BR-280 (CH2M Hill 2014, 2015a, b).”</p> <p>The sentence that is the subject of this comment has been revised to strike out the phrase that does not apply to shallow bedrock:</p> <p><i>“Historical chromium-containing discharges to the East Ravine would have come into direct contact with the bedrock formations; <del>whereas at the TCS, any chromium-containing releases would have reached the Alluvial Aquifer first, explaining the lack of Cr(VI) in bedrock under the TCS.</del>”</i></p> <p>Future reports and plans will incorporate these refinements in the description of the CSM.</p>
2	1.2.4	1-4	<p><u>1.2.4 Total Dissolved Solids, Page 1-4 Paragraph 2:</u> The paragraph states that, “<i>The relatively low specific conductivity at MW-68-180 indicates that Cr(VI) at MW-68-180 is not associated with relatively elevated TDS/specific conductivity.</i>” The cited sentence appears incorrect and may need to be stricken from the document/future documents. The groundwater below the TCS is understood to be naturally stratified with regards to Total Dissolved Solids (TDS) with increasing specific conductance with depth. The TDS variations in shallow and deep groundwater are an expected occurrence and, while different, are related/associated due to aquifer processes. Contamination in the shallow and deep aquifers below MW-68 could emanate from the same soil contamination source. Conceptually, one would expect shallow groundwater contamination close to a soil source to be higher in concentrations than concentrations detected in the deeper aquifer due to distance from the source. Finally,</p>	<p>Comment noted. The statement has been deleted.</p> <p><del>The relatively lower specific conductivity at MW-68-180 indicates that Cr(VI) at MW-68-180 is not associated with relatively elevated TDS/specific conductivity.</del></p>

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			contamination at a source area could also vary over time and “density driving” could also occur making interpretations difficult.	
3	2	2-2	<u>2 Test Objectives and Overview, Page 2-2, Third Paragraph, First Sentence:</u> The sentence states, <i>“The tracer test will be conducted concurrently with the constant-rate aquifer test and potentially extended beyond.”</i> For clarity, this does not apply to the MW-68 tracer that will be added after pumping and then monitored long-term for potentially several years.	This is correct and acknowledged. The text in section 2, third paragraph, has been updated to the following:  “The tracer test will be conducted concurrently with the constant-rate aquifer test and potentially extend beyond the constant-rate aquifer test with the exception of the tracer study at MW-68-180 which will be conducted after the completion of the TW-01 aquifer test.”
4	3.2	3-3	<u>3.2 MW-38D Review and Recommendations, Page 3-3, Third Paragraph:</u> The sentence states, <i>“These trends suggest Cr(VI) concentrations are decreasing as the plume contracts from the west, and that lower concentration water from the west is perhaps slightly more reducing.”</i> Reducing conditions arriving from the west is an entirely new, unsupported CSM for the Topock Project and will require further evaluation and support. Existing literature for Topock essentially indicates that segments of the floodplain deposits are reducing while the uplands are not. Oxidation reduction potential (ORP) measurements illustrated in the Revised Work Plan for well MW-38D document a drastic change in chemistry for two to three years after the well was damaged from a storm event in Bat Cave Wash. Perhaps this chemistry change was related to the storm event which would have allowed surface water to enter the well and aquifer. Perhaps organic material contained in the surface water affected the reduction potential of the aquifer materials surrounding the well. Further investigation is required for this well regarding well chemistry. The chemistry of neighboring wells (e.g., MW-40, MW-U, MW-V, MW-10, and MW-11) should be evaluated to see if significant changes in ORP are common in	A separate memo on the redox conditions surrounding MW-38D will be provided as requested. Please note, that the observation that “perhaps slightly more reducing conditions” are present in groundwater to the west was not meant to imply a strong reducing environment comparable to the conditions in the floodplain are present to the west of MW-38D and it is agreed that interpretation is not supported by the ORP and dissolved oxygen data alone. To avoid speculation about the changes in chemistry in this document, the interpretation of the CSM has been deleted:  <del>“These trends suggest Cr(VI) concentrations are decreasing as the plume contracts from the west, and that lower concentration water from the west is perhaps slightly more reducing. Dilution due to recharge is another potential explanation, but not entirely consistent with the sustained lower concentrations post-repair or the lack of change in specific conductance.”</del>

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			upland wells. Time-series plots for these wells should be prepared similar to those contained in the Revised Work Plan for MW-38D. A separate technical memorandum is requested to address this issue.	
5	4.3.1	4-4	The paragraph states that <i>“Reverse particle tracks to TW-01 posted on the figure provided information on predicted groundwater flow with time.”</i> The figure, Figure 12 for the Revised Work Plan, shows travel times are fastest to the west and slowest to the south of TW-01. This was not expected since bedrock thins to the south, groundwater flow direction and contaminant plume configuration is to the north/northwest, and since the Alluvial Aquifer has been described as being heterogeneously homogeneous with regards to model parameters. Additional discussion regarding this figure and how the model represents site conditions is requested at a future TWG meeting.	Modeled hydraulic conductivity parameters are relatively uniform in the TW-01 testing and source areas and there is no spatial bias in hydraulic conductivity values towards the bedrock to the south. Preferential groundwater flux comes from the thicker portions of the aquifer as radial distance from TW-01 increases. The results of the aquifer testing at TW-01 will be used to refine the CSM and the groundwater flow and transport model. This can be discussed at a future TWG meeting.
<b>DTSC, Aaron Yue, GSU Email Correspondence Comments – April 1, 2021</b>				
1	2	2-1	[Paraphrased from email] We request that the transducer already planned at MW-9 also be changed to a 5-minute frequency as it is located directly within the upper reaches of Bat Cave Wash and conceptually would be more likely to detect infiltration.	<p>Comment is acknowledged and MW-09 will be changed to a 5-minute frequency to capture infiltration into the aquifer.</p> <p>Section 4.2.4, paragraph 2, Sentence 2 has been modified to state the following:</p> <p>“Specifically, transducers in wells <u>MW-9</u>, MW-10S, MW-10D, MW-11S, MW-11D, MW-38S, MW-38D, MW-84 (four screens) and MW-85 (control well located outside wash – three screens) will be programmed to collect water level data at a 5-minute frequency.”</p>

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2	1.2.3	1-4	Regarding Comment 1 [above]: Add wells MW-59 and MW-98 to monitor for tracer long term from 68. MW-68 tracer monitoring may also need to be modified based on evaluation of transducer data and potential groundwater flow direction variations.	<p>Comment is acknowledged and wells MW-59 and the MW-98 cluster have been added to the long-term tracer monitoring network and the following text has been updated in section 4.1, paragraph 3, sentence 3 of the work plan:</p> <p>“Once the tracer injection into MW-68-180 has been completed, the MW-20 cluster, MW-26, <u>MW-59-100</u>, MW-66 cluster, MW-67 cluster, MW-78 cluster, MW-79 cluster, MW-80 cluster, and <u>the MW-98 cluster</u> will be monitored on a quarterly basis for the selected tracer in order to evaluate the flowpath.”</p>
3	2	2-1	<p>In the response [to Comment A above], it states:</p> <p>“This instrument data collection frequency will continue until a large precipitation event occurs even if it occurs past the end point of the TW-01 aquifer test.”</p> <p>The response seems open ended and subject to interpretation. How much time will be collection continue after the rain event? What is considered a large precipitation? One of the reason we suggested data collection for the full year in our original comment is to avoid that ambiguity. The other option is to leave the response open ended, but discontinuation of the data collection will take place with agencies approval after data evaluation.</p>	<p>PG&amp;E acknowledges the desire to collect data in Bat Cave Wash during a significant precipitation event to better understand aquifer recharge.</p> <p>Section 2.0 (Test Objectives) has been modified as follows:</p> <p>“Evaluate the influence of boundary conditions, with a primary focus on the bedrock interface and a secondary objective of evaluating recharge at Bat Cave Wash during a significant precipitation event. Note that data collection to assess the effects of a significant precipitation event may extend beyond the duration of the TW-01 aquifer test (see Section 4.2.4).”</p> <p>Modified Section 4.2.4 as follows:</p> <p>“To assess the potential impacts to hydraulic gradients from a large storm event, the sampling frequency of select transducers located in wells near Bat Cave Wash will be programmed at the start of the test to measure water levels at 5-minute intervals. Specifically, transducers in wells MW-9, MW-10S, MW-10D, MW-11S, MW-11D, MW-38S, MW-38D, MW-84 (four screens) and MW-85 (control well located outside wash – three screens) will be programmed</p>

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				to collect water level data at a 5-minute frequency. This instrument data collection frequency will continue at least three months past the occurrence of a large precipitation event (i.e. greater than 0.35 inches in a 24-hour period) even if it occurs past the end point of the TW-01 aquifer test. This will provide increased data resolution so that more detailed evaluations of the effects of flood conditions in the wash can be evaluated. These data will be analyzed, and the findings will be presented to the agencies and TWG during a forthcoming meeting. The instrument data collection frequency will not be changed in the above-listed wells until the agencies provide concurrence that the goals of the infiltration study have been met."
<b>FMIT Comments</b>				
1	4.1	4-1	<p>It is understood that the injection of a tracer in MW-68-180 will be performed, but after completion of the TW-01 aquifer test. The distinct tracer eosine will be injected into MW-68-180 to provide longer-term information for this area. The last bullet on page 3-5 states that "Details on tracer injection in this location with be set forth closer to the time of the injection, anticipated in 2022." It is assumed that this injection will occur as soon as possible following the completion of the TW-01 aquifer test, and that a specific work plan will be provided prior to performing this task.</p> <p>The Agencies should confirm that a work plan will be prepared and provided for review prior to the execution of the MW-68-180 injection.</p>	<p>In lieu of a separate work plan, PG&amp;E proposes edits to the text in Sections 3.4 and 4.1 to clarify the injection equipment required and the expected monitoring associated with the injection of eosine into MW-68-180. The quantity of the dye injection (25,000 gallons at 50 ppm) is already specified in Section 4.1.</p> <p>Section 3.4 Tracer Test Equipment and Work Zone Setup</p> <ul style="list-style-type: none"> <li>• <i>MW-68-180 is located centrally within the TCS. Injections in this location will use a 20,000-gallon frac tank or 6,000-gallon polypropylene tanks (with secondary containment) for mixing and storing tracer dye. Tracer injections at MW-68-180 are</i> <del>Details on tracer injection in this location with be set forth closer to the time of the injection,</del> <i>anticipated to start in 2022.</i></li> </ul>

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				<p>Section 4.1 Tracer Injections</p> <p><i>“Once the tracer injection into MW-68-180 has been completed, the MW-20 cluster, MW-26, MW-66 cluster, MW-67 cluster, MW-78 cluster, MW-79 cluster, and the MW-80 cluster will be monitored on a quarterly basis for the selected tracer in order to evaluate the flowpath. The monitoring frequency can be adjusted based on actual data obtained, with concurrence from the Agencies.”</i></p>
2	4.2.4	4-4	<p>Episodic flood events in Bat Cave Wash are rapid, short-lived events which may or may not have a long lead time to respond. It would be helpful if there were a reasonable scenario in place whereby when there is likely to be storms in the area, the transducer(s) could already be set to a shorter data collection period. That way, IF there is a storm water event in the wash, it could be captured by the transducers. If the event does not happen, there’s no down side. And if we wait until we are positive there will be flooding in the wash, there may not be sufficient time to respond in updating the transducers. Further thought and planning should happen to make sure these possible events get captured, as there really is no transducer data available which covers such an occurrence.</p>	<p>PG&amp;E acknowledges the desire to collect data in Bat Cave Wash and proposes the following revision to Section 4.2.4:</p> <p><i>“To assess the potential impacts from a <del>if a</del> large storm event is <del>predicted</del> during the period of the TW-01 aquifer test, the sampling frequency of select transducers located in wells near Bat Cave Wash will be reprogrammed to measure water level at 5-minute intervals. Specifically, transducers in wells MW-10S, MW-10D, MW-11S, MW-11D, MW-38S, MW-38D, MW-84 (four screens) and MW-85 (control well located outside wash – three screens) will be reprogrammed to collect water level data at a 5-minute frequency. This would provide increased data resolution so that more detailed evaluations of the effects of flood conditions in the wash can be evaluated. <del>If we are able to capture the water level effects of a large storm, then</del> These data will be analyzed, and the findings will be presented to the agencies and TWG during a forthcoming meeting.”</i></p>
3	5.1 and Figure C2, Detail 1	5-2	<p>What is the standard anchor spacing? Not mentioned in Detail 1, nor in the report text. Please add this information to the future revised TW-01 Aquifer Test Plan report.</p>	<p>Standard anchors are to be installed every 100 linear feet or as directed by the Resident Engineer. Section 5.1 of the Work Plan has been updated to read:</p> <p><i>“Soil anchors may be used approximately every 100 linear feet to anchor the pipeline along the slope in its intended alignment (Drawing C2, detail 1) if deemed necessary during</i></p>



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				<p>installation of the pipeline. <i>Piping will be secured to the National Trails Highway guardrail every third post or approximately 25 linear feet (Drawing C3, detail 8) when the pipeline alignment parallels the National Trails Highway.</i></p> <p>Clarification has also been added to Drawing 3, detail 8 as noted.</p>
4	Drawing C3		Per PG&E (Curt), in the vicinity of the NTH, the pipeline will be anchored to the existing wooden traffic barricades with "truck straps". In the future revised TW-01 Aquifer Test Plan report, please add a new detail which shows this anchoring. Define anchor spacing. Concerned about double contained HDPE pipe expanding out into the NTH during hot summer months.	Concur. A new detail for the truck strap installation has been added to Drawing C3 as Detail 8. Truck Straps will be installed every third guardrail post (estimated to be 25 LF) or as directed by the Resident Engineer.

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