Appendix A
Response to Comments

A1 DTSC and Stakeholder Comments on February 2005 Draft RFI/RI Report

Responses to DTSC and Stakeholder Comments on Sections 2.3 through 2.5 of the February 2005 Draft RFI/RI Report PG&E Topock Compressor Station

Commenting Agencies:

California Department of Toxic Substances Control (DTSC) and Geological Services Unit (GSU)
Arizona Department of Environmental Quality (ADEQ)
Metropolitan Water District of Southern California (MWD)

General Comments on Volume 1

DTSC COMMENT [E-comment S4-1] (3/10/06 GSU Memo, General Comment 1)

The revised RFI Report should include updated discussions that incorporate hydrogeologic data collected since June 2004.

RESPONSE: The revised RFI/RI Report includes updated presentation and discussion using the available hydrogeologic, groundwater characterization, and site monitoring data up through October 2007.

MWD COMMENT [S2-12] (6/30/05 MWD written margin comment, Section 1, page 1-1)

The June 2004 cutoff data for groundwater monitoring data excludes important information. Give the length of time that has passed between June 2004 and the comment deadline for this version of the draft RFI/RI, the data needs to be included.

RESPONSE: The revised Report includes updated presentation and discussion using the available hydrogeologic, groundwater characterization, and site monitoring data up through October 2007.

Section 2.3 (Site Geology)

DTSC COMMENT [S4-2] (3/10/06 GSU Memo, Comment 2)

Page 2-2, Section 2.3.1, first sentence. The reader should be referred to Figure 2-1 instead of Figure 2-2 for an illustration of the regional geomorphic setting.

RESPONSE: The revised Report references the regional topographic map, Figure 3-1, for this discussion.

DTSC COMMENT [S4-3] (3/10/06 GSU Memo, Comment 3)

Page 2-3, Section 2.3.1, first full paragraph. This paragraph should also discuss the dredge spoils that occur in the floodplain area.

RESPONSE: Section 3.5.1.1 in the revised Report discusses the available information on dredging activity and history in the study area.

DTSC COMMENT [S4-4] (3/10/06 GSU Memo, Comment 4)

Page 2-3, Section 2.3.2. This section should be supported by a geologic cross-section that illustrates the regional-scale geologic structure in the site vicinity.

RESPONSE: Appendix B5 in the revised Report includes a regional-scale geologic cross section and geologic maps of the study area.

DTSC COMMENT [S4-5] (3/10/06 GSU Memo, Comment 5)

Page 2-3, Section 2.3.2, last paragraph. This paragraph states that the surface expression of the Chemehuevi detachment fault terminates abruptly on the California side of the river. Please clarify whether the Chemehuevi detachment fault has been definitively shown to terminate on the west side of the Colorado River, or whether there is a possibility that the fault could be inferred to extend eastward into Arizona.

RESPONSE: Section 3.3.2 includes text that clarifies the surface location of the Chemehuevi detachment fault. Appendix B5 includes published geologic maps showing the mapped faults.

DTSC COMMENT [S4-6] (3/10/06 GSU Memo, Comment 6)

Page 2-4, Section 2.3.2, top of page. In addition to the Needles graben fault, the paragraph should discuss other younger faults in the area. For example, a fault cutting Pleistocene alluvium is reported in the vicinity of wells owned by El Paso Natural Gas Company.

RESPONSE: Section 3.3.2 in the revised Report includes text that discusses the younger faults in the area, including the normal fault that offsets alluvium near the El Paso Natural Gas facility in Arizona (location shown on Figure 3-5). Appendix B5 includes published geologic maps showing the mapped faults.

DTSC COMMENT [S4-7] (3/10/06 GSU Memo, Comment 7)

Page 2-4, Section 2.3.2. This section should include a discussion of the predominant lineaments that are observed in the Pre-Tertiary Bedrock and Miocene Conglomerate in the vicinity of the site or in the southern Mohave Valley. The lineament discussion should consider regional and site-specific studies in the area of the Topock Compressor Station.

RESPONSE: Section 3.3.2 in the revised Report includes discussion of the photolineament mapping conducted at the site by PG&E for the evaporation ponds siting. Appendix B5 includes the fault and lineament map from this 1986 study.

DTSC COMMENT [S4-8] (3/10/06 GSU Memo, Comment 8)

2-4, Section 2.3.3.1, first bullet. The description of the Pre-Tertiary Bedrock should acknowledge that relatively few borings have penetrated this unit in the site vicinity. Hence, the stratigraphic description developed based on these borings and a few outcrops may not be representative of the unit characteristics throughout the site area. For example, regional description of this unit and behavior of the unit during the IM3 injection well field drilling indicate that the unit may be highly fractured rather than locally fractured.

RESPONSE: The source and drilling information used for characterizing bedrock is discussed in Section 4.2.1, Figure 4-2, and Section 5.1.1. Additionally, Table B-4 in Appendix B4 includes a listing of the boring that encountered Miocene and pre-Tertiary bedrock. The March 2006 Bedrock Evaluation Technical Memorandum is referenced for additional information on bedrock geology and the potential for fracturing.

DTSC COMMENT [S4-9] (3/10/06 GSU Memo, Comment 9)

Page 2-4, Section 2.3.3.1, second bullet. The description of the Miocene Conglomerate should indicate that the conglomerate is not always red and that the unit is not always present. This paragraph should describe how the Miocene Conglomerate is distinguished in the field relative to reworked conglomerate or other stratigraphic units (e.g., geophysical signature, dipping bedding planes, moisture content).

RESPONSE: Section 3.4.1 discusses the features and criteria used to distinguish the Miocene Conglomerate and Basal Alluvium (reworked conglomerate).

DTSC COMMENT [S4-10] (3/10/06 GSU Memo, Comment 10)

Page 2-5, Section 2.3.3.2, second bullet. Recent drilling results suggest that the basal saline unit may be more appropriately defined as reworked conglomerate.

RESPONSE: Section 3.4.1 discusses the features and criteria used to distinguish the Basal Alluvium (previously referred to as basal saline unit and reworked conglomerate).

DTSC COMMENT [S4-11] (3/10/06 GSU Memo, Comment 11)

Page 2-6, Section 2.3.3.3. This section should also include a stratigraphic description of Reworked Miocene Conglomerate. The description should indicate how this unit is distinguished from other stratigraphic units encountered at the site.

RESPONSE: Section 3.4.1 discusses the features and criteria used to distinguish the Basal Alluvium (previously referred to as basal saline unit and reworked conglomerate).

DTSC COMMENT [S4-12] (3/10/06 GSU Memo, Comment 12)

Page 2-6, Section 2.3.4. This section should provide a conceptual discussion of the interaction between the Colorado River and site groundwater system (e.g., effect of river level fluctuations on groundwater levels and flow directions; mixing between river water and groundwater in the Alluvial Aquifer).

RESPONSE: The revised Report compares groundwater levels in floodplain wells to river fluctuations over selected time intervals (hourly to seasonal) in Section 5.2.3. A discussion of potential mixing between river water and groundwater is provided using stable isotope data in Section 6.5.2. Due to the convergence of natural alluvial groundwater, plume groundwater, and fluvial groundwater/river water in the floodplain, combined with IM pumping influences, estimates of natural mixing are not possible.

DTSC COMMENT [S4-13] (3/10/06 GSU Memo, Comment 13)

Page 2-7, Section 2.3.4, first full sentence. Cite references and/or data that support the statement that "the Miocene conglomerate and crystalline bedrock have very low permeability." Also, discuss whether there is a possibility of preferential flow along fracture systems or faults extending from California into Arizona. Provide a more detailed discussion of the bedrock unit hydrostratigraphy.

RESPONSE: Additional information provided in a Bedrock Evaluation Technical Memorandum will be incorporated as an addendum to this document.

DTSC COMMENT [S4-14] (3/10/06 GSU Memo, Comment 14)

Page 2-7, Section 2.3.4, last two paragraphs. These paragraphs should provide the reader with a better appreciation of the morphology, orientation, discontinuous nature, and fabric of individual alluvial fan and fluvial units. Discuss the potential for (and likely direction of) preferential flow within the alluvial fan and fluvial units. Discuss the potential effect of erosional discussion of the interfingering of alluvial fan and fluvial units and groundwater movement between the two units.

RESPONSE: Discussion on the inferred morphology and features of the alluvial fan deposits has been added to the HSU descriptions in Section 3.4.1.

DTSC COMMENT [S4-50] (3/10/06 GSU Memo, Comment 50)

Table 2-3. Add a note that indicates how the upper, middle, and lower portions of the Alluvial Aquifer are defined. Add a note that indicates where the items listed in the last column can be found in the RFI Report. For the borings, indicate the deeper encountered unit.

RESPONSE: Section 4.2.1.2 and Table 4-2 define the monitoring zone definitions for the FRI/RI drilling and well network. Appendix B4, Table B-4 includes a listing of all wells and borings and the deepest HSU encountered at the drilling locations.

DTSC COMMENT [S4-51] (3/10/06 GSU Memo, Comment 51)

Table 2-4. CH2M HILL (2004) is not included in the reference list. Well MR-24BR should be listed as a pre-Tertiary Bedrock well rather than as a Miocene Conglomerate well.

RESPONSE: Table 4-2 and other listings have been corrected for this well.

DTSC COMMENT [S4-53] (3/10/06 GSU Memo, Comment 53)

Figure 2-1. Please add a note indicating the source of the topographic data. Several places in the report text refer the reader to this figure for an illustration of the regional geologic setting. This figure is not an effective illustration of the Basin and Range terrain.

RESPONSE: The basemap source will be identified on the regional features topographic map (Figure 3-1). More morphologic features and will be annotated on this figure.

DTSC COMMENT [S4-54] (3/10/06 GSU Memo, Comment 54)

Figure 2-2. It would be helpful to the reader if this figure also showed the approximate locations of heavily vegetated areas.

RESPONSE: A recent aerial photograph (Figure 3-2) of the project site has been added to illustrate vegetation.

DTSC COMMENT [S4-55] (3/10/06 GSU Memo, Comment 55)

Figure 2-9. Use a different symbol to indicate that PGE-8 is an injection well (rather than a water supply well). This figure would be more useful if it color-coded the symbols to indicate the completion depth of a boring or well. For completeness, also show all boring and well locations associated with the former evaporation ponds. Also show the additional water supply wells on the Arizona side of the river (e.g., Sanders).

RESPONSE: A recent aerial photograph (Figure 3-2) of the project site has been added to illustrate vegetation.

DTSC COMMENT [S4-56] (3/10/06 GSU Memo, Comment 56)

Figure 2-10. Use a different symbol to indicate that PGE-8 is an injection well (rather than a water supply well).

RESPONSE: Well symbols to distinguish PGE-8 and other well types have been incorporated in Figures 4-2 and 4-4 , and Appendix B well location maps.

MWD COMMENT [S2-31] (6/30/05 MWD written margin comments on Section 2.3, page 2-2)

"The Study area is in the Basin and Range geomorphic province." What is <u>Basin and Range</u>? Do you mean <u>Mojave Desert</u>? "The dominant geologic feature…" What about features associated with the Colorado River?

RESPONSE: Following the usage in the majority of published reports, the Topock site occurs in the southern portion of the regional Basin and Range geologic province. There are several notable geologic features in the vicinity of the site, of which the Chemehuevi Mountains and Colorado River drainage are two. The text in Section 3.3.1 has been clarified to address this comment.

MWD COMMENT [S2-32] (6/30/05 MWD written margin comments on Section 2.3, page 2-3)

"Distinctive, reddish-brown cemented conglomerate of Miocene age (Tmc unit on Figure 2-4) is exposed locally in study area." Sentence is unclear. Is term "locally" correct? Is placement of term

"locally" correct in sentence? "The bedrock basement…" Doesn't note that these are fractured. This section glues the picture that suggests an unfractured and nonpermeable geological structure.

"The most prominent geologic structural feature in the study area is a Miocene-age, <u>low-angle normal fault (referred to as a detachment fault)</u> that forms…" Detachment faults can be rotated to look like normal faults but normal faults are not detachment faults. "The surface expression of the

Chemehuevi detachment fault is evident in the pronounced north-east-southeast lineament (?) that can be traced…terminating at the abrupt…"

Northeast-southeast: Do you mean east-west? Terminating: also mapped in Arizona. "The surface trace of the detachment fault is partially concealed…in the southwestern portion of the study area." Southwestern: western?

RESPONSE: Section 3.3.2 and Section 3.4 have been revised to clarify the descriptions of the units and the detachment fault (see response to DTSC Comment S4-5).

MWD COMMENT [S2-33] (6/30/05 MWD written margin comments on Section 2.3, page 2-4)

"According to the geologic literature (Howard et al. 1997) and PG&E technical reports (PG&E 1995), there is no evidence of continued fault movement on the detachment faults or evidence of other more recent active faulting in the study area. In the eastern portion of the study area (Figure 2-4), a north-northwest trending high-angle..." What about the metering station fault in Arizona? "Figure 2-4 shows the Needles graben fault feature offsets Quaternary deposits..." This is not shown on map. "As noted above, faulting and deformation is confined to the metamorphic and plutonic bedrock complex and the consolidated Miocene conglomerate." Except, what about the metering station fault in Arizona?

Depending on the previous investigation being referenced, one finds that different terms/names are being used for the various units. How do these terms/names used in this document for the various units relate back to previous documents. A table would be helpful.

RESPONSE: Section 3.3.2 in the revised Report includes text that discusses the younger faults in the area, including the normal fault that offsets alluvium near the El Paso Natural Gas facility in Arizona (location shown on Figure 3-5). Appendix B5 includes published geologic maps showing the mapped faults.

MWD COMMENT [S2-34] (6/30/05 MWD written margin comments on Section 2.3, page 2-5)

"The extent of the Miocene conglomerate is not known in the western and northern potions of the site…" Exposed west and northwest of the site. "Basal Saline Unit" Not a stratigraphic unit. Bouse Formation: The tan to pink fine-grained sands below station may also be remnant of Bouse.

RESPONSE: The text statement regarding the extent of the Miocene conglomerate unit (Tmc) referred to the study area outlined on Figure 3-5 (Geologic Map of Study Area). Although equivalent Tmc is mapped far west of the site, this unit is not exposed or has been encountered in borings in the western and northern portions of the area shown on site geologic map (Figure 3-5).

Based on updating the site hydrostratigraphic correlations, we agree the "Basal Saline unit" is not a separate stratigraphic unit but rather exhibits a distinctive geochemical characteristic of the Basal Alluvium stratigraphic unit. Section 3.4.1 discusses the features and criteria used to distinguish the Basal Alluvium (previously referred to as basal saline unit and reworked conglomerate).

Based on outcrop distribution, the fine-grained fluvial sand outcrops noted in this comment appear to be remnants of Colorado River floodplain deposits that are younger than the Bouse Formation, and is consistent with published geologic mapping.

MWD COMMENT [S2-35] (6/30/05 MWD written margin comments on Section 2.3, page 2-6)

"As noted by Metzger and Loeltz (1973), where the Bouse unit is not present, the contact between Older and Oldest Alluvium is not easily resolved in outcrop or identifiable in subsurface drilling locations." Contact can be picked out using geophysics.

"This gravel unit is encountered in a few deep boring locations within the present Colorado River floodplain at depths of approximately 60 to 90 feet below present river level." Omit: of approximately 60 to 90. <Insert> after depths: "greater than 60"

RESPONSE: Although subtle changes in geophysical response are noted in some drilling locations, the available geophysical logs for the site do not provide consistent or conclusive resolution on the contact between the Tertiary Alluvium and the overlying Quaternary Older Alluvium. We believe the statement by Metzger & Loeltz is accurate. Table 3-1 and Section 3.4.1.5 provide updated descriptions of the of the fluvial deposits.

MWD COMMENT [S2-36] (6/30/05 MWD written margin comments on Section 2.3, page 2-7)

"Because the Miocene conglomerate and crystalline bedrock have very low permeabilities, groundwater movement occurs primarily in the overlying unconsolidated deposits." What is this based on? "well-graded, permeable river gravel deposits are also locally present in the floodplain area." These form channels than can communicate over long distances.

"The Alluvial fan hydrostratigraphic units (Table 2-1) consist primarily of clayey/silty sand and clayey gravel deposits (typically 20 to 40 percent clay and silt content) inter-bedded with more porous and permeable sand and gravel deposits. Low-permeability clay layers that could serve as an aquitard (?) within the Alluvial Aquifer have been identified in a few of the wells completed in the study area, but the clay layers appear to be localized and no laterally extensive. Occur more as lenses and channels and not as interbeds.

RESPONSE: The statement regarding groundwater movement in bedrock is consistent with the Metzger & Loeltz regional geohydrologic report for the study area. Table 3-1 and Section 3.4.1 provide clarifying and updated descriptions of the alluvial and fluvial deposits.

MWD COMMENT [S2-52] (6/30/05 MWD written margin comments on Section 2.3, Table 2-1)

Basal Saline Unit? Not a Stratigraphic Unit.

RESPONSE: Section 3.4.1 discusses the features and criteria used to distinguish the Basal Alluvium (previously referred to as basal saline unit and reworked conglomerate).

ADEQ COMMENT [S1-12] (ADEQ 6/28/05 Memo)

Section 2.3.2 – Geologic Structure Figures 2-4 and 2-7. Figure 2-4, the Geologic Map of the Study Area does not project the detachment fault beneath the Colorado River at the bend in the river south of I-40. Figure 2-7 shows this fault extending beneath the river and to Arizona. The two figures should agree with one another, the fault line beneath the river may be inferred or concealed.

RESPONSE: Section 3.3.2 includes text that clarifies the surface location of the Chemehuevi detachment fault. Appendix B5 includes published geologic maps showing the mapped faults.

ADEQ COMMENT [S1-13] (ADEQ 6/28/05 Memo)

Section 2.3.3.1 Bedrock Units. The first bulleted item – aquifer testing results for well PGE08 suggest that fractures in bedrock are not filled in. The transmissivity of the aquifer based on aquifer testing in this well was estimated to be 10,000 gpd/ft in 1969 by Dames and Moore. This suggests that there is viable aquifer in the vicinity of PGE08, regardless of observations in rock outcrops and core samples.

RESPONSE: The revised Report provides a more thorough discussion of the initial short-term pumping test of PGE-8 in Section 5.1.4.2. Additional information from the technical memorandum summarizing the bedrock hydraulic testing in 2007 at PGE-7 and PGE-8 will be included as an addendum to this document.

Section 2.4 (Surface Water Hydrology)

DTSC COMMENT [S4-15] (3/10/06 GSU Memo, Comment 15)

Page 2-8, Section 2.4. Add a Section 2.4.3 that addresses the historical and current dredging operations in the vicinity of the site (e.g., main channel, Park Moabi Slough, Topock Marina). The section should discuss the placement of dredge spoils, as obtained from agency records or as identified through aerial photograph interpretation.

RESPONSE: Section 3.5.1.1 in the revised Report discusses the available information on dredging activity and history in the study area.

DTSC COMMENT [S4-16] (3/10/06 GSU Memo, Comment 16)

Page 2-8, Section 2.4.1. Provide a revised discussion of surface water quality that incorporates recent depth-discrete surface water sampling data.

RESPONSE: Section 7.2 presents the surface water characterization data, including the in-channel depth-discrete data though October 2007.

DTSC COMMENT [S4-17] (3/10/06 GSU Memo, Comment 17)

Page 2-8, Section 2.4.2. It is important for the reader to have a clear understanding of the factors that control the Colorado River level because of its effect on groundwater flow conditions within the floodplain area and elsewhere beneath the site. Please revise this section to include an expanded discussion of the factors controlling river levels near the site (e.g., information obtained from discussions with the U.S. Bureau of Reclamation, observations during the first half of 2005 (e.g., effect of Lake Havasu water level, effect of high precipitation levels within the region)).

RESPONSE: The revised Report includes the requested expanded discussion in Section 5.2.4.

DTSC COMMENT [S4-18] (3/10/06 GSU Memo, Comment 18)

Page 2-8, Section 2.4.2, third paragraph. This section discusses river level data collected in Topock Gorge between through 1980. The section and Figure 2-8a should be updated to include recent river level data that are available for Topock Gorge.

RESPONSE: Section 2.4.2 and Figure 2-8a were provided as an illustration of river fluctuation and trends over a longer period of time, and were not meant to be comprehensive. There are no recent data collected in Topock Gorge.

MWD COMMENT [S2-38] (6/30/05 MWD written margin comments on Section 2.4, Table 2-2)

Anions. Do you mean "Ions"?

RESPONSE: The revised Report has clearer terminology for general chemical parameters in the surface water quality table.

Section 2.5 (Site Hydrogeology)

DTSC COMMENT [S4-19] (3/10/06 GSU Memo, Comment 19)

Page 2-9, Section 2.5.1. Provide a more detailed discussion of the regional hydrogeologic setting that is supported by appropriate literature citations. Discuss how the regional flow system changes near the southern extent of the Mohave groundwater basin. Discuss the fate of groundwater at the southern extent of the groundwater basin.

RESPONSE: The revised Report has expanded the regional hydrogeologic setting using appropriate literature citations in Section 3.6.

DTSC COMMENT [S4-20] (3/10/06 GSU Memo, Comment 20)

Page 2-10, Section 2.5.2. Provide a detailed structural contour map of the top of the Miocene Conglomerate. Use the map to support a discussion of the potential influence of the bedrock surface configuration on groundwater flow.

RESPONSE: Section 5.1.3.1 presents the updated Miocene structure map (Figure 5-9) and discusses the potential influence on groundwater flow.

DTSC COMMENT [S4-21] (3/10/06 GSU Memo, Comment 21)

Page 2-10, Section 2.5.2.1, second full paragraph. Figure 2-9 should show all historical and existing well and boring locations in the site vicinity, regardless of whether installed for the RFI or IM.

RESPONSE: The historical and existing well and boring locations in the defined RFI/RI study area are shown on Figure 4-2 of the text and Appendix Figures B-1 and B-2 (borings and destroyed wells).

DTSC COMMENT [S4-22] (3/10/06 GSU Memo, Comment 22)

Page 2-10, Section 2.5.2.2. Add an east-west hydrogeologic cross-section that extends from the IM 3 injection well field area and through well clusters MW-28, MW-31 and MW-37. Add a north-south cross section through the floodplain area that incorporates recently installed wells (alternatively modify cross-section D-D′). Add figures (e.g., fence diagrams) that provide a three-dimensional perspective of hydrogeologic conditions in key areas of the site.

RESPONSE: Section 5.1.2 present seven hydrogeologic cross-sections that include the well clusters and orientations noted. Figure 5-23 presents a block-view perspective on the hydrogeologic conditions.

DTSC COMMENT [S4-23] (3/10/06 GSU Memo, Comment 23)

Page 2-11, Section 2.5.3. Given the length of the groundwater quality discussion, Sections 2.5.3.1 and 2.5.3.2 should be renumbered as Sections 2.5.3 and 2.5.4, respectively.

RESPONSE: The format of the revised Report was changed significantly from the February 2005 Draft RFI/RI. The revised Report includes a comprehensive discussion of groundwater quality in Section 5.3, along with plume geochemistry in Section 6.5.

DTSC COMMENT [S4-24] (3/10/06 GSU Memo, Comment 24)

Page 2-11, Section 2.5.3.1, first paragraph. Add text indicating that detailed results of tests conducted by CH2M Hill are provided in Appendix A and that citations for reports presenting results of earlier hydraulic tests are provided in Table 2-4.

RESPONSE: The revised Report includes the requested change in Sections 4.3 and 5.1.4.

DTSC COMMENT [S4-25] (3/10/06 GSU Memo, Comment 25)

Page 2-14, Section 2.5.3.2, first paragraph. The sentence presenting the 3,000 milligrams per liter (mg/L) comparative value for total dissolved solids (TDS) concentrations should be deleted. This paragraph should also discuss the basal saline unit.

RESPONSE: The revised Report has been revised to eliminate the reference to 3,000 mg/L TDS Section 5.3 provides a detailed discussion of TDS trends with depth across the site Hydrostratigraphic units are too variable in TDS to estimate average values, and the basal saline unit has been reclassified and combined with other deep alluvial classifications into Toa0.

DTSC COMMENT [S4-26] (3/10/06 GSU Memo, Comment 26)

Page 2-14, Section 2.5.3.2, second and third paragraphs. Provide a more comprehensive discussion of the nature of reducing conditions associated with the fluvial sediments. The following should be addressed: nitrate as an indicator for oxidation/reduction (redox) conditions conducive to hexavalent chromium; presence of higher redox conditions near the base of the Alluvial Aquifer; heterogeneous distribution of redox conditions near the base of the Alluvial Aquifer (e.g., observations at MW-27 well cluster); distinguish between organic content in dredge spoils and organic content in recent fluvial sediments; incorporate data from bench tests and core studies; sediment descriptions (e.g., coloration, grain size) indicative of lower redox zones; effect of surface water mixing on observed redox distribution. Defer effect of reducing zone on the fate and transport of hexavalent chromium to Section 13.0.

RESPONSE: The revised Report includes more detailed discussions of the redox conditions in the floodplain in Section 5.3 and the effect on chromium mobility in Section 6.5.

DTSC COMMENT [S4-27] (3/10/06 GSU Memo, Comment 27)

Page 2-14, Section 2.5.3.2, last paragraph. Three sources of water are apparent from the stable isotope data; river water ($\delta^{18}O$~-12‰; δD~-100‰), un-impacted groundwater ($\delta^{18}O$~-9‰; δD~-70‰), and groundwater associated with the chromium plume ($\delta^{18}O$~-5‰; δD~-50‰). The updated stable isotope data set should be reevaluated using the three end-member working hypothesis. An example evaluation of the three end-members is provided as Attachment A of this (GSU comments) memorandum. The results of this evaluation should be used to support an updated discussion of the site groundwater flow regime, and to provide further insight into (a) the chromium plume migration and (b) the extent of mixing between surface water and Alluvial Aquifer groundwater.

RESPONSE: The revised Report expands the discussion and includes stable isotope data from more recent sampling events. These end members are discussed in Section 6.5.2.

DTSC COMMENT [S4-28] (3/10/06 GSU Memo, Comment 28)

Pages 2-15 through 2-17, Section 2.5.3.2 The groundwater quality discussions on these pages are difficult for the reader to digest because the discussions are organized by hydrostratigraphic unite (e.g., bedrock, alluvial fan deposits, and fluvial deposits). More cogent discussions might result if the groundwater quality discussions were organized under un-impacted groundwater and impacted groundwater, and then subdivided by geographic area, Alluvial Aquifer depth interval, unit type (e.g., bedrock, reworked conglomerate), and surface water dilution effects.

RESPONSE: The revised Report groundwater quality sections have been rewritten for clarity. The suggested presentation structure is used for unimpacted groundwater (Section 5.3) and plume groundwater (Section 6.5).

DTSC COMMENT [S4-29] (3/10/06 GSU Memo, Comment 29)

Page 2-17, Section 2.5.4.1. This section should also discuss the estimated volume of groundwater that is recharged from the Colorado River and how far inland the mixing zone between the Alluvial Aquifer and surface water is observed.

RESPONSE: The revised Report contains an update of the discussion in Section 5.2.4 to clarify the water balance relationship between the river and groundwater. There is a net discharge of groundwater to the river. Only during the spring months (and some years early summer) does the river recharge the alluvial aquifer at the Topock Site area. Further north in Mohave Valley, the river is the main source of groundwater recharge.

DTSC COMMENT [S4-30] (3/10/06 GSU Memo, Comment 30)

Page 2-18, Section 2.5.4.1, second full paragraph. This paragraph should also discuss how far inland diurnal groundwater level fluctuations can be observed. It would be helpful to have a figure showing the observed magnitude of groundwater level fluctuations.

RESPONSE: The revised Report discusses the progressive reduced diurnal fluctuations with increasing distance from River in Section 5.2.4. A representative set of annual transducer hydrographs for wells from floodplain, Bat Cave Wash, and IM3 injection areas are used to graphically illustrate the differences in observed magnitude of the fluctuations.

DTSC COMMENT [S4-31] (3/10/06 GSU Memo, Comment 31)

Page 2-18, Section 2.5.4.1, third full paragraph. This paragraph should refer the reader to Figure 2-8. The paragraph should provide an order of magnitude estimate of recharge volume to bedrock in the Chemehuevi Mountains and to the Alluvial Aquifer adjacent to washes.

RESPONSE: The revised report was anticipated to include numerical model recharge estimates for the bedrock and Alluvial Aquifer, but due to delays in completing additional investigation that will be used for the groundwater model calibration, the estimates will be reported in the CMS.

DTSC COMMENT [S4-32] (3/10/06 GSU Memo, Comment 32)

Page 2-18, Section 2.5.4.2. This section should discuss how consumptive use of groundwater in the area factors into the groundwater budget.

RESPONSE: The revised Report includes a discussion of consumptive use in Section 3.6.3.

DTSC COMMENT [S4-33] (3/10/06 GSU Memo, Comment 33)

Page 2-19, Section 2.5.4.2, first full paragraph. It would be helpful to the reader to include a conceptual diagram showing the regional groundwater flow directions at the southern end of the Mohave Valley.

RESPONSE: The revised Report includes Figure 3-6, presenting a conceptual model of regional flow directions as discussed in the text.

DTSC COMMENT [S4-34] (3/10/06 GSU Memo, Comment 34)

Page 2-20, Section 2.5.5.1, first paragraph. The illustration of horizontal hydraulic gradients outside of the floodplain area should be supported by groundwater elevation contour maps generated using monthly averages of groundwater elevations, rather than the two-year average of groundwater elevations used for Figure 2-21. The time intervals contoured should be representative of high and low river stands.

RESPONSE: Section 5.2.1 of the revised Report discusses horizontal hydraulic gradients outside the floodplain area using groundwater elevation maps made using selected monthly averages of groundwater elevations.

DTSC COMMENT [S4-35] (3/10/06 GSU Memo, Comment 35)

Page 2-20, Section 2.5.5.2. This section discusses an upward vertical gradient between well PGE-08 and well MW-9 and refers the reader to Table 2-6. However, Table 2-6 does not present vertical gradient calculations for this well pair.

RESPONSE: The revised Report includes data with respect to PGE-8 and MW-9 in the table, now renumbered Table 5-3.

DTSC COMMENT [S4-36] (3/10/06 GSU Memo, Comment 36)

Page 2-20, Section 2.5.6. Please begin the discussion of the numerical groundwater flow model by describing the model purpose, objectives, current applications, and future applications. Refer the reader to the Revised Groundwater Flow Model Report for a detailed discussion of the model.

RESPONSE: The revised Report briefly describes the model in Section 4.2.7, and components of model input are provided in the hydrologic budget and hydraulic properties sections. Due to delays in completing additional investigation that will be used for the groundwater model calibration, , neither a complete description nor a reference to a completed report are possible at this time.

DTSC COMMENT [S4-57] (3/10/06 GSU Memo, Comment 57)

Figure 2-15. This figure would be more effective if the TDS data were presented in three or four panels (e.g., upper, middle, and lower depth intervals of Alluvial Aquifer, bedrock).

RESPONSE: The revised Report includes posting TDS data by depth interval in Figure 5-17 to aid in identifying the similarities and differences with depth within the Alluvial Aquifer.

DTSC COMMENT [S4-58] (3/10/06 GSU Memo, Comment 58)

Figure 2-16a. This figure does not effectively depict the stable isotope data for several reasons. First, the shades of green are difficult for the reader to distinguish. Second, too much data is presented. Third, presenting the data by stratigraphic unit is not effective. The figure should be revised to present all available data, to present the data more clearly, to illustrate the three water sources at the site (source water, river water, impacted groundwater, unimpacted groundwater), and to illustrate zones of mixing between water sources.

RESPONSE: The revised Report includes a revised graphical presentation of isotope data to clearly present all of the data, and to reflect differences related to origin and/or mixing of water.

DTSC COMMENT [S4-59] (3/10/06 GSU Memo, Comment 59)

Figure 2-16b. Please revise this figure to include the same scale for well MW-39-100 as is used for the other wells screened in the lower portion of the Alluvial Aquifer.

RESPONSE: The revised Report includes all Stiff diagrams in Appendix F, at a consistent scale for wells in each TDS category.

DTSC COMMENT [S4-60] (3/10/06 GSU Memo, Comment 60)

Figure 2-17. This figure would be more effective if the temperature data were presented in three of four panels (e.g., upper, middle, and lower depth intervals of Alluvial Aquifer, bedrock).

RESPONSE: The revised Report includes a color-coded posting of temperature data by depth interval in Figure 5-19.

MWD COMMENT [S2-37] (6/30/05 MWD written margin comments on Section 2.5, page 2-8)

"Surface Water Hydrogeology" Section does not discuss: man-made changes to the river. For example, the current river channel and Park Moabi Slough that has been dredged and lined with riprap.

RESPONSE: Section 3.5.1 provides description and information on the river channel features including the man-made effects (dredging and riprap).

MWD COMMENT [S2-38] (6/30/05 MWD written margin comments on Section 2.5, page 2-8)

"water quality results for Colorado River surface water samples are summarized in this section for ambient surface water quality characteristics." Average values only. Please provide background water quality data. "Surface Water Sampling" Section: The description of the sample is incomplete. Samples were only taken 6 inches from the surface. No vertical column sampling.

RESPONSE: Table 5-3 presents an updated summary of the surface water quality data and Section 5.3.3 provides discussion. The Report has been updated with more complete background water chemistry and includes the more recent in-channel surface water sampling in the discussion of surface water quality characterization. Complete analytical results can be found in Appendix H.

MWD COMMENT [S2-39] (6/30/05 MWD written margin comments on Section 2.5, page 2-9)

"The study area is located within the Sonoran Desert region of the Basin and Range…" Mojave Desert?

RESPONSE: Following the usage in the majority of published reports, the Topock site occurs in the southern portion of the regional Basin and Range geologic province (see Section 3.1).

MWD COMMENT [S2-40] (6/30/05 MWD written margin comments on Section 2.5, page 2-11)

"Key wells shown include the new IM groundwater extraction wells TW-2D and TW-2S, the multi-level well clusters MW-39 and MW-36 installed on the floodplain, and the sentry monitoring MW-34 well pair…" MW-34 recently deepened showing depth to bedrock is deeper with coarse gravels overlying bedrock. Very low storativity is also expected.

RESPONSE: Sections 3.4.1 and 5.1.4 present descriptions of the site hydrogeologic features and hydraulic properties of the site HSUs that have been updated with findings from the recent investigations.

MWD COMMENT [S2-41] (6/30/05 MWD written margin comments on Section 2.5, page 2-12)

Short-duration single well tests also have limitations due to well interferences, etc.

RESPONSE: The revised Report clarifies the features of short-term aquifer tests in the hydraulic testing discussion (Section 5.1.4). The point is made that longer-term aquifer tests represent the best set of test data, and will be used in model calibration.

MWD COMMENT [S2-42] (6/30/05 MWD written margin comments on Section 2.5, page 2-13)

"Evaluation of the data yielded an estimated transmissivity of 3,000 ft^2/day and a hydraulic conductivity of 30 ft/day ($1x10^{-4}$ m/s)". Average K over volume of aquifer influenced. Are there any springs in the Chemehuevi Mountains?

RESPONSE: The comment on hydraulic parameters is noted. There are no known springs in the Chemehuevi Mountains.

MWD COMMENT [S2-43] (6/30/05 MWD written margin comments on Section 2.5, page 2-14)

"For comparison purposes, the State of California does not consider groundwater with TDS concentrations above 3,000 mg/L to be a source of drinking water (SWRCB)." Note that the state has already designated this as a beneficial use aquifer. Please provide contours for Figure 2-15

"Low TDS is found in shallow fluvial wells close to the river and in the western parts of the state." What about vertically? What about dissolved O_2 levels? "Organic natural, probably from vegetation in the Topock marsh area, was incorporated into the fluvial sediments. Some of these organic-rich sediments…" Top 15 feet to 20 feet of sediment but not necessarily in active channel.

"Concentrations are reported in parts per thousand (or per millivolt) relative to standard mean ocean water. Samples plotting some distance below this line probably indicate evaporative processes are at work, which enrich the water in ^{IB}O relative to deuterium."

Omit: "..volt" and <insert> "0/00" <insert> heavier between "the" and "water", Omit "relative to" and <insert> "and"

RESPONSE: The revised Report includes additional discussion of the groundwater quality data including TDS distribution (lateral and vertical) incorporating data collected through October 2007. The comment on organic matter in fluvial deposits is noted. The revised Report includes additional discussion and provides updated information on the geochemical characterization of groundwater. Refer to Section 5.3

MWD COMMENT [S2-44] (6/30/05 MWD written margin comments on Section 2.5, page 2-15)

How do these values compare to local rainfall? What about past river water prior to dams? Are these influenced by PG&E discharges?

RESPONSE: The revised Report includes isotopic data for local rainfall.

MWD COMMENT [S2-45] (6/30/05 MWD written margin comments on Section 2.5, page 2-16)

Influenced by discharges to Bat Cave wash? Density driven flow? Isotopic variation may also reflect the heterogeneous nature of the alluvium, with heavier signatures indicating more stagnant zones." Why? Older water is generally lighter. "That well is screened in a lower-permeability zone, supporting the interpretation discussed above." Clarification need: Not clear as to which interpretation being influenced.

RESPONSE: The revised Report provides updated information on stable isotope data and reinterprets these data in Sections 5.3 and 6.5.

MWD COMMENT [S2-46] (6/30/05 MWD written margin comments on Section 2.5, page 2-17)

Perhaps a table or flowchart of the Groundwater Budget would help the discussion.

RESPONSE: The revised Report lists groundwater budget components but does not provide quantification of each component, since the model has not yet been calibrated. These quantifications will be provided in the CMS.

MWD COMMENT [S2-47] (6/30/05 MWD written margin comments on Section 2.5, page 2-18)

"Locally, in the study area, principal recharge to the groundwater system is from precipitation on the nearby mountains and infiltration from the intermittent flows in the desert washes." What is the basis for that conclusion? What are the budget estimates for recharge? "At that rate, there is virtually no direct recharge of groundwater from site rainfall." This appears to contradict paragraph above.

RESPONSE: This discussion, now in Section 3.6, has been revised for clarity. Isotopic data support the conclusion that local groundwater is derived from local recharge as opposed to Colorado River-influenced water.

MWD COMMENT [S2-48] (6/30/05 MWD written margin comments on Section 2.5, page 2-19)

This paragraph suggests that the river is the source of recharge. "Groundwater at the Topock site is recharged primarily from local precipitation rather than from the Colorado River." What is the basis for this conclusion? What are the budget estimates for discharge? What influence from flows in Bat Cave wash?

RESPONSE: The revised Report has been revised to state that local groundwater is derived primarily from local recharge.

MWD COMMENT [S2-49] (6/30/05 MWD written margin comments on Section 2.5, page 2-19)

Average gradients will be influenced by the duration of period used.

RESPONSE: Comment noted. The revised Report provides an updated discussion and presentation on the horizontal and vertical hydraulic gradients.

MWD COMMENT [S2-50] (6/30/05 MWD written margin comments on Section 2.5, page 2-20)

"Groundwater elevations from the upper, middle, and lower portion of the alluvial aquifer in June 2004 are shown and contoured in Figures 2-22A through 2-22C, respectively." There are very limited, i.e. snapshot. Elevations vary daily, weekly, monthly and annually. "As described in Section 2.4, the limited amount of rainfall recharge in the nearby mountains enters the Alluvial Aquifer via upward seepage from the bedrock underlying the Alluvial Aquifer." This suggests the bedrock is a viable conductor for groundwater movement and therefore contaminant transport.

"It is evident that the direction of groundwater gradient near the river changes during the course of each day seasonally in response to changes in river level (Section 2.4.2)." Unclear. Do you mean to say "each day" and "seasonally"? Inconsistencies on how groundwater moves onsite. This argument is counter to earlier comments. "There are no apparent continuous aquitards present at the site." Need nested bedrock well to show this.

RESPONSE: The revised Report provides an updated discussion and presentation on the horizontal and vertical hydraulic gradients in Section 5.2. When published, the Bedrock Evaluation Technical Memorandum will provide further interpretation of bedrock groundwater hydraulic characteristics.

MWD COMMENT [S2-51] (6/30/05 MWD written margin comments on Section 2.5, page 2-21)

"Water budget is represented…" This section needs to be updated.

RESPONSE: Groundwater budget is discussed in Section 3.6 of the revised report. Quantification of budget components will be provided under separate cover when the current groundwater model is calibrated.

MWD COMMENT (6/30/05 MWD written margin comments on Table 2-4)

Casing Diameter? Borehole Diameter?

RESPONSE: The hydraulic testing summary presented in Table 5-1 identifies the casing and borehole diameters.

MWD COMMENT (6/30/05 MWD written margin comments on Table 2-5)

"Background Groundwater wells" Identified as background historically. Not current. Can not find reference to Table 2.5 in the text.

RESPONSE: This table has been removed from the RFI and replaced with discussion of Background Study conclusions and comparisons of background concentrations with site COPCs.

MWD COMMENT [S2-57] (6/30/05 MWD written margin comments on Figure 2-19)

"River Level at 1-3". Do you mean River temperature?

RESPONSE: The revised Report includes an updated and clarified river temperature summary graph.

ADEQ COMMENT [S1-1] (6/28/05 Memo, Section 2.5)

In several places, Volume 1 of the RFI discusses upward vertical groundwater gradients reportedly observed in the bedrock aquifer (for example page 2-18, second line from top). Supporting documentation (such as spinner logs) was not found in the RFI to substantiate this conclusion. Please provide supporting data, and refer to tables and spinner logs provided in the RFI. ADEQ wishes to note that very few wells have been installed to intersect and monitor the bedrock aquifer.

RESPONSE: Table 2-6 and Section 2.5.5.2 of the February 2005 Draft RFI/RI present and describe the vertical hydraulic gradients measured in site well clusters. Spinner logging is a technique typically used to measure and evaluate horizontal inflow to a well screen during pumping. The February 2005 Draft RFI/RI also included summary plots and a description of the spinner "production" logs for two test wells completed in the Alluvial Aquifer (TW-1 and TW-2D). However, the spinner logging activity in these wells cannot provide data for evaluating vertical hydraulic gradients between the bedrock and the Alluvial Aquifer, since these wells are screened only in the Alluvial Aquifer. All information regarding vertical gradients is incorporated in the revised Report.

ADEQ COMMENT [S1-14] (6/28/05 Memo, Section 2.5.3.1 Hydraulic Properties)

Bedrock Units – The section of text regarding bedrock units does not include aquifer testing results for PGE08 which provide aquifer properties for the bedrock aquifer in this area. Aquifer testing in this well resulted in a calculated transmissivity of 10,000 gpd/ft2 (referenced in 4.1.2.1). This transmissivity does not suggest that the zone or bedrock aquifer yields "very little to moderate volumes of water", as described in the second sentence under Bedrock Units (although this may be true in some areas of the site).

It is important to note that aquifer properties in the bedrock aquifer may vary from location to location, depending on the degree of interconnectedness of the fractures and presence of faults (such as the detachment fault located beneath the facility and crossing the river) that may result in increased transmissivity in a preferential direction.

Flow and Gradients – spinner logs were not found in Volume 3 to support discussion regarding reduced flow in the bottom of TW-1 and variable flow. Spinner logs were not found in the RFI to support the statements regarding preferential flow paths within the alluvium (page 2-13 first paragraph). It would be helpful to provide the spinner log printouts in Volume 3 as supporting data.

RESPONSE: A more complete description of the PGE-8 test and qualitative assessment of hydraulic characteristics of the bedrock zone at this site location will be provided in the bedrock testing technical memorandum, to be released as an addendum to this report.

ADEQ COMMENT [S1-15] (6/28/05 Memo)

Section 2.5.3.2 Groundwater Quality, Page 2-14 first paragraph TDS. "Most site monitoring wells are in the 1,000 to 8,000 mg/L range. For comparative purposes, the State of California does not consider groundwater with TDS concentrations above 3,000 mg/L to be a source of drinking water." In terms of ARARs it may be important to note here and in other locations that in Arizona all aquifers which yield 5 gallons per day or more are protected for drinking water use, regardless of TDS or other water quality parameters. This information is provided in the event that either connection through bedrock aquifers or preferential pathways are found to exist and be possible conduits for groundwater containing Cr(VI).

RESPONSE: Table 6-1 presents the applicable or relevant and appropriate requirements for groundwater (state and federal primary and secondary MCLs) are identified as required by CERCLA.

ADEQ COMMENT [S1-16] (6/28/05 Memo)

Section 2.5.4 Groundwater Budget. Section 2.5.4.1 Groundwater Recharge, page 2-18 first sentence – "upward flow from bedrock". Please provide supporting data in Volume 3.

RESPONSE: Quantification of recharge and discharge components will be completed following model calibration.

ADEQ COMMENT [S1-17] (6/28/05 Memo)

Section 2.5.4.2 page 2-18 Groundwater Discharge "Upward hydraulic gradients typically observed in well clusters at the Topock site are consistent with this regional flow pattern." Please provide supporting documentation (such as spinner logs showing this) in Volume 3 or refer to tables containing supporting data. Provide details in this paragraph regarding which well clusters show indication of upward gradients or refer to the section of the RFI where this information is provided.

RESPONSE: The revised Report describes the available data and observations regarding vertical gradients in well clusters at the site in Section 5.2.2.

ADEQ COMMENT [S1-18] (6/28/05 Memo)

Section 2.5.5 Groundwater Gradients and Flow. Section 2.5.5.2 Vertical Gradients page 2-20 Text should note that the gradients shown in Table 2-6 are generally very slight (thousandths of a foot/ft).

RESPONSE: The revised Report describes the available data and observations regarding vertical gradients in well clusters at the site in Section 5.2.2.

ADEQ COMMENT [S1-19] (6/28/05 Memo)

Section 2.5 page 2-21 third paragraph Sacramento Wash Influence – The RFI states "2) constant flux along part of the eastern boundary representing groundwater flow associated with Sacramento Wash drainage" as an influence in the study area. Data collected by ADEQ suggests that groundwater withdrawal from water production wells may equal or exceed sub-flow from the wash in this part of the groundwater basin in Arizona (see previous memorandums prepared by ADEQ and submitted to CA DTSC on groundwater usage in Arizona). In addition, the marsh itself may act as a sink, due to evaporation/evapotranspiration.

Please note that field information will be forth coming regarding the rate of withdrawal for the Serrano well. Field observations during portable well sampling strongly suggest that this well which supplies water for a nursery/growing yard may be pumping 24 hours, 7 days a week. This well is located north of and adjacent to Sacramento Wash and ADEQ believes that this well may further act to counterbalance the influence of Sacramento Wash on groundwater flow in Arizona along the Colorado River.

RESPONSE: The revised Report provides additional discussion of the groundwater recharge and discharge estimated for the portion of Arizona immediately east of the site in Section 3.6. Available data compiled since the 2005 RFI indicates that subflow from the Sacramento Wash exceeds groundwater withdrawal (including the cited Serrano well extractions recently provided by ADEQ) by a factor of 2 to 3. In addition, Refuge records indicate marsh levels are maintained above river levels, suggesting the marsh functions for local groundwater recharge rather than discharge. Quantification of recharge and discharge components will be completed when the current model is calibrated.

ADEQ COMMENT [SI-20] (6/28/05 Memo)

Table 2-4 Summary of Well and Aquifer Tests and Estimated Hydraulic Properties - As part of this table, please provide a note regarding the source of information for listed aquifer thickness - is this the screened interval of the well or are these numbers based on boring logs, geophysical logs and other data? This question is important and relates to the accuracy of the calculated aquifer properties.

RESPONSE: The revised Report will include an updated and clarified summary and table of the aquifer tests and evaluation completed through March 2007.

ADEQ COMMENT [SI-21] (6/28/05 Memo)

Figure 2-16a Groundwater and Surface Water Stable Isotope Plot – where does cycled cooling tower blowdown (CTBD) plot on this figure? Samples of CTBD should be analyzed and compared

to the standard meteoric water line and other samples. (CTBD should also be plotted on trilinear diagrams along with well data.)

RESPONSE: The revised Report includes an updated and clarified summary of groundwater and surface water and estimates the isotopic ranges of the industrial and non-industrial sources. We were unable to analyze a current cooling tower blowdown sample for stable isotope data, but it is very likely to be much different than that discharged to form the plume, since the water was kept in circulation longer in the early days of operation.

ADEQ COMMENT [SI-22] (6/28/05 Memo)

Figure 2-20 River and Groundwater Elevations – There is a scale change between the two graphs on this figure. To allow comparison, the two graphs should be plotted on the same scale. The time scales are also different between these two graphs.

RESPONSE: The revised Report includes updated and clarified hydrographs (on common scale) of river and groundwater elevations.

ADEQ COMMENT [S1-23] (6/28/05 Memo)

Figure 2-22, 2-22b, 22c Groundwater Contour Maps – Please verify that elevations in extraction wells are not being used for contouring. Or if they are, are they being corrected for well in-efficiencies? How were wells selected for this contouring? Selection of wells for contouring can affect the outcome of contouring and selection criteria should be explained as a part of documentation. What was considered as the break off point for Upper Unconsolidated Aquifer/Alluvium?

RESPONSE: PG&E agrees that extraction wells are not reliable data points for water level contouring. Further, because well inefficiencies can be significant, but are difficult to estimate, none of the PG&E published reports including the RFI, have used extraction wells water levels, corrected or uncorrected. The revised Report includes representative groundwater gradient maps for the IM performance monitoring area and site-wide shallow well groundwater gradient maps. Refer to Section 5.2.1.

ADEQ COMMENT [S1-24] (6/28/05 Memo)

Groundwater Contouring – It would be appropriate for the RFI to provide contour maps for periods when the river is a gaining stream and losing stream. June is typically a transition month. It would be helpful to show the extremes (loosing and gaining periods) and the transitional period in terms of adequately depicting the system.

RESPONSE: The revised Report includes representative gradient maps from summer and winter seasons to illustrate the range of hydraulic conditions. Refer to Section 5.2.1.

ADEQ COMMENT [S1-25] (6/28/05 Memo)

From examining Figure 2-22c – it appears that only 3 wells in close proximity were used for contouring in conjunction with MW34-80 and possibly river elevations. Contouring is a subjective process that is made more complicated, if vertical gradients are present. Please provide explanation for use of river elevations in groundwater contouring and for using a very limited number of wells in creating this figure. Contouring does not currently include newly installed wells such as MW-34-100. It is possible that additional wells may be needed to adequately contour this zone.

RESPONSE: The revised Report includes groundwater gradient maps for depth intervals in the floodplain area (from IM performance monitoring reporting) using previously existing and newly installed monitoring wells (2005-2007). The revised Report qualifies the depths and distribution of well screen/data available to map gradients in the actively pumped IM area. Refer to Section 5.2.1.

DTSC RFI Response to Comments - PART B

Responses to DTSC and Stakeholder Comments on Sections 9, 10, 11, and 13 of the February 2005 Draft RFI/RI Report PG&E Topock Compressor Station

Commenting Agencies:

California Department of Toxic Substances Control (DTSC) & Geological Services Unit (GSU)
Colorado River Basin Regional Water Quality Control Board (CRWQCB)
Arizona Department of Environmental Quality (ADEQ)
Metropolitan Water District of Southern California (MWD)
Fort Mohave Indian Tribe (FMIT), Technical Consultant Hargis + Associates

Section 9 (Implementation of the RFI)

DTSC COMMENT (6/27/06 GSU Memo, General Comment 1, Section 9)

GSU will provide comments on the data gaps in the bedrock investigation in a separate memorandum. These comments will consider the document entitled "Information Review of Groundwater Conditions in Bedrock Formations at PG&E's Topock Compressor Station, Needles, California" dated March 15, 2006.

RESPONSE: Noted. DTSC's November 3, 2006 letter to PG&E included GSU comments and recommendations for additional bedrock characterization (GSU memorandum dated July 20, 2006), and requested a work plan for implementing these recommendations. On November 10, 2006, PG&E submitted the *Work Plan for Hydraulic Testing in Bedrock Wells* to address GSU's comments and recommendations.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 1)

Page 9-2, Section 9.1.3, last paragraph: Please elaborate on what is meant by "additional work to better define the groundwater plume boundaries and mechanisms."

RESPONSE: The summary of information and results presented in the February 2005 draft Report was based on site data collected through June 2004. The cited text acknowledged that additional investigations and monitoring were in progress and planned, and that these results and data would be helpful in refining the groundwater plume boundaries and mechanisms.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 2)

Page 9-3, Section 9.2. The list of documents seems incomplete because it does not include work plans for data collected prior to 1997.

RESPONSE: The intent of Section 9.2 was to list the work plans prepared specifically for the RFI in accordance with the 1996 Corrective Action Consent Agreement (CACA). PG&E's investigations that pre-date the CACA include the drilling, installation, and sampling of groundwater monitoring wells at the Old Evaporation Ponds site (1985-1993), and the drilling, installation, and sampling of groundwater monitoring wells at the New Evaporation Ponds site (1986-1989). These pre-RFI work plans have been cited in Section 4.3 and included in the Reference section.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 3)

Page 9.10, Section 9.3.4.1. Please elaborate on the criteria that were used to determine whether historical data should be included in the RFI Report.

RESPONSE: The historical (pre-RFI) data pertaining to site hydrogeology and groundwater conditions were summarized in the *Current Conditions Report* (Alisto 1997). The historical data most applicable for incorporation in the RFI include the well drilling logs and well testing data for the following investigations: PGE-series supply and injection wells, Old Ponds site investigations, New Ponds site investigations, Park Moabi water supply well, and the Caltrans exploratory borings for the I-40 bridge. The historical water quality data and groundwater elevation data from pre-RFI investigations are useful for general site assessment but are not recommended for full evaluation and analysis in the final RFI groundwater characterization. This is because of the variations and uncertainty of sample collection and analytical methods, and the infeasibility of completing data QC review, and validation of the historical chemical data.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 9)

Table 9-1: Please include PGE-01 and PGE-02 on this table.

RESPONSE: Table 4-2 and Appendix B2 tables include these decommissioned/abandoned industrial supply wells.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 10)

Table 9-2: This table should also summarize the groundwater data collected in the vicinity of the Old Evaporation Ponds.

RESPONSE: Section 4.3.2 provides citation of the reports where the re-RFI groundwater analytical data is presented. In confirming the assumptions for this RFI/RI with DTSC, it was agreed that Volume 2 would only present and discuss the analytical data collected under the RFI/RI work plans and data review program; hence, the Old Evaporation Ponds data have not been included.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 12)

Figure 9-1: The summary of pre-RFI activities seems incomplete. Examples of missing data collection activities include groundwater sampling at the Old Evaporation Ponds and data collection for the background soil data set presented in the RFI Report.

RESPONSE: Figure 4-1 has been updated to include the pre-RFI drilling and dates of the historical groundwater sampling conducted by PG&E at the Old Ponds and New Ponds sites.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 13)

Figure 9-2: Please include decommissioned/abandoned wells on this figure (e.g., PGE-01, PGE-02, Old Evaporation Pond wells). It would be helpful to color code the wells by the monitored zone (e.g., upper depth interval, bedrock).

RESPONSE: Appendix B, Figure B-2 shows the locations of decommissioned/abandoned wells. Figure 4-5 (Groundwater Sampling Locations) uses color-coding to distinguish the different monitoring zones.

ADEQ COMMENT [S1-36] (6/28/05 ADEQ Memo)

Section 9.1.5 Phase 5, page 9-3 – Second paragraph: "The objective of the IM was to provide hydraulic control of the groundwater plume boundaries near the Colorado River and maintain a groundwater gradient away from the Colorado River." Please note that only the first portion of the sentence (hydraulic control) is stated in Section 1.2.1. Both sections should be consistent.

It would be helpful to iterate here and elsewhere that more work will be required in the future to control the plume boundaries. Data from MW-34-100 suggests that the eastern edge of the plume is undefined and additional investigation may be required towards the east. Interim Measures are limited in nature and for this project did not include defining and evaluating a capture zone. Capture zone definition and evaluation are typically left for the final remedy process. Without additional data regarding the edge of the plume east of MW-34-100, it is hard to prove or disapprove whether the plume boundary is being controlled. Maintaining a landward groundwater gradient is really the primary objective of Interim Measures, as implemented today for this project. Please refer back to comments on Section 1.2.1.

RESPONSE: Comment noted. References to the IM in the revised Report have been made consistent with IM documents and internally consistent.

ADEQ COMMENT [S1-37] (6/28/05 ADEQ Memo, page 9)

Section 9.2.4 Interstitial Water Samples (Table 13-11). Table 13-11 provides the analytical results for the interstitial water samples. The data is flagged in this table, indicating that holding times were exceeded. This brings the data somewhat into question. Text in the RFI does not currently mention the flagging of the data present in this table.

No interstitial samples were collected south of I-40, for example adjacent to the East Ravine and the location of former injection well PGE08 (Figure 9-2).

RESPONSE: The quality and usability of the previously collected interstitial water data will be discussed in the revised Report. In December 2005-January 2006, PG&E conducted additional pore water sampling in the river, including the locations specified in the comment. The results of the more recent pore water investigation are presented in the revised Report.

ADEQ COMMENT [S1-38] (6/28/05 ADEQ Memo, page 9)

Section 9.2.5 Surface Water Samples. It is important to note that none of the sampling locations in the river at the time of this draft report were positioned adjacent to the highest plume concentrations in the floodplain wells, especially, none were in line and adjacent to MW-34-100 (and the wells located west of this well with greater concentrations). ADEQ notes that there are also no surface water sample locations adjacent to the East Ravine or downriver of this ear towards the mouth of Topock Gorge. Modeling runs performed by Hill suggest that the plume could potentially be pulled in this direction by groundwater withdrawal in Arizona water supply wells.

From Technical Workgroup Meeting discussions, the sample collection depth has been identified as 6 inches from the top of the water column in the Colorado River. ADEQ requests that text describe the collection point as 6 inches beneath the water surface.

All this is important information that should be provided in the RFI to frame interpretation of the results. Without it, the results are misleadingly optimistic. For example, if chromium were to reach the river, the lower water column is the more likely location where it would be detected/found. Samples collected in the upper 6 inches would not be suitable for examining this issue. Therefore conclusions regarding potential influence of the plume on surface water cannot be made.

PG&E has prepared a surface water sampling proposal which will be implemented in July 2005. This includes depth specific sampling and additional sampling locations to address the concerns above. This is an important step in responding to ADEQ's concerns. The RFI should include information about the new procedures that will be implemented.

This section also should also cross reference Section 13.13.1 which discusses detections of Cr(VI) in the Colorado River during the June 2002 sampling event. Please see ADEQ comments regarding conclusions made by Hill.

RESPONSE: As ADEQ indicates, PG&E's expanded surface water sampling program, including in-channel sampling, has been conducted since summer 2005. The revised Report presents and discusses the data from the expanded surface water monitoring program through October 2007.

ADEQ COMMENT [S1-34] (6/28/05 ADEQ Memo, page 10)

Section 9.2.5 and Table 9-2 Sampling Record for Groundwater and Surface Water Monitoring Locations – It is not completely clear from text and the table which sampling locations included sampling at different depths. Additional footnotes in Table 9-2 would make this clearer and a brief discussion in text. Also, this data was only collected in one sampling event. Please make sure text and figures clearly reflect past sampling. Also the sample collection depth of 6 inches below the surface of the river should be clearly stated for all other samples.

RESPONSE: The revised Report includes a clarified and thorough presentation of PG&E's surface water sampling activities, including the results and collection methods used in initial 1996-2004 RFI sampling and the expanded surface water monitoring program initiated in summer 2005.

ADEQ COMMENT [S1-40] (6/28/05 ADEQ Memo, page 10)

Table 9-1, Drilling and Construction Summary for Wells Within the RFI Study Area – ADEQ requests that depth to bedrock be added to this table for any wells that were completed into or reached bedrock. New wells should be included in this table to bring it to current conditions with all available data.

RESPONSE: Table 4-2 identifies the wells that are completed in bedrock formations, and their well depths. Table B-4 in Appendix B4 includes a listing of the depth and elevation of bedrock for the wells/borings that reached bedrock.

MWD COMMENT [S2-86] (6/30/05 MWD written margin comment on Section 9.1, page 9-1)

Please provide clarification: What were the objectives? What was achieved? What were the results? Where there data quality objectives established? Did the data collected meet the objectives?

RESPONSE: All of the RFI data collection efforts were conducted according to work plans that were submitted to, and approved by, DTSC. The work plans contain information on objectives and the rationale for the sampling. The completed phases of the RFI sampling met the objectives presented in the initial work plans. An updated listing of the work plans approved and usedfor the RFI/RI are summarized in Table 4-1.

MWD COMMENT [S2-87] (6/30/05 MWD written margin comment on Section 9.1.1, page 9-1)

What were the detection limits?

RESPONSE: Section 4.1 is intended as a general overview of the completed RFI phases and specific details such as detection limits are not included. The detection limits for the various samples collected as part of the RFI are identified in the report Tables, and for earlier data, in the complete RFI/RI chemical database report (Appendix H3 through H6).

MWD COMMENT [S2-88] (6/30/05 MWD written margin comment on Section 9.2.4, page 9-6)

Was purge water monitored for field parameters?

RESPONSE: Section 6.1.1 confirms that the routine groundwater sampling includes monitoring the purge water for the field parameters pH, conductivity, dissolved oxygen, temperature, , and oxygen/reduction potential.

MWD COMMENT [S2-89] (6/30/05 MWD written margin comment on Section 9.3, page 9-7)

Data Quality Objectives?

RESPONSE: Though not specifically identified as Data Quality Objectives (DQOs), the various work plans, statements of work, and quality assurance project plans prepared as part of the RFI program contain information relevant to DQOs.

MWD COMMENT [S2-90] (6/30/05 MWD written margin comment on Section 9.3.4.1, page 9-10)

“To best manage historical data in a manner…” What data was excluded? Please provide a list.

RESPONSE: All groundwater and surface water data collected under for the RFI/RI workplans and data review program are included in the Volume 2 Report.

Section 10 (Regulatory Guidelines and Standards)

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 4)

Page 10-5, Section 10.1.6. Please describe the methods that were used to derive the soil background data set.

RESPONSE: The soil data collected by the initial RFI contractors (E&E and Alisto) were used to derive the background data set presented in the February 2005 draft RFI/RI Report. The methodology was described in Section 10.1.6.3 and Tables 10-7 and 10-8 in the draft Report. In summary, the background metals concentrations reported for the initial RFI sampling were either the statistically derived "upper tolerance limit" of detected concentrations, or the maximum detected concentrations (for sampling results/detections too limited for statistical analysis). As requested by DTSC in 2006, the initial background soil data set will be replaced with data from a more comprehensive soil background investigation scheduled for first quarter 2007. The results of this sampling will be presented and discussed in the Volume 3 (Soil) of the revised RFI/RI Report.

ADEQ COMMENT [S1-41] (6/28/05 ADEQ Memo, page 10)

10.1.3 Comparison Values for Groundwater. If groundwater is in connection with surface water or "daylights", then surface water standards for the constituents of concern (COCs) may be applicable. This is something for future consideration as more data comes in and ARARs are developed for consistency with CERCLA requirements.

In Arizona, all aquifers (defined as yielding more than 5 gallons per day) are protected for drinking water use regardless of TDS. This becomes relevant if there a possibility of connection beneath the river in a bedrock aquifer or in gravel layers at the interface of bedrock.

The transmissivity (T) value of 10,000 gpd/fts for PGE08 suggests that a bedrock aquifer is present in California could potentially be in connection with a bedrock aquifer on the Arizona side of the Colorado River.

RESPONSE: Comments noted. Applicable or relevant and appropriate requirements for groundwater will be identified as required by CERCLA.

PG&E believes the value of 10,000 gpd/ft reported by Dames & Moore for the initial pumping test of PGE-08 is not representative of the bedrock formation. Data from the 2007 PGE-8 testing verified that there is a clear hydraulic response in nearby alluvial wells from pumping at PGE-8, with a lack of response from nearby bedrock wells. This supports the conclusion that the 10,000 gpd/ft transmissivity estimate was likely influenced by hydraulic communication with the Alluvial Aquifer. This is summarized in Section 5.1 of the revised report.

Section 11 (Conceptual Site Models)

DTSC COMMENT (6/27/06 GSU Memo, General Comment 3, Section 11)

Section 11 describes pathways to groundwater associated with selected wastewater management practices for the Topock Compressor Station. The section discusses groundwater pathways related to the former percolation bed in Bat Cave Wash (SWMU 1/ AOC 1) and injection well PGE-08 (SWMU 2/AOC 2). This section should be revised to discuss the groundwater pathways associated with the following SWMUs and AOCs.

- SWMU 5. The RFI Report should consider the sludge drying beds as a potential source to groundwater. Review of the historical aerial photographs indicates ponded water in the drying beds which potentially allowed wastewater to migrate through joints in the concrete. The beds were also used for wastewater treatment which also had associated impounded water.
- SWMU 6. Between 1969 and 1985, approximately 30,000 gallons per day were discharged to the chromium reduction tank. Hexavalent chromium concentrations in influent and effluent were on the order of 0.6 to 6 milligrams per liter (mg/L) and 0.42 mg/L, respectively. The tank represents a source to groundwater because the base of this tank was not lined or paved (see Section 4.1.5.1).
- AOC 10 (East Ravine). The groundwater pathway is likely to be complete in the East Ravine. A 1955 aerial photograph shows two drainage ditches conveying liquids or runoff from the compressor station area to the ravine. Aerial photographs from 1964 and 1967 show ponded water in the ravine. The volume of wastewater discharged to the ravine is unknown, but could be assumed to have been sufficient to percolate to groundwater.

PG&E should expand Section 13.1.2.2 to discuss these potential sources to groundwater. Depending on the findings of additional soil investigation, PG&E may need to expand the extent of the chromium plume depicted in the RFI Report and other monitoring reports to include the area of the sludge drying beds and chromium reduction tank.

RESPONSE:

Section 5 of Volume 1 of the revised RFI/RI Report (submitted to DTSC and the federal agencies on September 6, 2006) describes the closure activities and status of all SWMUs and AOCs within the site investigation and closure process. Based on closure activity documentation, including confirmation soil sampling, and the closure certification acceptance issued by DTSC in 1995, the sludge drying beds and chromium reduction tank were classified as closed SWMUs. Therefore, SWMUs 5 and 6 were not carried forward in the RFI/RI process. Additionally, the 2nd bullet Comment 3 should be clarified that the chromium reduction tank was a 10′ high by 5′ diameter steel tank set within an unlined pit, and that there was no indication of liquid releases at this unit during the RFA facility inspection (A.T. Kearney 1987).

As part of the upcoming Work Plan for RFI/RI soil investigation, Part B (sites within the Compressor Station property), PG&E does plan to drill some deep soil borings at the facility as part of the investigation of AOC 13 (Unpaved Areas within the Compressor Station) and may complete one or more of these borings as monitoring wells if groundwater is encountered. Although this activity will not be associated with the closed SWMUs 5 and 6, it will provide additional subsurface soil and groundwater characterization in the vicinity of these closed SWMUs.

Currently, an additional groundwater investigation is planned to characterize the groundwater conditions of bedrock formations in the East Ravine and MW-23 area. The work plan for the East Ravine groundwater investigation, dated December 11, 2007, was submitted to DTSC and DOI. Following implementation, the results of this investigation will be reported in the RFI/RI Volume 3, data summary reports, or monitoring reports, as appropriate given the nature of the data and the affect on RFI/RI conclusions.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 4, Section 11)

The conceptual site models (CSMs) included in Section 11 are intended to support the risk assessment. The RFI Report should also include a conceptual model of chromium plume migration from all known and potential source areas to the present groundwater plume position. The RFI Report should discuss the potential fate and transport of chromium discharged to Bat Cave Wash, the chromium reduction tank, and into injection well PGE-08. In addition, the RFI Report should discuss the potential contaminant migration pathways associated with the East Ravine (e.g., potential for water to travel through thin sediments to bedrock, potential to travel through bedrock to floodplain area). The discussion related to injection well PGE-08 should address the potential effect of upward hydraulic gradients and the Chemehuevi Fault on migration of injected water.

RESPONSE:

The revised Report presents and discusses conceptual site models for the potential fate and transport of chromium discharged to Bat Cave Wash (SWMU 1) and the injection of treated blow-down wastewater in well PGE-8 (SWMU 2) in Section 6.6. Depiction of historical flow of discharge water was made with the 2005 numerical model, since this remains the most recent calibrated groundwater model. Refinement of the historical discharge water flow estimates will be made when the model is recalibrated later in 2008. As noted in the response to Comment 3, the chromium reduction tank was certified as a clean-closed SWMU with no evidence of adjacent liquid releases, and therefore development of an area-specific CSM (including fate and transport assessment) for this SWMU is not warranted and was not included in the revised Report.

Regarding the East Ravine (AOC 10), additional drilling and characterization is planned as part of the planned East Ravine groundwater investigation. The December 2007 work plan for the East Ravine groundwater investigation proposed drilling and groundwater characterization and installation of monitoring wells at two primary drilling locations, and identified other contingency locations. The results of this investigation will be reported in the RFI/RI Volume 3, data summary reports, or monitoring reports, as appropriate.

The feasibility of incorporating the results of proposed additional drilling and evaluation of the groundwater pathway within the unpaved areas of the Compressor Station (AOC 13) in the revised Report will be assessed after the Work Plan for the Part B soil investigation is submitted and approved by the agencies.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 5)

Page 11-2, Section 11.1.2, second sentence: This sentence states that there are no potable water supplies in the immediate vicinity of the compressor station. Please restate that the closest potable water supply is the Park Moabi well and that the groundwater pathway does not appear to be complete for this receptor.

RESPONSE: This statement has been deleted from the revised Report. Discussion of potential groundwater pathway will be presented in the Risk Assessment.

ADEQ COMMENT [S1-43] (6/28/05 ADEQ Memo, page 11)

Section 11.0, Conceptual Site Model, page 11-1: "Both groundwater beneath the compressor station and surface water in the Colorado River have designated beneficial uses that include municipal and domestic water supply, although much of the groundwater contains levels of TDS that inhibit its use of potable water supply." Arizona aquifers are protected as drinking water sources regardless of TDS and water quality.

RESPONSE: Section 6.1.2 discussed the applicable or relevant and appropriate requirements for groundwater for this RFI/RI as required by CERCLA.

ADEQ COMMENT [S1-45] (6/28/05 ADEQ Memo, page 11)

Figure 11-2 Conceptual Site Model Groundwater and Figure 11-3 Conceptual Site Model SWMU 2/AOC2 – Inactive Injection Well PGE08: The draft RFI estimates that 16 million gallons per year were injected into PGE08 for about a 3 year period of time, although some confusion appears to exist about the actual volume. If there are upward gradients from the bedrock aquifer as suggested in the draft RFI in earlier sections, then the previously injected wastewater may have the ability to impact sediments and surface water. It would be useful to include a discussion of the mechanism involved with injecting CTBD containing chromium into an aquifer that may exhibit upward gradients – how would the injected plume be expected to behave in the bedrock aquifer? Would it potentially daylight in other areas?

RESPONSE: As described in Section 5.1 of the revised Report, recent testing of PGE-8 provides evidence for a hydraulic connection between that well and nearby wells in the Alluvial Aquifer. No response to PGE-8 pumping was discernable from nearby bedrock wells, suggesting the fractures in bedrock are better connected with the alluvium than in significant horizontal distances within bedrock. Quantification of flow will be estimated following model calibration.

FMIT TECHNICAL COMMENT [T1-3] (7/7/05 Hargis+Associates letter comment, page 4)

Groundwater Pathway to Colorado River:

Sections 11.1.2 and 11.1.3 of the RFI Report discuss conceptual site models with regard to groundwater and surface water and sediment, respectively. The pathway from the Solid Waste Management Unit ("SWMU") 1/AOC 1 – "Former Percolation Bed to the Colorado River" is depicted in Figure 11-2 of the RFI Report. This pathway is considered in the RFI Report to be a "potentially-complete pathway" (p. 11-3). If this pathway were complete, then DTSC should evaluate the potential impact on the Colorado River. The extensive computer modeling being performed at the site could be used to estimate the in-stream concentrations that would result from seepage into the Colorado River under steady conditions.

For example, potential mixing in the river could be estimated based on a hypothetical interception of the plume with the river and conservative estimates of travel time based on the distance from the nearest monitor well. These initial estimates could ignore mass removal or retardation in the sediments or in the aquifer that might occur in order to evaluate the magnitude of the potential concentrations more conservatively. Estimates could then be refined, if and when necessary, to include these other transport parameters.

In fact, the relevant location and dimensions of such a seepage interface have already been incorporated into the model in the form of a limited reach along the west bank of the Colorado River that receives simulated groundwater flow from "alluvial layers in the plume area" (PGE, 2004). Once the rate of seepage and Cr(VI) mass influx is calculated, then the rate of dilution and fate of the Cr(VI) solute in the river could be projected.

A simple analogy related to the rate of volume dilution of groundwater seepage entering the river can be drawn from the 130 gallons per minute (gpm) maximum pumping rate estimated to contain the plume. The equivalent seepage rate inferred from this pumping rate is then less than 0.3 cubic feet per second (cfs). This seepage rate might then be compared with measured flow data for the Colorado River below Davis Dam. Records for the 2003 water year at that location, for example, indicate that mean of daily mean discharge was 13,890 cfs, with a maximum-recorded discharge of 22,600 cfs and a minimum recorded discharge of 7,270 cfs (Fisk, et al., 2004). Thus, it can be seen that the 0.3 cfs seepage rate is exceeded by the average discharge in the Colorado River by a factor of over 46,000 times. This type of information and analysis perhaps puts a more realistic perspective on the urgency of the IMs.

RESPONSE: Information on the hydrogeologic conceptual site model, including groundwater gradient and flow are presented in Section 5.4 of the revised Report, and fate and transport of chromium is summarized in Section 6.7. Potential exposure pathways via surface water and their significance will be considered in the Risk Assessment, under separate cover.

Section 13 (Groundwater and Surface Water Characterization Results)

DTSC COMMENT (6/27/06 GSU Memo, General Comment 2, Section 13)

Volume 2 should provide an up-to-date discussion of hydrogeologic conditions and chromium distribution within the Alluvial Aquifer. Hence, this volume should include revised Sections 2.3, 2.5, 11.1.2, and 13.0, and Appendix A, that consider all hydrogeologic data collected through the data cutoff date established for this volume. As required by the DTSC letter dated February 3, 2006, Volume 2 should be supported by a network of interlaced fence diagrams that depict the detailed stratigraphy, significant unit contacts, erosional surfaces, and chromium plume configuration.

RESPONSE: The Volume 2 revised Report will present discussion of hydrogeologic conditions and chromium distribution within the Alluvial Aquifer, and include maps, cross-sections, and other graphical displays updated with the current site information. On July 28, 2006, at DTSC's request, PG&E submitted draft 3-D block diagram figures and interlaced fence diagrams/cross-sections generated from the site hydrogeologic conceptual model. DTSC's comments on the July 2006 draft graphical displays have not been received. Section 5.1.2 presents and describes the detailed stratigraphy, significant unit contacts, erosional surfaces, on series of seven intersecting cross-sections. Figure 5-23 presents a block diagram perspective view of the site hydrogeology and chromium plume configuration.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 6, Section 13)

With the additional data collected since June 2004, PG&E has sufficient data to prepare a more sophisticated CSM of chromium plume migration than is described in Section 13.1.3 and shown in Figure 13.2. GSU anticipates that the CSM for chromium plume migration will use the fence diagrams and/or block diagrams required by the February 3, 2006 DTSC letter, and will include a narrative that addresses key issues affecting chromium migration. Some items that should be addressed by the CSM presented in Volume 2:

a. Probable historical chromium transport directions and rate of movement from various source areas to current plume center of mass. Discuss direction and rate of plume migration under the following conditions.

- Groundwater extraction at PGE-01, PGE-02, PGE-06, and PGE-07 and groundwater mound induced by discharge to Bat Cave Wash.
- After cessation of pumping from water supply wells, but continued discharge to Bat Cave Wash.
- After cessation of discharge to Bat Cave Wash.

Support discussion with groundwater flow model simulations of induced gradients and groundwater flow regime.

b. Factors affecting observed chromium plume configuration and distribution of chromium mass at various depths in the Alluvial Aquifer (e.g., upper, middle, lower). Some items to be addressed:

- Possible mechanisms for a relatively shallow plume mass at some upland locations (e.g., MW-31, MW-50), a fully penetrating plume mass at other locations (e.g., MW-20, MW-26/MW-51), and a deep plume mass at other locations (e.g., MW-37D, MW-50).
- Possible mechanisms for chromium plume distribution observed at elevations less than 325 feet mean sea level (e.g., MW-46-175, MW-50-200) in alluvial fan deposits.

- Potential effect of salinity of discharged wastewater on chromium plume migration.

c. Extent to which geochemical conditions in fluvial sediments allow reduction of hexavalent chromium to trivalent chromium (e.g., persistent chromium plume in lower portions of Alluvial Aquifer in fluvial sediments above Miocene Conglomerate). Discuss organic content of floodplain sediments and groundwater. Discuss any observations of vegetation buried after construction of Parker Dam and whether this vegetation could be contributing to reducing conditions.

d. Potential fate and transport of wastewater injected into PGE-08

e. Possible mechanisms for significant concentration trends.

f. Projected eastern extent of the chromium plume.

Although portions of Section 13 address some of these elements, the additional data collected since June 2004 should allow a more thorough discussion of these issues than is presented in this section.

RESPONSES to Individual General Comment #6 Items:

a. Historical chromium transport directions and rate of movement of the chromium plume in the Alluvial Aquifer at SWMU 1 are addressed and presented in the revised Report for the scenarios listed in this comment in Section 6.6. The most recent calibrated model was used for this exercise (CH2M HILL, 2005v). Updates of this discussion will be supplied in the revised Groundwater Model Report. It should be noted that there are no records available that indicate the replacement compressor station supply wells PGE-6 and PGE-7 were ever operated for facility supply, and hence groundwater pumping from these wells was not included in the modeling scenarios.

b. Aquifer heterogeneity is the likely primary factor that affects the observed chromium plume configuration and distribution of chromium mass in the Alluvial Aquifer. The revised Report includes a general discussion of the complexity of the depositional environments that comprise the Alluvial Aquifer and the effects of geochemistry on the distribution of chromium in the plume (Sections 5 and 6.6). However, to attempt to describe specific mechanisms for observations at specific wells would require speculation beyond what is considered appropriate or meaningful in the context of an RFI/RI. The revised Report also includes a discussion regarding the effects of salinity on groundwater transport at the site (Section 6.7.3).

c. The revised Report presents and discusses the available data and information regarding the groundwater geochemical conditions and the nature and concentrations of organic carbon in the fluvial sediments and groundwater in Sections 6.6 and 6.7. Although historical records indicate a significant rise in river stage occurred in response to construction of Parker Dam in the 1940s, the historical aerial photographs during this time period do not indicate significant areas of vegetated floodplain were buried by new river sediment.

d. Currently, there is insufficient data to model or assign meaningful hydraulic properties to the bedrock formations at the site, and hence, evaluating the fate and transport of wastewater injected into PGE-8 would be speculative at best. Quantification of property estimates of bedrock, based on the testing of wells PGE-8 and PGE-7, will be provided in the upcoming bedrock groundwater testing technical memorandum. Results of testing are summarized in Section 5.1, and indicate that there is a more effective hydraulic communication between bedrock and alluvium in that area than between bedrock wells.

e. The revised Report includes a general discussion of concentration trends in the plume in Section 6.6.

f. The projected eastern extent of the chromium plume was evaluated and updated in June 2006 based on the results of new drilling in the floodplain area and Cr(VI) and water quality monitoring conducted for IM performance monitoring (see figures in the July and August 2006 monthly PMRs). Section 6.3.3 summarizes the results of plume delineation using data through October 2007. This discussion indicates the supplementing groundwater investigation planned for installing additional monitoring wells on the Arizona side of the Colorado River.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 7, Section 13)

In various discussions over the last two years, several stakeholders have raised concerns regarding saline-driven transport of the chromium plume. PG&E has responded that saline-driven transport is not a significant factor for the chromium plume migration and is not always associated with the chromium plume. Given that this issue continues to be raised, GSU recommends that Volume 2 include a stronger discussion of naturally-occurring salinity stratification observed in the site vicinity and reported in the literature for the Mojave Desert. Hence, the salinity discussion at the top of Page 13-3 should be more fully developed. In addition, the CSM for chromium plume migration should address salinity.

RESPONSE: The conceptual site model for chromium plume migration presented in the revised Report addresses the salinity and temperature factors relating to groundwater density in Section 6.7.3.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 8, Section 13)

Data collected from wells installed in the floodplain area after June 2004 indicate that the toe of the chromium plume occurs at depths of approximately 60 to 80 feet below the river bottom on the western side of the river. Recent data indicate that, near the western edge of the Colorado River, the toe of the chromium plume occurs in zones approximately 5 to 40 feet thick, frequently above or very near the top of Miocene Conglomerate, and at concentrations approaching 1 mg/L. The data suggest that the plume has migrated an unknown distance beneath the river. For the lower depth interval of the Alluvial Aquifer, it is no longer appropriate to show a closed contour depicting that the chromium plume entirely west of the Colorado River.

RESPONSE: The comments on the groundwater chromium plume depiction are noted. In June 2006, at DTSC request, PG&E prepared revised Cr(VI) contour maps of the Alluvial Aquifer in the floodplain area for presentation in the IM performance monitoring reports. Section 6.3 presents chromium distribution maps presenting October 2007 sampling data and the 20 ug/L Cr(VI) outline in the aquifer depth zones base on analysis of the relevant hydrogeologic, water quality, and geochemical data. A supplementing groundwater investigation is planned for implementation after October 2007 to better delineate the eastern limit of the chromium plume. This investigation will include installation of additional monitoring wells in locations along the east shoreline of the Colorado River in Arizona. The results of this groundwater investigation and sampling will be reported in an addendum to the RFI/RI Report, Volume 2.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 6)

Page 13-3, Section 13.1.2.2, first full paragraph: This section references literature studies that report naturally-occurring hexavalent chromium concentrations up to 50 micrograms per liter (µg/L) in the region. Volume 2 of the RFI should also provide the range of hexavalent chromium concentrations observed in wells sampled by the Groundwater Background Study.

RESPONSE: Section 6.3.3 discusses the results of the background study regarding the UTL concentration and range of Cr(VI) observed n the Background Study sampling.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 7)

Page 13-4, Section 13.1.3, first paragraph: This discussion of the reducing conditions in fluvial deposits should address the depth limitation for these conditions that is observed in some areas of the floodplain. For example, although well clusters MW-34 and MW-36 are completed in fluvial sediments, hexavalent chromium persists in the lower wells of these clusters.

RESPONSE: The revised Report presents and discusses chromium and water quality data through October 2007 and trends for sampling locations in the floodplain and in sediments beneath the river in Sections 6.3 and 6.4. Discussion of the extent of reducing conditions is discussed in Sections 5.3 and 6.7.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 8)

Page 13-6, Section 13.2.1.2: It would be helpful to the reader if this section also referenced and discussed a north-south cross-section through the easternmost extent of the upland area (e.g., cross-section that includes MW-23, MW-21, MW-26/51, MW-20, MW-31, MW-19/50, MW-47, MW-35).

RESPONSE: Section 5.1.2 presents a several cross-sections, including the wells listed, to depict the hydrogeology and aquifer thickness in the area immediately west of the floodplain.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 11)

Table 13-2: When updating this table to include data collected after June 2004, please also add the filtration status of the samples. Also, please clarify in the notes that a conventional purge method is used unless otherwise noted in the remarks column.

RESPONSE: The chromium results summary Table 6-2 will include footnotes confirming the requested information.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 14)

Figure 13-2: As indicated by the conceptual site model discussion in Section 13.1.3, this figure should also depict the chromium plume.

RESPONSE: The requested information is incorporated in the updated conceptual site model block diagram included in the revised Report (Figure 5-23).

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 15)

Figure 13-8: It would be helpful to the reader to include the location and screen intervals of wells PGE-01 and PGE-02 on this cross section.

RESPONSE: On cross-section B (Figure 6-4), these decommissioned wells would project at a similar location. Hence, the approximate location and combined gross screen interval (PGE-1 and PGE-2, as reported in historical records), will be added to this cross-section.

CRWQCB COMMENT [E-comment R1-1] (6/30/05 letter, General Comment, page 1)

Regional Board Staff is deeply concerned regarding the possible discharge of the hexavalent chromium contaminant plume to the Colorado River, which supplies drinking water to 22 million people in Southern California. In January 2004, a hexavalent chromium concentration of 110 parts per billion (ppb) was reported for river sentry well MW-34-80) located sixty feet from the Colorado River. Between February 14 and May 25, 2005, 110 parts per billion concentrations in new floodplain well MW-34-100 (at the same location as MW-34-80, but monitoring a deeper zone), have ranged from 402 to 559 ppb. The May 25 concentration of 559 ppb is the highest concentration detected to-date adjacent to the river. Hexavalent chromium concentrations in the monitoring well are increasing in a statistically significant upward trend, despite efforts to create a landward gradient of the plume by pumping extraction well TW-2D. PG&E has acknowledged that continued control of the plume is dependent on startup of the treatment plant, scheduled for July 16, 2005, which will increase current capacity to pump and treat contaminated groundwater and establish a landward gradient of the plume away from the Colorado River. The groundwater treatment plant and treated groundwater re-injection will be regulated under Board Order No. R7-2004-0103.

Additional monitoring activities including vertical profile sampling of the Colorado River, scheduled for July 2005, and pore water/seepage sampling of river bottom sediments, scheduled for September 2005, may provide verification of plume discharge to the river. Therefore, particularly give the approaching seasonal drop in river water level, it is imperative that hydraulic control of the contaminant plume achieved quickly to protect the Colorado River.

RESPONSE: PG&E appreciates the concerns expressed by the CRWQCB. The interim response actions have been developed specifically to address hydraulic containment of the hexavalent chromium plume as mapped in the floodplain, and will be discussed in the revised Report. The completion of the RFI/RI Report represents the next step in arriving at a long-term remedy to the concerns expressed in this comment.

CRWQCB COMMENT [R1-2] (6/30/05 letter, Specific Comment, page 2)

Pore Water Sampling Section 13.3.3: Staff concurs with DTSC comments regarding the inadequacy of the pore water data set discussed in Section 13.3.3 of the RFI document. DTSC's comments are detailed in June 9, 2005 correspondence to PG&E.

RESPONSE: PG&E conducted a significantly expanded Pore Water Study in December 2005-January 2006 to address data gaps in the pore water data set. The results of this study are included in the revised Report.

ADEQ COMMENT [E-comment S1-2] (6/28/05 ADEQ Memo, page 2)

Concentration Contouring – Concentration contouring would be very useful for depicting vertical and horizontal distribution. It would be helpful if the RFI contained concentration contouring for chromium and TDS to depict the vertical and horizontal extent of contamination and to facilitate discussion and the next steps in the Resource and Recovery Act (RCRA) remedial process. Concentration contours are very useful in examining the spatial behavior of the plume.

RESPONSE: The present depiction of the lateral distribution of Cr(VI) are presented on color-coded result-posted maps of the depth zones of the Alluvial Aquifer (Figures 6-2a, 6-2b, 6-2c). The 50 ug/L Cr(VI) limit line is shown for each zone. The vertical distribution of Cr(VI) are shown on selected cross-sections as color-posted results. The average TDS concentrations are posted in map and cross section view, and are not contoured , due to the horizontal and vertical variability in data in groundwater at the site.

ADEQ COMMENT [S1-7] (6/28/05 ADEQ Memo, page 2)

ES10.1, page ES-14: "Cr(IV) has not been detected in samples of Colorado River water collected at multiple locations both upstream and downstream from the Topock site." While this statement is accurate, it should be noted that with the exception of one sampling event, samples were collected in the upper 6 inches of the water column where hexavalent chromium from the groundwater plume would be least likely to be found. A new surface water sampling plan is under development which includes depth specific sampling at an expanded network of sampling locations. The RFI should note that this sampling will be implemented in July 2004 and was requested by stakeholders.

It should be further noted both here and in ensuing references to surface sampling results through-out the RFI that hexavalent chromium (Cr(VI)) was found in one round of sampling (June 2002), as reported in Section 13.13.1 of the draft RFI. Although these results were not confirmed in verification sampling and re-analysis of the samples, results should be clearly reported throughout the RFI, along with qualifying factors. It should also be noted that re-analyzed samples would have exceeded method holding times. Also, given the dynamic nature of the river and river elevation changes, re-sampling of the upper 6 inches for the purposes of verification would be very unlikely to result in repeated results.

RESPONSE: The revised Report describes the expanded in-channel, depth-specific surface water monitoring activity PG&E began in 2005, and the pore water study that PG&E implemented in December 2005-January 2006. These data collection activities address the primary comments on site characterization and fate and transport assessment. Note that with one exception, the results of all these recent sampling programs have been consistent findings of non-detect for Cr(VI) and Cr(T) in all samples of Colorado River water. The revised Report further qualifies the anomalous "false-positive" Cr(VI) detections that were encountered in the June 2002 monitoring.

ADEQ COMMENT [S1-8] (6/28/05 ADEQ Memo, page 3)

Interstitial Sampling – For interstitial samples, data is provided in Table 13-11. The data in Table 13-11 is flagged and the notes indicate that holding times were exceeded and a reporting limit of 10 ppb was used. With this reporting limit, it is unknown if Cr(VI) is present at lower concentrations. Methods with lower reporting limits are now in use in investigations (such as either 218.6 or 7199). The statement "Samples of interstitial water from shallow drive points installed at eight locations in the river bottom were also non-detect for Cr(VI)" should be qualified to reflect the missed holding times and the higher reporting limit.

New interstitial sampling should be performed utilizing methods with lower reporting limits and in deeper locations that are adjacent to: SWMUs that require additional investigation (including PGE08, and the East Ravine); MW-34-100; and, areas of the plume with highest concentrations. Interstitial water quality results are an important component of site characterization and assessing the fate and behavior of chromium beneath the Colorado River.

RESPONSE: PG&E agrees with ADEQ that interstitial water quality samples are an important component of site characterization and assessing the fate and behavior of chromium beneath the Colorado River. To this goal, the revised Report describes the pore water study that PG&E implemented in 2005-2006. Note that the results of the pore water study were non-detect for Cr(VI) and Cr(T) in all samples underneath the Colorado River. The revised Report further qualifies the anomalous "false-positive" Cr(VI) detections that were encountered in the June 2002 monitoring. Methods with lower reporting limits were used for the analyses of the 2006 pore water samples: 0.2 µg/L for Cr(VI) and 1.0 µg/L for Cr(T).

ADEQ COMMENT [S1-9] (6/28/05 ADEQ Memo, page 3)

ES10.2: add to last bullet "and assessing if bedrock aquifer is present that may be in communication with the California bedrock aquifer…" Aquifer testing should be repeated with a sustained pumping test in PGE08 while monitoring nearby wells for response, including wells located in Arizona.

RESPONSE: The revised Report provides more discussion on the available data on hydraulic conditions of the bedrock in the PGE-8 area in Section 5.1.

ADEQ COMMENT [S1-11] (6/28/05 ADEQ Memo, page 4)

Leading Edge of the Plume – The leading edge of the plume is currently not defined east of MW-34-100 and chromium concentrations have increased in this new well since initial data reports in February 2005. The RFI was written in February 2005 prior to data collected in well MW-34-100. "Hydraulic and analytical data indicated that the pumping has been generally effective in achieving IM objectives over the period from March through December 2004". This statement does not take into account the trend of increasing concentrations of chromium in MW-34-100 that have been detected and is diverging line of evidence. The RFI does not address nor mention this point in this section, or in other parts of the RFI that address Interim Measures.

A bedrock aquifer appears to be present in Arizona, and receptors are present in the form of active water supply wells (City of Needles wells, Serrano Well, Sanders wells, and wells in the southern portion of Golden Shores and potentially EPNG wells). The discussion of interim measures assumes that the plume has not moved beneath the river and is contained on the east side of the Colorado River. Additional data is needed – both in terms of providing existing data (such as spinner logs) and possibly new data (such as sustained aquifer testing in PGE08).

RESPONSE: The revised Report describes the available hydrogeologic, groundwater characterization, and Cr(VI) distribution data from investigations and sampling through October 2007 in Sections 6.4 and 6.5. The hydraulic data observed in the PGE-8 pumping test are described in Section 5.1.

ADEQ COMMENT [S1-49] (6/28/05 ADEQ Memo, page 12)

13.1.1 Site Hydrogeology Summary, First Paragraph, last sentence: "Because the Miocene conglomerate and crystalline bedrock have very low permeability, groundwater movement occurs primarily in the overlying unconsolidated deposits." Data provided in the draft RFI suggests that if anything, aquifer characteristics in the conglomerate and bedrock vary. The transmissivity observed in PGE08 of 10,000 gpd/ft suggests that groundwater does move in this aquifer. ADEQ believes that the bedrock aquifer requires further characterization.

RESPONSE: PG&E believes the value of 10,000 gpd/ft reported by Dames & Moore for the initial pumping test of PGE-08 is not representative of the bedrock formation. Data from the 2007 PGE-8 testing verified that there is a clear hydraulic response in nearby alluvial wells from pumping at PGE-8, with a lack of response from nearby bedrock wells. This supports the conclusion that the 10,000 gpd/ft transmissivity estimate was likely influenced by hydraulic communication with the Alluvial Aquifer. This is summarized in Section 5.1 of the revised report.

ADEQ COMMENT [S1-50] (6/28/05 ADEQ Memo, page 12)

13.1.2 Site Geochemistry Summary, Page 13-2: "The State of California does not consider groundwater containing TDS at concentrations exceeding 3,000 mg/L to be a source of drinking water." Please note that Arizona aquifers are protected as drinking water sources regardless of TDS and water quality. This information may be relevant when Appropriate or Relevant and Applicable Requirements (ARARs) are assessed for consistency with CERCLA requirements.

RESPONSE: Section 6.1.2 discussed the applicable or relevant and appropriate requirements for groundwater for this RFI/RI as required by CERCLA.

ADEQ COMMENT [S1-51] (6/28/05 ADEQ Memo, page 13)

Section 13.1.2.1 Natural Sources of Chromium (and Table 13-1): This paragraph references the Robertson report (1975 and 1991) in relation to naturally occurring hexavalent chromium in groundwater. It should be noted that the studies performed by Robertson were regional, and did not focus on this study area. Also Table 13-1 contains a slight misrepresentation of Roberson's data as presented in his 1991 report. Table 13-1 of the RFI indicates that background range of hexavalent chromium referenced in the 1991 Robertson paper is 0-50 ppb. Figure 8 of USGS Professional Paper 1406-C "Geochemistry of Ground Water in Alluvial Basins of Arizona and Adjacent Parts of Nevada, New Mexico, and California – Regional Aquifer System Analysis" actually does not show coverage in the study area, which is in the Lake Mohave Basin. This should be clearly noted.

RESPONSE: Specific citation of the Robertson data and reference to the study used is not included in the Volume 2 RFI/RI, and therefore, no clarification is needed.

ADEQ COMMENT [S1-52] (6/28/05 ADEQ Memo, page 13)

Section 13.1.3 Conceptual Site Model, page 13-4, Second Paragraph: This paragraph implies that the plume is confined to the alluvial aquifer. It is important to add recent data to the RFI including results for MW-34-100. These results affect the understanding of the site and contaminant migration. Data from well MW-34-100 is diverging evidence that the plume is confined and contained. The eastern edge of the plume including the results of grab samples collected in wells in addition to MW-34-100 present divergent evidence with respect to confinement of the plume. The bedrock aquifer has not been characterized to date.

RESPONSE: Section 6.3.3 summarizes the results of plume delineation using data through October 2007. This discussion indicates the supplementing groundwater investigation planned for installing additional monitoring wells on the Arizona side of the Colorado River. The revised Report will also summarize the available Cr(VI) sampling characterization results for the bedrock wells at the site. Section 5.2.2 presents and discusses the vertical gradients between bedrock and the Alluvial Aquifer at the site.

ADEQ COMMENT [S1-53] (6/28/05 ADEQ Memo, page 13)

Section 13.2.1.1, Lateral and Vertical Distribution: This section and related figures and tables do not include the most recent data for newly installed well.

Page 13-5: "Except for the initial sample after well construction, Cr(VI) has not been detected in groundwater samples from MW-24BR during 5 years of RFI sampling". It is important to note that MCLs are exceeded in this well cluster in the next screened interval up: MW-24B, which has an average concentration of 4.14 mg/L compared to the California MCL of 0.5 mg/L. This relates to ADEQ comments and request for more information regarding the affect of upward gradients on contaminant migration.

Page 13-6: "During 5 years of RFI sampling, Cr(VI) has not been detected in groundwater samples from the bedrock well PGE08 (detection reporting limits of 0.01 and 0.0002 mg/L). Please see previous discussion regarding mechanisms of transport in the bedrock aquifer if upward gradients are present.

RESPONSE: Section 6.3.4 presents and discusses the results of chromium sampling of the bedrock wells at the site. The fate and mobility of chromium in bedrock formations, utilizing the results of the 2007 bedrock hydraulic testing, are described in Section 6.7.

ADEQ COMMENT [S1-54] (6/28/05 ADEQ Memo, page 13)

Section 13.2.1.4 Chromium Association with Stable Isotope Data. In discussing stable isotope data and chromium concentrations, the influences of infiltration in surface drainages (washes) on groundwater quality results should also be evaluated. Topographic maps show drainages which flow towards the Colorado River on the California side of the River. Has the influence of infiltrating surface water runoff in dry washes been taken into account when examining plots of well data with respect to the standard meteoric water line? Also, the physical geologic principle of actualism suggests that if these processes are at work today in the study area they can be expected to be at work in the past, resulting in gravel layers that are perpendicular to the river and that may provide preferential flow pathways.

RESPONSE: The revised Report includes an updated discussion of stable isotope data relative to aquifer unit, site location, and chromium concentrations in Sections 5.3 and 6.5.

ADEQ COMMENT [S1-55] (6/28/05 ADEQ Memo, page 14)

Section 13.3, Surface Water Quality Characterization
13.3.1 Chromium Sampling Results (Table 13-10): Information in the RFI pertaining to surface water sampling and hexavalent chromium has indicated that it has not been detected in the Colorado River.

The second paragraph indicates that Cr(VI) was detected in six samples in June of 2002 but was not confirmed through reanalysis and verification sampling. In the previous portions of the RFI that mention surface water sampling results, this information should be clearly stated.

Although follow-up data may suggest this is a false positive, it is important to note that the concentrations detected in the 6 samples ranged from 15.9 to 25.7 ppb – if real, these results represent exceeded Arizona surface water quality standards for Cr(VI). The drinking water source standard for Cr(VI) is 21 ppb. The Aquatic and Wildlife Warm Cr(VI) acute standard is 16 ppb and the chronic standard is 11 ppb. Previous references to surface water sampling results should provide this information, qualified as un-reproduced in verification sampling. Given the short holding times for chromium analysis (24 hours) it is important to note that re-analysis would have exceeded holding times for Cr(VI) analysis and therefore should not be relied upon for assessing whether the data is valid or not. Also data validation reports should be made available for this data as part of the RFI.

Verification sampling for this and future river sampling should take into account the river stage at the time of sampling, June is the transition period at the end of the seasons in which the river is a gaining stream (accentuating groundwater movement toward the river). The data of verification sampling is not provided in text, but if this was performed as river levels were increasing, this may have had an effect on verification sampling results.

It should also be made clear that these results are primarily for samples collected in the upper portion of the water column, approximately 6 inches below the surface of the river.

Total Chromium has also been detected at average concentrations ranging from 5.5 to 12.4 ppb, below the Arizona Drinking Water Source Standard of 100 ppb. These detections were in both upstream samples and samples near I-40.

Table 13-10 does not allow for comparison of the June 2002 results for other COCs, since it only lists the number of sampling rounds and number of detections rather than the results. Text should discuss whether or not there were increased or anomalous concentrations of other COCs during that same sampling event and where this supports the conclusions made by PG&E.

RESPONSE: The revised Report includes an updated and expanded discussion of the surface water sampling results and characterization, including the in-channel depth-specific sampling initiated in summer 2005. The data review and verification sampling for the suspected false-positive Cr(VI) results from June 2002 sampling are presented and qualified as appropriate. The revised Report includes an updated summary table of surface water sampling and references Appendix H, the database report of RFI analytical chemistry results.

ADEQ COMMENT [S1-56] (6/28/05 ADEQ Memo, page 14)

Section 13.3.3 Interstitial Water Samples. Text indicates that hexavalent chromium was not detected in the previous interstitial water samples which were collected, but the data tables show this data as flagged for exceeded holding times. Text should qualify the results. Also – interstitial samples were not collected adjacent to the areas with the highest plume concentrations. This should be noted as a data gap. A more thorough interstitial sampling program should be implemented.

It should also be noted, given the observations of increasing Cr(VI) concentrations in well MW-34-100, that deeper investigations beneath the river appear to be warranted.

RESPONSE: The revised Report includes a summary and results for the pore water study PG&E implemented in December 2005-January 2006. This study addresses many of the comments on the initial interstitial sampling activity conducted February 2003. The revised Report summarizes the limitations of the early study.

ADEQ COMMENT [S1-57] (6/28/05 ADEQ Memo, page 15)

Section 13.4 Groundwater and Surface Water Characterization, Page 13-15: "The chromium plume is essentially confined to the more permeable alluvial/fluvial deposits that compromise the Alluvial Aquifer." This statement should be qualified-investigations conducted to data have not extended into bedrock and recent data not yet included in the RFI suggests the plume may extend beneath the river (MW-34-100). This discussion should include data that has been collected in the winter and spring of 2005, since it is relevant to the overall picture of the site and contaminant migration.

RESPONSE: The groundwater and surface water characterization sections provided in the revised Report have been updated to include results and evaluation of the groundwater, surface water, and pore water sampling investigations and monitoring through October 2007.

ADEQ COMMENT [S1-58] (6/28/05 ADEQ Memo, page 15)

Section 13.4, Page 13-16: "Cr (VI) has not been detected in samples of the Colorado River water collected at multiple locations both upstream and downstream from the Topock site." This statement is slightly inaccurate. It was detected in samples collected by PG&E in June 2002. This data has been flagged as questionable and was not repeated in verification samples, but the results should be considered as part of the data set.

RESPONSE: The groundwater and surface water characterization conclusions section provided in the revised Report have been updated to include results and evaluation of the groundwater, surface water, and pore water sampling investigations and monitoring through October 2007. The data review and verification sampling for the suspected false-positive Cr(VI) results from June 2002 sampling are presented and qualified as appropriate.

ADEQ COMMENT [S1-59] (6/28/05 ADEQ Memo, page 15)

Section 13.4, Page 13-16: "Samples of interstitial water from the shallow drive points installed at eight locations in the river bottom were also non-detect for Cr(VI)." These samples exceeded holding times, therefore the results are called into question and more sampling should be performed. Further, sampling locations were not positioned adjacent to the highest plume concentrations, nor key locations such as the East Ravine.

RESPONSE: The conclusions of quality assurance-flagged data from 2002-2003 sampling will be qualified. The revised Report presents and discusses the locations and results for the December 2005-January 2006 pore water investigation.

ADEQ COMMENT [S1-60] (6/28/05 ADEQ Memo, page 15)

Section 13.5, Data Needs for Groundwater Characterization. ADEQ suggests the following additions to this list:

- Aquifer testing in the bedrock aquifer using PGE08 and MW-24BR while monitoring nearby monitoring wells and wells in Arizona (including City of Needles wells, and PGE09N and S)
- Additional wells for improved water level contouring/equipotential maps, including the deeper potion of the aquifer at the bedrock interface
- Concentration contouring Cr(VI) and TDS
- Interstitial Water Sampling along the shoreline. Locations should include the previous locations and locations adjacent to the East Ravine, MW-34, etc. Use of methodology with lower detection levels (218.6 or 7199)
- Deeper sampling beneath the river along the bedrock interface
- Addition newer data to the RFI (February through June data)

For Surface Water

- An enhanced sampling program that includes routine depth specific sampling at key locations using clean sampling techniques.
- More sampling locations

RESPONSE: The Volume 2 RFI/RI report summarizes the results and recent characterization activities that address installation of additional wells at the alluvium/bedrock contact for water quality monitoring, expanded hydraulic gradient contouring, pore water sampling, in-channel, depth-specific surface water sampling and hydraulic testing and characterization of the bedrock formations The report also indicates the additional groundwater characterization studies planned to be implemented after October 2007: (1) further delineation of the groundwater chromium plume in areas along the east shoreline of the Colorado River in Arizona (2) further characterization of groundwater conditions in the East Ravine area to the southeast of the compressor station, and (3) further characterization of groundwater conditions beneath the compressor station. See the response to ADEQ comment S1-2 above for concentration contouring.

ADEQ COMMENT [S1-61] (6/28/05 ADEQ Memo, page 16)

Section Figure 13-5, Hexavalent Chromium Results – Lower Zone of Alluvial Aquifer 2003-2004 Groundwater Monitoring. This figure requires critical revision based on recent findings in deeper wells installed and data collected since February 2005. New deeper wells and data gap wells should be added to the figure.

RESPONSE: Section 6.3.1 presents the of distribution of Cr(VI) on maps of the depth zones of the Alluvial Aquifer (Figures 6-2a, 6-2b, 6-2c) for the October 2007 site-wide groundwater sampling event.

ADEQ COMMENT [S1-62] (6/28/05 ADEQ Memo, page 16)

Figures 13-6 though 13-11 Hexavalent Chromium Results Hydrogeologic Sections: These figures should be updated with new data collected in the winter of 2004 and 2005 and sample analysis data collected since February 2005. New wells have been added and well clusters deepened since this figure was generated. There is also new information regarding the bedrock surface that should be reflected in these figures.

RESPONSE: Section 6.3.2 presents five cross-sections, updated with new wells, and showing the results of October 2007 chromium sampling.

ADEQ COMMENT [S1-63] (6/28/05 ADEQ Memo, page 16)

Figure 13-9 Distribution of Cr(VI) and Indicator Parameters in Floodplain Area: Although included in the above comment, it is especially important to update this figure to include data collected since February 2005, including data from MW-34-100. The figure represents edge of plume information that is not up to date.

RESPONSE: Figure 5-20 presents updated data of Cr(VI) and indicator parameters in the floodplain area, including well MW-34-100.

ADEQ COMMENT [S1-64] (6/28/05 ADEQ Memo, page 16)

Figures 13-12, 13-13 Chromium Concentrations in Selected Monitoring Wells. This figure provides two graphs for comparison of Cr(VI) concentrations over time. The scale is different in two figures, making comparisons between the two tables difficult. Please examine the data for Jan 2001 for well MW-24B which falls outside the concentration trends for this well and discuss this in text. Corresponding text should discuss which wells are showing increasing trends, or decreasing trends. Why were wells MW-22, 23, 27, and 34 excluded from this assessment?

RESPONSE: Section 6.4 presents a summary of the long-term concentration trends (increasing, decreasing, stable) observed at selected well clusters. The scales for the graphs used in this discussion (Figures 6-7, 6-8, and 6-9) were selected to best depict the data for the wells shown on the individual figures. Appendix I includes Cr(VI) concentration graphs, for reference, for selected additional wells with consistent Cr(VI) detections.

MWD COMMENT [E-comment S2-2] (6/30/05 MWD letter, page 2)

Environmental Setting Requires Additional Characterization:
PG&E has made improvements in understanding the local geology as compared to earlier drafts of the RFI. However, the current RFI/RI relies on outdated geologic information and should be updated to include more current information related to river protection. In particular, recently completed floodplain wells have identified highly transmissive geologic deposits located adjacent to the Colorado River that contain a groundwater plume with high concentrations of Cr6. Recognition of these contaminant pathways is vital to assessing migration of contamination to the river.

The bedrock geology that received wastes discharged through injection well PG&E-8 is also inadequately characterized. Geologic reports of the site bedrock have described a rock that is highly fractured and sheared due to tectonic movement along ancient faults. It is widely recognized in the geologic community that faults, fractures and shears can be efficient groundwater conductors that provide a means for contaminant migration. Therefore, additional investigation of the bedrock characteristics is warranted to more fully understand the extent of contamination that occurred from the unregulated discharges into well PG&E-8.

RESPONSE: PG&E has implemented recent characterization activities that address additional wells for water quality monitoring and hydraulic gradient contouring, pore water sampling, and in-channel surface water sampling. PG&E has also conducted well testing to re-assess the hydraulic properties of the bedrock formations at the Compressor Station site The revised RFI/RI Report discusses the results of the PGE-8 and PGE-7 hydraulic testing in Section 5.1. The revised Report includes updated maps and cross-sections showing current Cr(VI)distribution.

MWD COMMENT [S2-3] (6/30/05 MWD letter, page 3)

Degree and Extent of Contamination Not Defined:
Descriptions and assumptions made in the report regarding the degree and extent of contamination are inconsistent with field-testing results. For example, Cr6 has been repeatedly found at high concentrations in groundwater at locations where the most recent model concluded there would be not contamination. Over-reliance on theoretical models, to the exclusion of reliable field data, may lead to inaccurate conclusions. Cr6 has been repeatedly found closer to the Colorado River and at increasingly higher concentrations than models have predicted. Interim measure will not adequately protect the Colorado River unless the elevated Cr6 levels recently found adjacent to the River are recognized and adequately addressed in the RFI/RI.

Cr6 has recently been detected at concentrations up to 559 ppb at approximately 60 feet from the river. These levels are significantly higher than any previously detected in the area. A similar situation is occurring in another floodplain well near the river. These data indicate that the chromium plume may be moving past these sentry monitoring wells toward the Colorado River and that the Interim Measure efforts may not be effective. The June 2004 cut-off date excludes these important findings and results in an incomplete characterization of the dynamics of plume movement in this critical area at the river's edge.

In addition to chromium, contamination by TDS also poses a significant threat to the water quality of the Colorado River. TDS was found at extremely elevated levels at the Topock site, reaching above 40,000 mg/L in a well completed in the floodplain near the river. This is significantly above the drinking water standard is 500 mg/L. Although regulated as a secondary drinking water standard, and perhaps though to be less critical than chromium, TDS is the single key index of usability of Colorado River water for drinking, irrigation and industrial purposes. Large amounts of TDS and chromium were co-disposed along with other hazardous substances into local ravines and washes over the decades. The magnitude and extent of the TDS plume should be evaluated to better understand its distribution as well as the distribution of other plumes of hazardous substances that may be present.

The RFI/RI cites State of California Water Resources Control Board Resolution 88-63, that water exceeding a criterion of 3,000 mg/L TDS should not be used as potable water supply. However, the RFI/RI does not mention that groundwater in the basin near the Topock facility is already designated for municipal use and therefore can be reasonably expected to supply a public water system. Examples of public water systems within two miles of the site that are producing from similar zones include the Park Moabi system and the Topock Marina wells. The RFI/RI should acknowledge that contamination from the PG&E facility has likely contributed to the TDS levels in the local basin exceeding 3,000 mg/L.

RESPONSE: The Volume 2 RFI/RI report summarizes the results and recent characterization activities that address installation of additional wells in the floodplain area, including slant wells under the Colorado River for water quality monitoring, expanded hydraulic gradient contouring, pore water sampling, in-channel, depth-specific surface water sampling, and hydraulic testing and characterization of the bedrock formations Sections 6.6 summarizes the site conceptual model for the chromium plume migration in groundwater based on data and analysis through October 2007. Based on the information and conclusions presented in the RFI/RI Report, Volume 1, TDS was not identified as a COPC for the site areas/units addressed in this groundwater RFI/RI (e.g., SWMU 1/AOC 1 and SWMU 2). A related parameter, electrical conductivity (specific conductance), was identified as a COPC and is discussed in section 6.2. Table 6-1 presents the chemical-specific ARARs for the this groundwater RFI/RI. Note that the Arizona drinking water standards were not listed in the site ARARs memorandum issued by DOI for this RFI/RI (Appendix G).

MWD COMMENT [S2-4] (6/30/05 MWD letter, page 4)

Potential Contaminant Migration Pathways Endanger Colorado River:
The RFI/RI contains a number of contradictory statements on groundwater movement at the site and factors influencing groundwater levels. The report states that the principal source of groundwater recharge is from local precipitation, yet the general conceptualization form USGS hydrogeologic reports indicate that the Colorado River is responsible for recharging the alluvial aquifer of the Mohave Valley. Counter to what is assumed in the RFI/RI, local precipitation recharge accounts for only a small fraction of groundwater recharge in this area. These assumptions have led to errors in delineating migration pathways and evaluating their significance, and in developing an accurate groundwater model. Since the groundwater model is used as a tool to determine groundwater extraction rates to protect the Colorado River, these erroneous assumptions and contradictions must be corrected.

In the RFI/RI, PG&E suggests that potential chemical reducing zones in shallow sediments of the river's floodplain will convert Cr6 to the less soluble trivalent chromium (Cr3), thereby removing it from groundwater. There is a misperception that Cr3 would be less problematic in a drinking water source than Cr6. However, any Cr3 entering Metropolitan's system would be oxidized into Cr6 as part of the normal disinfection process use during drinking water treatment. Any form of chromium contamination process used during drinking water treatment. Any form of chromium contamination reaching the Colorado River, whether Cr6 or the less toxic from Cr3, is a health concern.

Additionally, the report implies that once the Cr6 is converted to Cr3, all the Cr3 is removed from the groundwater, either by adsorbing strongly to soils, or forming an insoluble precipitate. Without proper reference or direct evidence, this scenario remains unconvincing that such groundwater conditions would prevent migration of chromium and other contaminants to the Colorado River.

RESPONSE: The wording has been modified in the revised Report to make the discussion of recharge clearer (refer to Section 3.6). Stable isotope data support the conclusion that most of the groundwater beneath the Topock Site is recharged by local precipitation rather than Colorado River water or river-influenced groundwater. Although most groundwater in the Mohave Valley basin does originate in the Colorado River, nearly all of this groundwater discharges back to the river upstream of the Topock Site, as predicted by the most recent calibrated model. The comment does not refer to a specific discussion with respect to groundwater recharge. We note that the text refers to a 4-month period (February-May) in which the river recharges groundwater at the site. Over the rest of the year, groundwater discharges to the river (under natural conditions), so that there is not a net recharge to groundwater in the site area from the river.

Additional information has been provided regarding the low solubility of Cr(III) in groundwater (i.e., actual solubility ranges under site conditions and measured concentration in project groundwater monitoring wells) in Section 6.7.

MWD COMMENT [S2-107] (6/30/05 MWD written margin comments on Section 13.1.1, page 13-1)

What about theorized groundwater discharges from bedrock into the alluvium? "Due to the variable topography at the site, the depth to groundwater ranges from as shallow as.." How does this compare to the average slope of the river? "The alluvial fan hydrostratigraphic units consist primarily of clayey/silty sand and clayey gravel deposits…interbedded with.." Channel. "Groundwater at Topock site is recharged from local precipitation…" Colorado River?

RESPONSE: The intent of this comment is unclear. The section that this comment refers to states that groundwater at the Topock site is recharged primarily from local precipitation, with the Colorado River exerting strong control over groundwater levels.

MWD COMMENT [S2-108] (6/30/05 MWD written margin comments on Section 13.1.2, page 13-2)

"For comparative purposes, the State of California does not consider groundwater…" See previous comment on this issue. Why not use the TDS of PG&E blowdown that was discharged to Bat Cave Wash for comparison? TDS Distribution? Source of increased TDS? "It is common to find saline water at depth in arid basins" Internally drained basins. "The deeper wells in Bat Cave Wash (MW-37D, MW-38D) contain about four times the TDS of the nearby shallow wells. Many deep alluvial wells outside the plume area also have elevated TDS and sodium." Impacted with TDS from PG&E discharges? "As such, the local environment near the Topock site would be expected to yield modest concentrations of chromium (up to 0.05 mg/L) to groundwater." How was this value determined? Why not 10 ug/L? "These sources were among those cited in similar geologic…" Given that many of these sites have anthropogenic sources or are internally drained basins, the comparison is questionable. What is the estimated amount of Cr6 mass that was discharged to the various sites in the Study Area?

RESPONSE: The intent of these comments is not completely clear. TDS is considered to be a COPC at the site. Saline water at depth in arid basins is not solely a function of internal drainage. The revised Report will contain the results from the background study to more completely evaluate the range of naturally occurring metals concentrations, including Cr(VI), in groundwater in the vicinity of the Topock site.

MWD COMMENT [S2-109] (6/30/05 MWD written margin comments on Section 13.1.3, page 13-4)

"For this characterization, the chromium plume is defined as chromium-bearing groundwater exceeding the state MCL for Cr(T) of 0.05 mg/L." The plume should be related to Cr(T) that was discharged by PG&E, irrespective of concentration.

RESPONSE: Section 6.3.3 describes the basis for using the 50 ug/L Cr(VI) outline for defining the groundwater chromium plume at the Topock site. Since there is a natural background concentration for Cr(VI) and Cr(T) at the site, it is necessary to apply a standard for characterization. At this site, the natural background level for Cr(VI) (31.8 ug/L) and the chromium MCL (50 ug/L) are approximately the same, and would define similar plumes.

MWD COMMENT [S2-110] (6/30/05 MWD written margin comments on Section 13.2.1, page 13-4)

"At the northern and eastern limits of the chromium plume, <u>strongly reducing conditions are observed in groundwater</u> in the fluvial deposits in the floodplain (Figure 13-2)… The reducing conditions in the fluvial sediments provide a <u>natural geochemical barrier that great limits or prevents</u> the movement of <u>Cr(VI) through the fluvial sediments</u>. Only in the shallow sediments adjacent to the river.

RESPONSE: Comment noted. The revised Report reflects the depth of the strongly reducing conditions within the saturated fluvial deposits in Sections 5.3 and 6.7.

MWD COMMENT [S2-111] (6/30/05 MWD written margin comments on Section 13.2.1, page 13-5)

"For this discussion, Cr(VI) and Cr(T) groundwater results for the RFI well network from the period March 2003 through <u>June 2004</u>…" Discussion needs to incorporate recent monitoring results of elevated levels of Cr6.

RESPONSE: Section 6.3.1 presents the of current distribution of Cr(VI) on maps of the depth zones of the Alluvial Aquifer (Figures 6-2a, 6-2b, 6-2c) for the October 2007 site-wide groundwater sampling event..

MWD COMMENT [S2-112] (6/30/05 MWD written margin comments on Section 13.2.1, page 13-5)

Lateral and Vertical Distribution Section: There appears to be a bias from low-flow sampling results and a large number of shallow wells compared to deeper wells.

RESPONSE: Recent analytical data from October 2007 was used for evaluating the lateral and vertical distribution of chromium in Section 6.3. Since 2004, low-flow sampling has not been used for the RFI/RI groundwater sampling.

MWD COMMENT [S2-113] (6/30/05 MWD written margin comments on Section 13.2.1, page 13-6)

"The Cr(VI) detection in the initial sample is likely due…during 5 years of RFI sampling, Cr(VI) has not been detected in groundwater samples from the bedrock well PGE-8.." Consider: Conservative contaminants have been seen to move a long distance in fractured bedrock at other sites.

RESPONSE: The revised Report describes the available groundwater sampling data and recent hydraulic testing data from bedrock wells in Sections 6.3 and 5.1, respectively.

MWD COMMENT [S2-114] (6/30/05 MWD written margin comments on Section 13.2.2, page 13-6)

"The data show a wide range in concentration and no uniform trend of Cr(VI) concentration with depth in the aquifer" Could this be because of stratigraphy is not uniform?

RESPONSE: Section 6.3 of the revised Report discusses potential reasons for vertical variation in the concentration of chromium. Two of these, heterogeneity and permeability variations (vertical and lateral) of the aquifer media and site-specific geochemical conditions affecting the stability of Cr(VI), can be related to stratigraphy.

MWD COMMENT [S2-115] (6/30/05 MWD written margin comments on Section 13.2.2, page 13-6)

Sept 2003 lower Cr6 detection limits. Are sections A, C and E cross section?

RESPONSE: The meaning of the comment on detection limits is unclear. Both the Section letter and the appropriate figure number are referred to in the text for these cross sections.

MWD COMMENT [S2-116] (6/30/05 MWD written margin comments on Section 13.2.1.3, page 13-7)

Flushing Cr6 by River water?

RESPONSE: The correlation between ORP, chromium and nitrate is discussed more fully in Section5.3 of the revised Report, where the presence of microorganism communities in the shallow fluvial zone is postulated as the most likely reason for the relationship.

MWD COMMENT [S2-117] (6/30/05 MWD written margin comments on Section 13.2.1.4, page 13-8)

Is there enough sampling data to come to this conclusion? "There is, therefore, a natural system in place that strongly attenuates the transport of chromium through shallow fluvial sediments." <insert – between "shallow" and "fluvial"> - organic rich. Data from MW-27?

RESPONSE: The revised Report clarifies the depth of the reducing zone in Sections 5.3 and 6.7.

MWD COMMENT [S2-118] (6/30/05 MWD written margin comments on Section 13.2.2, page 13-9)

Clarification needed: If wells at the margin of the plume are trending up or down, how is this considered stable? See for example MW-35.

RESPONSE: The Volume 2 report addresses the nature and extent of the chromium in groundwater at the site and the observed data trends. See Section 6.7 for the discussion of the fate, stability, and transport of chromium for this RFI/RI characterization.

MWD COMMENT [S2-119] (6/30/05 MWD written margin comments on Section 13.2.3, page 13-10)

"This pumping would have had an effect…all of the chromium plume." Consider: Could the pumping have accelerated the movement of the Cr6 mass downgradient from the facility? "As described in previous sections, the fluvial deposits in the floodplain are associated with…" <Insert: between "the" and "fluvial"> shallow. <Insert: between "floodplain" and "are"> adjacent to the Colorado River. "In order to reach the river, groundwater from these depths would have to move…from solution." There doesn't appear to be evidence that reducing zones exist beneath the river. In 1970, wastewater discharge to Bat Cave Wash was ceased; since that time, the plume has migrated solely under natural gradients. <insert – between "migrated" and "solely"> toward the river. "It is reasonable to assume that this protective zone…" Consider: As the river continually downcuts and deposits new bed load deposits, it creates abrupt internal changes in sediment grain size and organic content. "In conclusion, though elevated Cr(VI) exists in deep floodplain groundwater.." On the other hand, there is no evidence that Cr6 is not in the river. Information is lacking beneath the river.

RESPONSE: The effect of pumping at wells PGE-1 and PGE-2 is discussed in Section 6.6 of the revised Report. Additional information from the December 2005-January 2006 pore water study will be added to the text with respect to reducing conditions related to the river sediments.

MWD COMMENT [S2-120] (6/30/05 MWD written margin comments on Section 13.2.4.1, page 13-11)

How is TDS distributed with respect to stratigraphy, the river, and PG&E discharges?

RESPONSE: The revised Report includes additional discussion of the groundwater TDS distribution (lateral and vertical) incorporating new data from sampling through October 2007. Refer to Section 5.3.

MWD COMMENT [S2-121] (6/30/05 MWD written margin comments on Section 13.2.6, page 13-12)

What about Thallium? Thallium has been found at another PG&E compressor station.

RESPONSE: Thallium is not listed as a COPC for the Topock site. It is not discussed in the revised Report, since only two samples (out of 258 historically) contained thallium above detection limit. One well was a plume well (MW-12) and one was far from the plume (CW-3D). Both detections were just above the method detection limit of 1 μg/L, and no other samples from these wells contained detectable thallium.

MWD COMMENT [S2-122] (6/30/05 MWD written margin comments on Section 13.3.1, page 13-14)

Re-tests were outside of holding times. Please provide complete laboratory QA/QC for these data.

RESPONSE: The revised Report includes an updated and expanded discussion of the surface water sampling results and characterization. The data review and verification sampling for the suspected false-positive Cr(VI) results from June 2002 sampling are presented and qualified as appropriate.

MWD COMMENT [S2-123] (6/30/05 MWD written margin comments on Section 13.3.3, page 13-15)

What about field measured parameters? Consider: The extent and location of these samples were too limited to draw any conclusions

RESPONSE: The revised Report includes additional data points from the December 2005-January 2006 pore water study in the discussion of interstitial sediment and water analyses. Field parameter results are provided in Appendix H of the report.

MWD COMMENT [S2-124] (6/30/05 MWD written margin comments on Section 13.4, page 13-15)

"For the RFI, the chromium plume is defined as…" Consider: Should the Cr6 plume be defined based on its source from PG&E. "The chromium plume is essentially confined to the more … " There has been an incomplete evaluation for bedrock. "At the northern and eastern limits of the chromium plume, geochemical reducing conditions are observed in groundwater in the fluvial deposits in the floodplain." <insert Shallow : between "the" and "fluvial"

RESPONSE: The intent of this first set of annotated comments on Section 13 text is unclear. Section 5.1.4 and 6.3.4 summarize the results and recent hydraulic testing and groundwater characterization of the bedrock formations, respectively. Section 5.3.1.6 describes the conditions and depths that geochemical reducing conditions are observed in the fluvial deposits.

FMIT TECHNICAL COMMENT [T1-2] (7/7/05 Hargis+Associates letter comment, page 2)

Applicability of Natural Attenuation (Section 13):
Based on H+A's review of the available data, the Tribe believes that there are compelling reasons to believe that the natural attenuation capacity of the aquifer at the Topock Site may be sufficient to at least serve as a component of the site remedy. Field evidence supporting natural attenuation of hexavalent chromium ("Cr(VI)") in the aquifer is strong. This evidence is both reported and discussed throughout the RFI Report. For example:

Reducing Conditions Associated with Fluvial Sediments (p. 2-14) – This section discusses contrasting oxidation-reduction potential ("ORP") within the alluvial and shallow fluvial zones of the Alluvial Aquifer. Whereas oxidizing conditions are typical of groundwater in wells completed in the alluvial zone, conditions in the shallow fluvial groundwater tend to be reducing. The presence of reducing conditions is further corroborated by the ORP of various ion radicals of nitrogen, iron, and manganese. The text further states that:

"The reducing conditions observed in the floodplain sediments are likely caused by microbial breakdown of the organic carbon present in these shallow fluvial deposits. These reducing conditions in the fluvial deposits play a key role in the attenuation of the hexavalent chromium….."

Fate and Transport of Chromium (p. 13-10/11) – This section assembles available information on the behavior of both Cr(VI) and trivalent chromium ("Cr(III)") species in groundwater at the Topock site. It is ultimately concluded that:

"….though elevated Cr(VI) exists in deep floodplain groundwater, there is no evidence that CR(VI) is discharging to the river. In fact, available evidence strongly suggests that Cr(VI) is **being removed** from the groundwater by a blanket of reductive fluvial sediments….." [Emphasis added.]

These conclusions are supported by independent technical literature for other sites that indicate the reduction of Cr(VI) to Cr(III) in natural systems. For example, Palmer and Puls (1994) discuss the ability of aquifers to naturally attenuate Cr(VI) by reduction in the aquifer. Potential reductants include reduced iron, manganese, sulfur, and nitrogen species, and total organic carbon ("TOC") present in both soil and groundwater. On a mass basis however soil has been shown to be more important than groundwater in reducing concentrations of Cr(VI).

Reduced metal species such as divalent iron ("Fe(II)") do not usually exist at high concentrations in soils in aerobic aquifers. TOC concentrations within the aquifer matrix, however, can provide a conservative estimate of an aquifer's capacity for reducing Cr(VI) chromium. Along these lines, Barcelona and Holm (1991) calculated the reduction capacity of aquifer solids ("R_T") in moles per gram using the following equation (see H+A letter).

Because aquifers with aerobic conditions usually have low concentrations of Fe(II), TOC concentration are important in estimating their reductive capacity. Because the estimated aquifer reduction capacity for Cr(VI) calculated from TOC concentrations is larger than, or in the same order of magnitude as, the Cr(VI) reductive capacity measured directly in the laboratory method described below, it is considered to be a conservative estimate.

The reductive capacity of the aquifer relative to the ambient concentration within the groundwater is, of course, dependent on the concentration of Cr(VI) in the groundwater. The available Cr(VI) reductive capacity of the aquifer matrix, expressed as the amount of Cr(VI) that can be reduced per unit mass of aquifer material, can be estimated by a method outlined in Bartlett and James (1988). This method is based on the Walkley and Black Method (Walkley and Black, 1934). This laboratory test provides a more direct measure of the reduction capacity of the aquifer for Cr(VI) because it employs a Cr(VI) solution, potassium dichromate ($K_2Cr_2O_7$), and soil matrix samples collected from the study site.

In Section 13.5 of the RFI Report, PG&E lists further data needs for groundwater characterization. Absent from this list are activities that would further examine parameters that would be used to evaluate natural attenuation capacity of the aquifer. Specifically, in light of the above discussion, it would be appropriate to consider drilling exploratory borings around the periphery of the chromate plume (e.g., perhaps four borings), but only after consultation with the Tribes on the need for and location of specific boring to ensure that all efforts are made to avoid cultural and spiritual impacts.

The purpose of these borings would be to collect soil samples with depth. Such samples would then be analyzed for TOC and potentially other parameters indicative of redox conditions so that the geochemical environment, particularly the reductive capacity of the aquifer, can be conceptualized in three dimensions. If necessary, this information could be further utilized in a geochemical model of a predictive nature that could be used to evaluate potential changes in Cr(VI) in the future.

Before any further IMs are enacted, DTSC should consider other actions that could lessen the impact on the spiritual and cultural values of the Tribe as well as environmental impacts. This above discussion identifies at least one other alternative is potentially viable and could have a significantly less adverse effects.

RESPONSE: DTSC takes its responsibility to balance the spiritual and cultural values of the tribes with actions necessary for characterization and cleanup very seriously. Discussion of the reducing conditions associated with the fluvial sediments and data collected to characterize those conditions at the site are presented in the revised Report that specifically address the site hydrogeology and groundwater characterization in Sections 5.3 and 6.7.

Responses to DTSC September 7, 2007 Comments On PG&E Response to Comments on the Hydrogeology and Groundwater Sections of the February 2005 Draft RFI/RI Report PG&E Topock Compressor Station

Commenting Agencies:

California Department of Toxic Substances Control (DTSC) and Geological Services Unit (GSU)

General Comments

1. The revised RFI/RI Report should utilize data collected up to July 31, 2007. Data collected after this date will be reported in other reports or addendums to the RFI/RI Volume 2 Report. The December 5, 2006 PG&E letters reviewed identified an anticipated March 2007 RFI/RI cutoff date.

2. Information (e.g., aquifer tests, flow logging) currently being obtained through the investigations of bedrock wells (i.e., PGE-7, PGE-8, MW-48, and MW-23) should be included in the revised RFI Report.

PG&E RESPONSES TO STAKEHOLDER RFI COMMENTS (PARTS A & B)

DTSC COMMENT [S4-18] (3/10/06 GSU Memo, Comment 18)

Page 2-8, Section 2.4.2, third paragraph. This section discusses river level data collected in Topock Gorge between 1930 through 1980. The section and Figure 2-8a should be updated to include recent river level data that are available for Topock Gorge.

PG&E RESPONSE: *Section 2.4.2 and Figure 2-8a were provided as an illustration of river fluctuation and trends over a longer period of time, and were not meant to be comprehensive. The revised Report text and figure will be updated with any additional available information.*

DTSC FOLLOWUP: DTSC desires a comprehensive summary that includes more recent data that should be available. Section 2.4.2 and Figure 2-8a should be updated to include recent river level data that are available for Topock Gorge.

PG&E Response: Available data from the Topock Gorge gauging station was added to the figure, which is now Figure 3-10.

DTSC COMMENT [S4-20] (3/10/06 GSU Memo, Comment 20)

Page 2-10, Section 2.5.2. Provide a detailed structural contour map of the top of the Miocene Conglomerate. Use the map to support a discussion of the potential influence of the bedrock surface configuration on groundwater flow.

PG&E RESPONSE: *The revised Report will include a structural contour map of the bedrock surface. The text will be modified to present a discussion of the effects of the bedrock surface on groundwater flow.*

DTSC FOLLOWUP: Please ensure that all data used to derive the structural contour map of the bedrock surface are clearly described within the revised Report text and/or on the figure itself.

PG&E Followup: Section 5.1.3.1 discusses Miocene bedrock surface map and the data used for preparation. Referenced Appendix Table B-4 lists the depths and elevations used for the bedrock structure map.

DTSC COMMENT [S4-29] (3/10/06 GSU Memo, Comment 29)

Page 2-17, Section 2.5.4.1. This section should also discuss the estimated volume of groundwater that is recharged from the Colorado River and how far inland the mixing zone between the Alluvial Aquifer and surface water is observed.

PG&E RESPONSE: *The revised Report will update the discussion in this section to clarify the water balance relationship between the river and groundwater. There is a net discharge of groundwater to the river. Only during the spring months (and some years early summer) does the river recharge the alluvial aquifer at the Topock Site area. Further north in Mohave Valley, the river is the main source of groundwater recharge.*

DTSC FOLLOWUP: As originally requested, please also ensure the revised Report discusses how far inland the mixing zone between the Alluvial Aquifer and surface water is observed.

PG&E Response: The revised Report discusses isotopic evidence for mixing in Section 6.5.2. However, precise delineation of natural mixing is not possible because IM pumping has enhanced the mixing of river-influenced groundwater and local, non-influenced groundwater.

DTSC COMMENT [S4-34] (3/10/06 GSU Memo, Comment 34)

Page 2-20, Section 2.5.5.1, first paragraph. *The illustration of horizontal hydraulic gradients outside of the floodplain area should be supported by groundwater elevation contour maps generated using monthly averages of groundwater elevations, rather than the two-year average of groundwater elevations used for Figure 2-21. The time intervals contoured should be representative of high and low river stands.*

PG&E RESPONSE: *The revised Report will discuss horizontal hydraulic gradients outside the floodplain area using groundwater elevation maps made using selected monthly averages of groundwater elevations.*

DTSC FOLLOWUP: Note: The time intervals contoured shall be representative of high and low river stands (see also PG&E Response to ADEQ Comment [S1-24] (6/28/05 Memo)).

PG&E Followup: Section 5.2.1 discusses the hydraulic gradients outside the floodplain area and shallow zone gradient maps are provided for high river stand (June 2006, Figure 5-11a) and low river stand (December 2006, Figure 5-12a).

DTSC COMMENT [S4-50] (3/10/06 GSU Memo, Comment 50)

Table 2-3. Add a note that indicates how the upper, middle, and lower portions of the Alluvial Aquifer are defined. Add a note that indicates where the items listed in the last column can be found in the RFI Report. For the borings, indicate the deeper encountered unit.

PG&E RESPONSE: *The drilling summary table in the revised Report will include the aquifer interval definitions and will be updated with full listing of drilling locations. For borings not completed as wells, the deeper encountered unit will be listed.*

DTSC FOLLOWUP: As originally requested, please also add a note to Table 2-3 that indicates where the items listed in the last column can be found in the RFI Report.

PG&E Followup: Table 4-2 (drilling summary table) includes a complete listing of wells and borings with updated monitoring zone designations. The table footnotes specify the Appendices where the additional characterization data is provided. For consistency with the Appendix B drilling compilation, the HSU encountered in wells and borings are presented in Appendix Table B-4.

DTSC COMMENT [S4-51] (3/10/06 GSU Memo, Comment 51)

Table 2-4. CH2M HILL (2004) is not included in the reference list. Well MR-24BR should be listed as a pre-Tertiary Bedrock well rather than as a Miocene Conglomerate well.

PG&E RESPONSE: *The revised Report will clarify the monitored zone for MW-24BR as Miocene and/or pre-Tertiary Bedrock in Table 2-4 to be consistent with other tables and discussions in the revised Report.*

DTSC FOLLOWUP: As originally requested, please ensure that the CH2M HILL (2004) reference in Table 2-4 is included in the reference list. Additionally, the geophysical data obtained during Spring 2007 during investigation of well PGE-7 should be utilized in establishing the stratigraphic unit monitored by well MW-24BR.

PG&E Followup: Tables 4-3 and 5-1 (hydraulic testing inventory and results tables) have been updated with monitoring zone designations and references to the prior reports confirmed for Volume 2.

ADEQ COMMENT [E-comment S1-2] (6/28/05 ADEQ Memo, page 2)

Concentration Contouring – *Concentration contouring would be very useful for depicting vertical and horizontal distribution. It would be helpful if the RFI contained concentration contouring for chromium and TDS to depict the vertical and horizontal extent of contamination and to facilitate discussion and the next steps in the Resource and Recovery Act (RCRA) remedial process. Concentration contours are very useful in examining the spatial behavior of the plume.*

PG&E RESPONSE: *The February 2005 draft Report included plume contour maps using 50 µg/L Cr(VI) for site-wide plume delineation. The revised Report will include updated figures that depict the horizontal and vertical Cr(VI) distribution and plume contouring, and will be similar to the contour maps in PG&E's 2006 IM performance monitoring reports. Contouring TDS concentrations in map and cross section view is not warranted, based on the horizontal and vertical variability in data in groundwater at the site.*

DTSC FOLLOWUP: As TDS (Total Dissolved solids) is a constituent of potential concern and was part of the waste stream that was discharged along with the hexavalent chromium to groundwater at the site, PG&E will need to illustrate the spatial distribution of TDS within the aquifer, both vertically and laterally, within the revised Report. If contouring is not warranted, then it is suggested that TDS concentrations for bedrock, the upper, middle, and lower zones be depicted in map views. Cross section views should also depict TDS concentrations to illustrate the horizontal and vertical variability in data.

PG&E Followup: Figures 5-17a,b,c and 5-18 present the average TDS results for the Alluvial Aquifer zones and in cross-section view, respectively.

ADEQ COMMENT [S1-23] (6/28/05 Memo)

Figure 2-22, 2-22b, 22c Groundwater Contour Maps – *Please verify that elevations in extraction wells are not being used for contouring. Or if they are, are they being corrected for well in-efficiencies? How were wells selected for this contouring? Selection of wells for contouring can affect the outcome of contouring and selection criteria should be explained as a part of documentation. What was considered as the break off point for Upper Unconsolidated Aquifer/Alluvium?*

PG&E RESPONSE: *PG&E agrees that extraction wells are not reliable data points for water level contouring. Further, because well inefficiencies can be significant, but are difficult to estimate, none of the PG&E published reports including the RFI, have used extraction wells water levels, corrected or uncorrected. The revised Report will include* *representative groundwater gradient maps for the IM performance monitoring area and site-wide shallow well groundwater gradient maps generated and reported in PG&E's groundwater monitoring reports.*

DTSC FOLLOWUP: The revised Report should also discuss how wells were selected for contouring and the division/"break off point" between aquifer zones as requested in ADEQ's comment.

PG&E Followup: The revised Report describes the break-off points for shallow, mid-depth, and deep Alluvial Aquifer wells and the non-stratigraphic rationale for these breaks in Sections 4.2.1.2 and 5.2.1.

ADEQ COMMENT [S1-25] (6/28/05 Memo)

From examining Figure 2-22c – it appears that only 3 wells in close proximity were used for contouring in conjunction with MW34-80 and possibly river elevations. Contouring is a subjective process that is made more complicated, if vertical gradients are present. Please provide explanation for use of river elevations in groundwater contouring and for using a very limited number of wells in creating this figure. Contouring does not currently include newly installed wells such as MW-34-100. It is possible that additional wells may be needed to adequately contour this zone.

PG&E RESPONSE: *The revised Report will include groundwater gradient maps for depth intervals in the floodplain area (from IM performance monitoring reporting) using previously existing and newly installed monitoring wells (2005-2007). The revised Report will qualify the depths and distribution of well screen/data available to map gradients in the actively pumped IM area.*

DTSC FOLLOWUP: The revised Report should also discuss the use of river elevations in groundwater contouring as requested in ADEQ's comment.

PG&E Followup: The revised Report shows river elevations from transducer locations I-3 and RRB, along with interpolated values in between. Refer to Figures 5-11a and 5-12a.

ADEQ COMMENT [S1-38] (6/28/05 ADEQ Memo, page 9)

Section 9.2.5 Surface Water Samples. It is important to note that none of the sampling locations in the river at the time of this draft report were positioned adjacent to the highest plume concentrations in the floodplain wells, especially, none were in line and adjacent to MW-34-100 (and the wells located west of this well with greater concentrations). ADEQ notes that there are also no surface water sample locations adjacent to the East Ravine or downriver of this ear towards the mouth of Topock Gorge. Modeling runs performed by Hill suggest that the plume could potentially be pulled in this direction by groundwater withdrawal in Arizona water supply wells. From Technical Workgroup Meeting discussions, the sample collection depth has been identified as 6 inches from the top of the water column in the Colorado River. ADEQ requests that text describe the collection point as 6 inches beneath the water surface.

All this is important information that should be provided in the RFI to frame interpretation of the results. Without it, the results are misleadingly optimistic. For example, if chromium were to reach the river, the lower water column is the more likely location where it would be detected/found. Samples collected in the upper 6 inches would not be suitable for examining this issue. Therefore conclusions regarding potential influence of the plume on surface water cannot be made.
PG&E has prepared a surface water sampling proposal which will be implemented in July 2005. This includes depth specific sampling and additional sampling locations to address the concerns above. This is an important step in responding to ADEQ's concerns. The RFI should include information about the new procedures that will be implemented.

This section also should also cross reference Section 13.13.1 which discusses detections of Cr(VI) in the Colorado River during the June 2002 sampling event. Please see ADEQ comments regarding conclusions made by Hill.

PG&E RESPONSE: *As ADEQ indicates, PG&E's expanded surface water sampling program, including in-channel sampling, has been conducted since summer 2005. Note that all surface water samples collected under the expanded surface water program have shown no detectable Cr(VI) in any river water samples. The revised Report will be updated with data from* the expanded surface water monitoring program through March 2007.

DTSC FOLLOWUP: ADEQ noted the lack of surface water sample locations adjacent to the East Ravine. As the East Ravine is a concern to DTSC (see response to GSU General Comment 3, Section 11) with anomalously high hexavalent chromium detected in nearby shallow bedrock well MW-23, DTSC requests that PG&E add a new Shoreline Location to the Surface Water Monitoring Program for a period of one year. This location should be located due east of groundwater well MW-23 between Shoreline Locations R-22 and I-3 in the vicinity of the open "pond" that laps up onto the bedrock surface. Although this location is not on the main channel, data from this location could help to ensure that the Colorado River is not currently being impacted from site related activities. Data collected from this surface water location shall be reported in routine Groundwater and Surface Water Monitoring Reports and not reported in the revised Report.

PG&E RESPONSE: The new surface water location in the pond east of MW-23 has been added to the routine groundwater and surface water monitoring program.

ADEQ COMMENT [S1-43] (6/28/05 ADEQ Memo, page 11)

Section 11.0, Conceptual Site Model, page 11-1: "Both groundwater beneath the compressor station and surface water in the Colorado River have designated beneficial uses that include municipal and domestic water supply, although much of the groundwater contains levels of TDS that inhibit its use of potable water supply." Arizona aquifers are protected as drinking water sources regardless of TDS and water quality.

PG&E RESPONSE: *Applicable or relevant and appropriate requirements for groundwater will be identified as required by CERCLA.*

DTSC FOLLOWUP: Appropriate sections of the revised Report should clearly incorporates ADEQ's comment that Arizona aquifers (defined as yielding more than five gallons a day) are protected as drinking water sources regardless of TDS and water quality.

PG&E RESPONSE: The DOI's December 2007 list of applicable or relevant and appropriate requirements did not include any Arizona Water Quality Standards.

MWD COMMENT [S2-41] (6/30/05 MWD written margin comments on Section 2.5, page 2-12) *Short-duration single well tests also have limitations due to well interferences, etc.*

PG&E RESPONSE: *The revised Report will clarify the features of short-term aquifer tests in the hydraulic testing discussion.*

DTSC FOLLOWUP: The term "features" is somewhat vague in the preceding PG&E response. The revised Report shall acknowledge and address limitations of short-duration single well tests.

MWD COMMENT [S2-49] (6/30/05 MWD written margin comments on Section 2.5, page 2-19) *Average gradients will be influenced by the duration of period used.*

PG&E RESPONSE: *The revised Report will provide an updated discussion and presentation on the horizontal and vertical hydraulic gradients.*

DTSC FOLLOWUP: The updated discussion in the revised Report should indicate and illustrate why a particular time interval (e.g., one month versus two weeks) was chosen to average gradient data from well transducers.

PG&E Followup: Section 5.2.2 of the revised Report describes the periods used for averaging. The purpose was to collect as many accurate data pairs as possible and provide min, max, and average gradient values; it is assumed that by including many measurements that the range of gradients is more accurately estimated.

MWD COMMENT [S2-50] (6/30/05 MWD written margin comments on Section 2.5, page 2-20)

"Groundwater elevations from the upper, middle, and lower portion of the alluvial aquifer in <u>June 2004</u> are shown and contoured in Figures 2-22A through 2-22C, respectively." There are very limited, i.e. snapshot. Elevations vary daily, weekly, monthly and annually. "As described in Section 2.4, the limited amount of rainfall recharge in the nearby mountains enters the Alluvial Aquifer via <u>upward seepage from the bedrock</u>

underlying the Alluvial Aquifer." This suggests the bedrock is a viable conductor for groundwater movement and therefore contaminant transport.

"It is evident that the direction of groundwater gradient near the river changes during the course of each day seasonally in response to changes in river level (Section 2.4.2)." Unclear. Do you mean to say "each day" and "seasonally"? Inconsistencies on how groundwater moves onsite. This argument is counter to earlier comments. "There are no apparent continuous aquitards present at the site." Need nested bedrock well to show this.

PG&E RESPONSE: *The revised Report will provide an updated discussion and presentation on the horizontal and vertical hydraulic gradients and summarize the information presented in the Bedrock Evaluation Technical Memorandum regarding assessment of bedrock water-bearing characteristics.*

DTSC FOLLOWUP: PG&E will need to respond to the "each day seasonally" concern identified above if this unclear, undefined term will be carried forward into the revised Report.

PG&E Followup: The intended phrase was correctly interpreted by MWD as being "each day *and* seasonally". This has been corrected in the revised Report.

MWD COMMENT [S2-86] (6/30/05 MWD written margin comment on Section 9.1, page 9-1)

Please provide clarification: What were the objectives? What was achieved? What were the results? Were there data quality objectives established? Did the data collected meet the objectives?

PG&E RESPONSE: *All of the RFI data collection efforts were conducted according to work plans that were submitted to, and approved by, DTSC. The work plans contain information on objectives and the rationale for the sampling. The completed phases of the RFI sampling met the objectives presented in the initial work plans. A listing of the work plans prepared under the RFI program is provided in Section 9.2 and will be updated in the revised Report.*

DTSC FOLLOWUP: Discussion of soil and sediment data quality contained in either the revised Report or RFI Volume 3 (Soils) should refer the reader to the Soil and Sediment Data Usability Assessment Memorandum (CH2M Hill, 2006a) to provide additional data quality information regarding historical soil and sediment data.

PG&E Followup: Section 4.1.2 summarizes the approved work plans and data review program documents that apply to groundwater and surface water and river sediment characterization. The soil and sediment data quality documents and assessment will be discussed in the RFI/RI Volume 3 report.

MWD COMMENT [S2-122] (6/30/05 MWD written margin comments on Section 13.3.1, page 13-14)

Re-tests were outside of holding times. Please provide complete laboratory QA/QC for these data.

PG&E RESPONSE: *The revised Report will include an updated and expanded discussion of the surface water sampling results and characterization. The data review and verification sampling for the suspected false-positive Cr(VI) results from June 2002 sampling will be presented and qualified as appropriate.*

DTSC FOLLOWUP: The revised Report should reference the document reporting the June 2002 sampling results and summarize associated laboratory QA/QC data.

PG&E RESPONSE: The Report references the August 2002 document reporting the June 2002 sampling results in Section 7.2 and summarizes the data quality review.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 3, Section 11)

Section 11 describes pathways to groundwater associated with selected wastewater management practices for the Topock Compressor Station. The section discusses groundwater pathways related to the former percolation bed in Bat Cave Wash (SWMU 1/ AOC 1) and injection well PGE-08 (SWMU 2/AOC 2). This section should be revised to discuss the groundwater pathways associated with the following SWMUs and AOCs.

- *<u>SWMU 5</u>. The RFI Report should consider the sludge drying beds as a potential source to groundwater. Review of the historical aerial photographs indicates ponded water in the drying beds which potentially allowed wastewater to migrate through joints in the concrete. The beds were also used for wastewater treatment which also had associated impounded water.*
- *<u>SWMU 6</u>. Between 1969 and 1985, approximately 30,000 gallons per day were discharged to the chromium reduction tank. Hexavalent chromium concentrations in influent and effluent were on the order of 0.6 to 6 milligrams per liter (mg/L) and 0.42 mg/L, respectively. The tank represents a source to groundwater because the base of this tank was not lined or paved (see Section 4.1.5.1).*
- *<u>AOC 10 (East Ravine)</u>. The groundwater pathway is likely to be complete in the East Ravine. A 1955 aerial photograph shows two drainage ditches conveying liquids or runoff from the compressor station area to the ravine. Aerial photographs from 1964 and 1967 show ponded water in the ravine. The volume of wastewater discharged to the ravine is unknown, but could be assumed to have been sufficient to percolate to groundwater.*

PG&E should expand Section 13.1.2.2 to discuss these potential sources to groundwater. Depending on the findings of additional soil investigation, PG&E may need to expand the extent of the chromium plume depicted in the RFI Report and other *monitoring reports to include the area of the sludge drying beds and chromium reduction tank.*

PG&E RESPONSE:

Section 5 of Volume 1 of the revised RFI/RI Report (submitted to DTSC and the federal agencies on September 6, 2006) describes the closure activities and status of all SWMUs and AOCs within the site investigation and closure process. Based on closure activity documentation, including confirmation soil sampling, and the closure certification acceptance issued by DTSC in 1995, the sludge drying beds and chromium reduction tank were classified as closed SWMUs. Therefore, SWMUs 5 and 6 were not carried forward in the RFI/RI process. Additionally, the 2nd bullet Comment 3 should be clarified that the chromium reduction tank was a 10' high by 5' diameter steel tank set <u>within</u> an unlined pit, and that there was no indication of liquid releases at this unit during the RFA facility inspection (A.T. Kearney 1987).

As part of the upcoming Work Plan for RFI/RI soil investigation, Part B (sites within the Compressor Station property), PG&E does plan to drill some deep soil borings at the facility as part of the investigation of AOC 13 (Unpaved Areas within the Compressor Station) and may complete one or more of these borings as monitoring wells if groundwater is encountered. Although this activity will not be associated with the closed SWMUs 5 and 6, it will provide additional subsurface soil and groundwater characterization in the vicinity of these closed SWMUs.

For AOC 10 (East Ravine), PG&E acknowledges that the supplemental deeper drilling and sampling investigation would be appropriate to determine if groundwater is present and to complete the characterization of a potential groundwater pathway at AOC 10. Accordingly, it is recommended that the Work Plan for RFI/RI soil investigation, Part A (draft submitted November 16, 2006) include supplemental deeper soil and groundwater characterization activities for AOC 10. The draft Work Plan for the Part A soil investigation will be revised to include deeper drilling to bedrock in one or more soil boring locations in AOC 10 (where feasible).

DTSC FOLLOWUP: SWMUs 5 and 6 will be carried forward in the RFI/RI process and further investigated as indicated in Section 5 of PG&E's RFI/RI Report – Volume 1 (CH2M Hill, 2007a).

<u>SWMU 6, Chromate Reduction Tank</u>: The 1990 Closure Report (Mittelhauser Corporation, 1990) suggests that the Chromate Reduction Tank could have leaked and released contaminants to groundwater. Page 6-4 of the 1990 Closure Report states, "The soil floor of the hole in which the Chromate Reduction Tank sat was unlined. There was a "bathtub ring" on the walls of the hole and the soil floor appeared compacted, as if water had stood in the hole." The Closure Report further states, "The bottom of the tank had a 2-foot-square fiberglass patch on the inside and a 1-foot-diameter welded steel patch on the outside." The revised Report should acknowledge that the SWMU 6, Chromate Reduction Tank is a potential historical site source for chromium that is planned to be further investigated during upcoming soil sampling investigations within the facility's fence line.

PG&E Followup: Volume 3 of the RFI/RI Report will address this comment.

AOC 10 (East Ravine): The revised Report should acknowledge that groundwater investigation will be required for the East Ravine. This will likely require drilling into bedrock due to existing site geology. Concern exists that the East Ravine is a source of groundwater impact due to the following factors: significant amounts of fluids were impounded behind the largest dam (Area 10c - CH2M Hill, 2007a/ 2006b) during the 1960's; the chromium concentrations detected in soil samples from the 10c impoundment area are the highest (3,360 mg/kg) detected on the entire facility (CH2M Hill, 2006b); the impoundment 10c area contains a white powdery material similar to the white material in Bat Cave Wash; a greenish gray layer has also been identified in the 10b area of the East Ravine; and chromium has recently been detected in groundwater in bedrock well MW-23 in 2006 and 2007 at concentrations greater than 1,000 ug/L (CH2M Hill, 2007b).

PG&E Followup: The revised Report indicates that an additional groundwater investigation is planned to characterize the groundwater conditions of bedrock formations in the East Ravine and MW-23 area. The work plan for the East Ravine groundwater investigation, dated December 11, 2007, was submitted to DTSC and DOI. Following implementation, the results of this investigation will be reported in the RFI/RI Volume 3, data summary reports, or monitoring reports, as appropriate given the nature of the data and the affect on RFI/RI conclusions.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 4, Section 11)

The conceptual site models (CSMs) included in Section 11 are intended to support the risk assessment. The RFI Report should also include a conceptual model of chromium plume migration from all known and potential source areas to the present groundwater plume position. The RFI Report should discuss the potential fate and transport of chromium discharged to Bat Cave Wash, the chromium reduction tank, and into injection well PGE-08. In addition, the RFI Report should discuss the potential contaminant migration pathways associated with the East Ravine (e.g., potential for water to travel through thin sediments to bedrock, potential to travel through bedrock to floodplain area). The discussion related to injection well PGE-08 should address the potential effect of upward hydraulic gradients and the Chemehuevi Fault on migration of injected water.

PG&E RESPONSE:

The revised Report will present and discuss conceptual site models for the potential fate and transport of chromium discharged to Bat Cave Wash (SWMU 1) and the injection of treated blow-down wastewater in well PGE-8 (SWMU 2). These discussions will be based on the site data that will be available as of March 2007(assumed cut-off date for the revised Report). The data from the planned hydraulic testing of the PG&E bedrock wells and updated model runs for groundwater flow for the Alluvial Aquifer at SWMU 1 will be incorporated. As noted in the response to Comment 3, the chromium reduction tank was certified as a clean-closed SWMU with no evidence of adjacent liquid releases, and therefore development of an area-specific CSM (including fate and transport assessment) for this SWMU is not warranted and will not be included in the revised Report.

Regarding the East Ravine (AOC 10), additional drilling and soil sampling characterization is planned as part of the upcoming RFI/RI soil investigation. Based on the proximity to bedrock outcrop surrounding the East Ravine, it is anticipated that one or more of the deepened soil borings (see Response to General Comment 3) will confirm the depth to bedrock and support the current interpretation that the alluvium in this area is thin (i.e., < 30 feet thick) and significantly above the water table. Where use of drilling equipment is feasible, selected borings will be drilled to bedrock and soil samples analyzed to characterize the complete alluvium interval. Samples of groundwater will be collected in the deeper borings if encountered. The results of the deepened soil borings in East Ravine will be included in the revised Report as available relative to the RFI/RI cut-off date.

The feasibility of incorporating the results of proposed additional drilling and evaluation of the groundwater pathway within the unpaved areas of the Compressor Station (AOC 13) in the revised Report will be assessed after the Work Plan for the Part B soil investigation is submitted and approved by the agencies.

DTSC FOLLOWUP: The revised Report should acknowledge that groundwater investigation will be required for the East Ravine. The revised Report must also discuss a conceptual site model for the potential fate and transport of chromium discharged to the East Ravine (AOC 10) that will be further evaluated through groundwater investigation. The revised Report should acknowledge that SWMU 5 and 6 are potential historical site sources of chromium that are planned to be further investigated during upcoming soil sampling investigations within the facility’s fence line. Also see DTSC response to the preceding comment.

PG&E Followup: The revised Report indicates that an additional groundwater investigation is planned to characterize the groundwater conditions of bedrock formations in the East Ravine and MW-23 area. Section 6.7.2 of the revised Report describes the site hydrogeologic conceptual model for the East Ravine area. The revised Report additionally indicates that additional soil and groundwater characterization will be conducted as part of planned soil sampling investigations within the compressor station facility as part of the RFI/RI Soils investigation.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 5, Section 11)

Section 11 repeatedly makes the assertion that the groundwater pathway associated with incidental surface releases (e.g., cooling towers, southeast fenceline, East Ravine) is incomplete. The revised report should include a more robust discussion that supports this assertion. The discussion should be supported by calculations (if needed) and appropriate references.

DTSC FOLLOWUP: PG&E did not respond to this comment as part of the RFI/RI Volume 2 Report responses. The revised Report must address this groundwater pathway concern.

PG&E Followup: Potential exposure pathways via overland surface flows and their significance will be considered in the Risk Assessment, under separate cover.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 6, Section 13)

With the additional data collected since June 2004, PG&E has sufficient data to prepare a more sophisticated CSM of chromium plume migration than is described in Section 13.1.3 and shown in Figure 13.2. GSU anticipates that the CSM for chromium plume migration will use the fence diagrams and/or block diagrams required by the February 3, 2006 DTSC letter, and will include a narrative that addresses key issues affecting chromium migration. Some items that should be addressed by the CSM presented in Volume 2:

a. Probable historical chromium transport directions and rate of movement from various source areas to current plume center of mass. Discuss direction and rate of plume migration under the following conditions.

- *Groundwater extraction at PGE-01, PGE-02, PGE-06, and PGE-07 and groundwater mound induced by discharge to Bat Cave Wash.*
- *After cessation of pumping from water supply wells, but continued discharge to Bat Cave Wash.*
- *After cessation of discharge to Bat Cave Wash.*

Support discussion with groundwater flow model simulations of induced gradients and groundwater flow regime.

b. Factors affecting observed chromium plume configuration and distribution of chromium mass at various depths in the Alluvial Aquifer (e.g., upper, middle, lower). Some items to be addressed:

- *Possible mechanisms for a relatively shallow plume mass at some upland locations (e.g., MW-31, MW-50), a fully penetrating plume mass at other locations (e.g., MW-20, MW-26/MW-51), and a deep plume mass at other locations (e.g., MW-37D, MW-50).*
- *Possible mechanisms for chromium plume distribution observed at elevations less than 325 feet mean sea level (e.g., MW-46-175, MW-50-200) in alluvial fan deposits.*
- *Potential effect of salinity of discharged wastewater on chromium plume migration.*

PG&E RESPONSES to Individual General Comment #6 Items:

a. Historical chromium transport directions and rate of movement of the chromium plume in the Alluvial Aquifer at SWMU 1 will be addressed and presented in the final Groundwater Model Report for the scenarios listed in this comment. A summary of this presentation will be incorporated in the revised RFI/RI Report. It should be noted that there are no records available that indicate the replacement compressor station supply wells PGE-6 and PGE-7 were ever operated for facility supply, and hence groundwater pumping from these wells will not be included in the modeling scenarios.

b. Aquifer heterogeneity is the likely primary factor that affects the observed chromium plume configuration and distribution of chromium mass in the Alluvial Aquifer. The revised Report will include a general discussion of the complexity of the depositional *environments that comprise the Alluvial Aquifer and the effects of geochemistry on the distribution of chromium in the plume. However, to attempt to describe specific mechanisms for observations at specific wells would require speculation beyond what is considered appropriate or meaningful in the context of an RFI/RI. The revised Report will also include a discussion regarding the effects of salinity on groundwater transport at the site. It should be noted that all available records indicate that the cooling tower blow-down would be classified as brackish to slightly saline water (between 1,000 and 20,000 mg/L TDS). The TDS of this water would not be drastically different from the TDS of natural groundwater in bedrock or in the deeper interval of the Alluvial Aquifer.*

DTSC FOLLOWUP to General Comment 6a and 6b:

6a: There appears to be some uncertainty regarding the use of wells PGE-6 and PGE-7 as station water supply wells. Modeling of chrome transport with PGE-6 and PGE-7 extraction should be considered if additional operations information becomes available for these wells or if other modeling scenarios are not able to reasonably depict site conditions. Potential for the chromium groundwater plume to be influenced by extraction at nearby Arizona wells (i.e., Topock-1, Topock-2, Topock-2A, Topock-3, Smith well, Sanders well, PGE-09N, and PGE-09S) should also be discussed and included in the revised Report and Groundwater Model Report.

PG&E Followup: No records have been found that demonstrate use of these wells for water supply. They were installed as backup wells following destruction of PGE-1 and PGE-2 for freeway construction, but the Arizona wells were already in use for facility water supply and have remained so. Section 6.6 of the revised Report discusses historical migration of discharge water, and model simulations of this migration include pumping from Arizona wells – the Topock-2A/3 wells were the only active wells with significant pumping rates.

6b: One goal of a conceptual site model is to explain observed site conditions. Therefore, as originally requested in General Comment 6b, PG&E shall consider factors affecting observed chromium plume configuration and distribution of chromium mass at various depths in the Alluvial Aquifer (e.g., upper, middle, lower). Also see the subsequent DTSC comment regarding saline-driven plume transport.

PG&E Followup: The revised Report describes the distribution of chromium at all levels and relates to other groundwater properties such as TDS in Section 6. The issue of density-driven flow is addressed in Section 6.7.3.

DTSC COMMENT (6/27/06 GSU Memo, General Comment 7, Section 13)

In various discussions over the last two years, several stakeholders have raised concerns regarding saline-driven transport of the chromium plume. PG&E has responded that saline-driven transport is not a significant factor for the chromium plume migration and is not always associated with the chromium plume. Given that this issue continues to be raised, GSU recommends that Volume 2 include a stronger discussion of naturally-occurring salinity stratification observed in the site vicinity and reported in *the literature for the Mojave Desert. Hence, the salinity discussion at the top of Page 13-3 should be more fully developed. In addition, the CSM for chromium plume migration should address salinity.*

PG&E RESPONSE: *The published water quality data for comparable alluvial groundwater basins in the Mojave Desert, California and western Mojave County, Arizona (e.g., USGS and ADEQ reports) will be reviewed and discussed in the revised Report as appropriate. The conceptual site model for chromium plume migration presented in the revised Report will address the salinity and other general chemistry characteristics of the Alluvial Aquifer.*

DTSC FOLLOWUP: In addition, an expanded discussion regarding saline-driven plume transport is also requested. Site-specific salinity and density information, along with standard processes and mechanisms, should be used to discuss the potential for saline-driven flow at the Topock site. In particular, the revised Report should address factors raised by Hunt and Flowers (2007b) regarding density mixing processes. During a recent presentation (Hunt and Flowers, 2007a), Professor James Hunt summarized that brine releases can sink through an aquifer and become emplaced on top of bedrock or within fin-grained units and act as a persistent source for dissolved phase plume contamination. The presentation included the PG&E Hinkley, California Compressor Station as an example of a hexavalent chromium plumed formed from releases of dense brines. The plume was hypothesized to persist due to the slow, continued release of contaminants from an emplaced subsurface brine. As the Hinkley site had operations and waste management practices similar to Topock, it is reasonable for PG&E to evaluate this potential contaminant transport mechanism at Topock. The revised RFI Report should thoroughly discuss this topic as it could impact the selection of remedial measures and development of the conceptual site model.

The revised Report should also present a discussion on stratified plumes. This discussion should utilize the API 2006 reference on diving plumes. In particular the site conceptual model should consider Figure 4 of the API 2006 bulletin regarding diving plumes near streams due to bank storage.

PG&E Followup: Section 6.7.3 presents an assessment of the site groundwater data regarding salinity and temperature conditions and the potential for density-driven flow.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 3)

Page 9.10, Section 9.3.4.1. *Please elaborate on the criteria that were used to determine whether historical data should be included in the RFI Report.*

PG&E RESPONSE: *The historical (pre-RFI) data pertaining to site hydrogeology and groundwater conditions were summarized in the Current Conditions Report (Alisto 1997). The historical data most applicable for incorporation in the RFI include the well drilling logs and well testing data for the following investigations: PGE-series supply and injection wells, Old Ponds site investigations, New Ponds site investigations, Park Moabi water supply well, and the Caltrans exploratory borings for the I-40 bridge. The historical water quality data and groundwater elevation data from pre-RFI investigations are useful for general site assessment but are not recommended for full evaluation and* *analysis in the final RFI groundwater characterization. This is because of the variations and uncertainty of sample collection and analytical methods, and the infeasibility of completing data QC review, and validation of the historical chemical data.*

DTSC FOLLOWUP: The GSU concurs with the general approach regarding the historical hydrogeological data, but does not believe that it is infeasible to assess the quality of the historical data. PG&E has recently conducted a data quality/usability assessment of historical soil and sediment data (CH2MHill, 2006a) and, while not currently considered necessary, could conduct a similar assessment of historical groundwater data. Note: For completeness, the revised Report should cite available historical hydrogeological data from the several underground storage tank groundwater wells completed at the Topock Marina in Arizona.

PG&E Followup: Comment noted. As discussed with DTSC, completing a QC review and validation of the pre-RFI groundwater data is possible but is considered not needed or warranted given the extensive set of existing RFI/RI data and the considerable effort required to locate the necessary laboratory analytical data documentation. Table 4-2 and Appendix B2 contain the available well drilling information for the 5 UST decommissioned monitoring wells at the Topock Marina.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 4)

Page 10-5, Section 10.1.6. Please describe the methods that were used to derive the soil background data set.

PG&E RESPONSE: *The soil data collected by the initial RFI contractors (E&E and Alisto) were used to derive the background data set presented in the February 2005 draft RFI/RI Report. The methodology was described in Section 10.1.6.3 and Tables 10-7 and 10-8 in the draft Report. In summary, the background metals concentrations reported for the initial RFI sampling were either the statistically derived "upper tolerance limit" of detected concentrations, or the maximum detected concentrations (for sampling results/detections too limited for statistical analysis). As requested by DTSC in 2006, the initial background soil data set will be replaced with data from a more comprehensive soil background investigation scheduled for first quarter 2007. The results of this sampling will be presented and discussed in the Volume 3 (Soil) of the revised RFI/RI Report.*

DTSC FOLLOWUP: The RFI/RI Report, Volume 3 shall include examples of any statistical calculations and procedures (as text, table, spreadsheet, or appendix) to provide reviewers with a clear understanding of the technique and more easily allow stakeholders to replicate the statistical calculations if so desired. Finally, the additional background soil data that is to be collected in the future (CH2M Hill, 2006b) will be used to supplement the existing background soil data set and not necessarily replace it.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 5)

Page 11-2, Section 11.1.2, second sentence: This sentence states that there are no potable water supplies in the immediate vicinity of the compressor station. Please *restate that the closest potable water supply is the Park Moabi well and that the groundwater pathway does not appear to be complete for this receptor*.

PG&E RESPONSE: *The discussion of active water supply wells in the revised Report will be updated with the requested information.*

DTSC FOLLOWUP: This section of the revised Report should also comment on the status of the following active or recently active water supply wells in the immediate vicinity of the station: Topock-1, Topock-2, Topock-2A, Topock-3, Smith well, Sanders well, PGE-09N, PGE-09S.

PG&E Followup: Section 5.1.1 discusses the status of water supply wells in the RFI/RI study area; including the wells listed.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 6)

Page 13-3, Section 13.1.2.1, first paragraph: This section references literature studies that report naturally-occurring hexavalent chromium concentrations up to 50 micrograms per liter (µg/L) in the region. Volume 2 of the RFI should also provide the range of hexavalent chromium concentrations observed in wells sampled by the Groundwater Background Study.

PG&E RESPONSE: *Validation of analytical results of the 2005-2006 Groundwater Background Study was completed in July 2006. The determination of the final background groundwater concentrations for Cr(VI) and other metals will not be available until the statistical analysis is completed and approved (anticipated by March or April 2007). Accordingly, it is possible that only a summary of the sampling results and ranges of concentrations from the Groundwater Background Study will be presented in the revised Report.*

DTSC FOLLOWUP: As originally requested, the revised Report should also provide the range of hexavalent chromium concentrations observed in wells sampled during the Groundwater Background Study. The observed range of concentrations will not change regardless of the statistical approach utilized and will provide salient information applicable to the Topock site. See also PG&E response to DOI Comment 139.

PG&E Followup: The Revised Background Study chromium UTL value is reported in Section 6.5 of the revised Report.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 9)

Table 9-1: Please include PGE-01 and PGE-02 on this table.

PG&E RESPONSE: *Available information for these decommissioned/abandoned industrial supply wells will be included in the revised Report.*

DTSC FOLLOWUP: Please ensure that these two wells are listed in the equivalent Table 9-1 in the revised Report.

PG&E Followup: Table 4-2 and Appendix B2 include information on these wells.

DTSC COMMENT (6/27/06 GSU Memo, Specific Comment 10)

Table 9-2: This table should also summarize the groundwater data collected in the vicinity of the Old Evaporation Ponds.

PG&E RESPONSE: *We feel it is appropriate to summarize the groundwater data that was collected for both the Old Evaporation and New Evaporation Ponds sites and cite the reports that presented these data. However, as indicated in the above response to Specific Comment 3, we feel the actual data from these historical studies should not be incorporated in the data set used for the RFI characterization due to the lack of analytical data documentation, QC review, and validation.*

DTSC FOLLOWUP: See the DTSC response regarding Specific Comment 3 above.

PG&E Followup: As discussed with DTSC, completing a QC review and validation of the pre-RFI groundwater data is possible but is considered not needed or warranted given the extensive set of existing RFI/RI data and the considerable effort required to locate the necessary laboratory analytical data documentation.

PG&E RESPONSES TO DOI RFI COMMENTS

Comment 32: PG&E did not respond to this comment. The response provided for Comment 32 actually responds to Comment 31. PG&E shall address the request contained within Comment 32 within the revised Report.

PG&E Followup: DOI comment #32 requested that separate monitoring zone maps be used to display all types of hydrogeologic and groundwater data. Section 4.2.1.2 describes the monitoring zone designations that are used to display the groundwater characterization data, specifically, groundwater elevation maps (Figures 5-11/-12), TDS (Figure 5-17/-18), temperature (Figure 5-19), and Cr(VI) (Figures 6-2a,b,c). The well location map (Figure 4-5) and the data tables presenting the drilling, hydrogeologic, and all chemical data similarly identify the monitoring zones.

Comment 47: PG&E did not respond to a portion of this comment (third paragraph) regarding comparison to background conditions and “not solely potential standards”. PG&E shall address the third paragraph contained in Comment 47 within the revised Report.

PG&E Followup: The revised Report compares TDS distribution in non-plume (Section 5.3) and plume (Section 6.5) areas of the aquifer, and discusses Background Study TDS to site wells.

Comment 101, Page 11-1: It should be noted that groundwater well installations are being discussed for the East Ravine area and within the fence line of the Compressor Station. Additionally, all soils data to be collected from upcoming investigations will be evaluated at each included AOC/SWMU to determine if additional groundwater pathways may exist.

PG&E Followup: Comment noted. Additional soils data from upcoming investigations will be addressed in the RFI/RI Volume 3 Report.

Comment 158: The comment discusses the potential for radial flow from discharges into Bat Cave Wash due to reported mounding associated with the discharge. PG&E's response indicated that the spreading associated with the mounding would not be excessive as based on model simulations. PG&E further states that the extent of plume spreading beneath Bat Cave Wash is not known, but is reasonably well defined.

The lateral extent of the plume near wells MW-9, MW-11, and MW-38S/D has not been fully assessed. To the west, only well cluster MW-40S/D is located west of Bat Cave Wash approximately 1,000 feet away from the discharge area. The presence of anthropogenic hexavalent chromium in well MW-40D is not easily explained. Perhaps radial flow did occur to the west at the discharge area causing the observed detection in well MW-40D. Density driven flow or anisotropic flow along alluvial channels might also explain the occurrence of contamination at well MW-40D. PG&E should provide greater discussion on the cause of the observed chromium detection at MW-40D in the revised Report. The GSU suggests that a groundwater well cluster to the west of Bat Cave Wash, in the vicinity of wells MW-9 and MW-10 would be valuable in monitoring the plume. This well cluster would be valuable remedial planning, plume delineation, and monitoring the effectiveness of remedial measures.

PG&E Followup: The revised Report provides a more extensive discussion on the estimated flowpaths of discharge water in the subsurface through time in Section 6.6.

Comment 166: See Comment 101 regarding other potential sources of groundwater contamination (Page 14 of 27 in DOI's RTC). See also 6/27/06 GSU Memo, General Comments 3 and 4 (These are on page 7 and 8 of 32 on Part B of DTSC RTC. These relate to AOC 10 East Ravine migration pathways) .

Comment 167: The comment discusses the need for a groundwater risk assessment, but does not appear to be addressed by PG&E's response.

The comment discusses the need for a groundwater risk assessment, but does not appear to be addressed by PG&E's response

PG&E RESPONSE: The response has been revised in the DOI RFI comments.

REFERENCES

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CH2M Hill, May 30, 2006a. Soil and Sediment Data Useability Assessment Technical Memorandum, PG&E Topock Compressor Station, Needles, California.

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A2 DOI Agencies Comments on February 2005 Draft RFI/RI Report

DOCUMENT REVIEW AND COMMENT RESOLUTION SHEET

Document Title	**PG&E Topock Compressor Station Draft RCRA Facility Investigation and Remedial Investigation Report**	**Document Date/Revision**	**February 2005 DRAFT**
Reviewer, Organization, and Phone Number	**Department of Interior: BLM, BOR, FWS, and USGS**	**Review Criteria**	**Full**
		Response Summary Updated:	**March 6, 2008**

Comment No./ Location	Agency	Comment	Comment Response	Type[a]
Draft Topock RFI/RI Report (February 2005)				
		SECTION 2.0 (Physical Characteristics & Setting)		
17. Section 2.0 General Comment [E-comment 1-17]	BLM	Because of the manner in which data are presented in this RFI, the reviewer must search for a table(s) and Appendices to validate any conclusion made in the RFI, and too often the data cannot easily be found. This re-occurring problem impedes the clarity of the RFI. This problem needs to be remedied in future versions of the RFI report. Additional inconsistencies relevant to this comment: According to Table 2-4, seven borings encountered the basal unit (Tsu) that include MW-20-130, MW-24B, MW-38D, MW-40D, TW-1, TW-2D, and TW-2S. - Appendix A4, Figure A4-2 presents well TW-2. It is unclear if this log is relevant to either well TW-2S or TW2D. - the resistivity and conductivity geophysical logs for MW-20-130 are so poor a footnote should be provided explaining their condition Figure A4-4 presents a geophysical log for MW-38 and MW-40. It is unclear if this is actually well MW-38D and MW-40D.	Due to the volume of data being presented in the RFI/RI report, summarizing the data into tables and placing more detailed information into appendices was required to keep the document from becoming overly large and complex to read. Some of the drilling and geophysical logs used simplified field identifications for the initial boring (e.g., TW-2, MW-38). After well installation, the identifications were modified to distinguish completion depth after well (TW-2D, MW-38D). Tables 4-2, 4-3, Appendix B2 and C1-2 include an updated drilling and well construction tables that clarifies the field and final boring and well identifications. Inconsistencies noted have been addressed. This was also addressed in RFI/RI Volume 1, dated September 2006.	M
18. Page 2-1	BLM	First paragraph: Define the boundary for the western portion of	The paragraph uses the presence of	M

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Section 2.1 [1-18]		the study area.	physiographic features to define the southern, eastern, and northern boundaries to the site. These features do not define the regulatory site boundary, but were provided as a way of visualizing the site's location within the local topography. Section 1.1.4 of the Final Volume 2 describes western boundary of the study area as Park Moabi Road. Section 4 identifies the locations of data included in the RFI; for conservatism the data include drilling and sampling locations outside the study area in area of potential affect.	
19. Page 2-4 Section 2.3.2 [1-19]	BLM	Third paragraph: "…*a north-northwest trending high-angle normal fault that offsets Quaternary alluvium…"* and "*Figure 2-4 shows the Needles graben fault feature…"* It is uncertain if these two sentences are referring to the same feature or two separate features; moreover, the Needles graben fault feature is not labeled on Figure 2-4. The Needles graben fault trace should be labeled on Figure 2-4; additionally, if the two fault features are the same, then combine the two sentences to eliminate confusion.	Section 3.3.2 clarifies the fault descriptions and Figure 3-5 shows the general location of the Needles graben. Appendix B5 provides additional regional information on faults.	M
20. Page 2-4 Section 2.3.3 [1-20]	BLM	Suggest summarizing the range of depths to where bedrock units are encountered in the study area.	Appendix Table B-4 provides a listing of the depth to bedrock for the RFI/RI wells and borings, and Section 5.1.3.1 provides more description.	S
21. Page 2-5 Sections 2.3.3.2 and 2.3.3.3 [1-21]	BLM	Suggest summarizing the apparent thickness of the alluvium in the study area. For each subheading in these two sections, add the corresponding stratigraphic unit symbol, for example, "Basal Saline Unit (Tsu)" and reference Table 2-1 and/or Figure 2-4.	Table 3-1 and Section 5.3.1 describe general thickness information for the primary HSUs. Appendix Table B-4 provides a listing of the wells/borings that encountered the primary HSUs. Table 3-1 presents the updated stratigraphic unit abbreviations that are used throughout the report.	S
22. Page 2-5 Section 2.3.3.2 [1-22]	BLM	First bullet, third sentence: "An upper and lower unit of Oldest Alluvium is recognized on the geophysical logs of some of the deeper borings (Table 2-1)." Table 2-1 only shows the sequence of the hydrostratigraphic units of the site and does not provide additional information regarding this separation or the wells where this occurs. The RFI needs to be more specific and not make reference to "some of the deeper	Section 3.4 and Table 3-1 provide updated description of the HSUs and clarifies the criteria for distinguishing hydrostratigraphic units. Appendix Table B-4 provides a listing of the wells/borings that identifies the depth and geologic formations encountered.	M

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		borings." Further, Appendix A4 (Geophysical Logs) does not provide any correlation to borehole lithology. The RFI text and Appendix A4 need to provide specific information regarding the location(s) and depths of where the Toa separations are found and the basis for the separation.		
23. Page 2-5 Section 2.3.3.2 [1-23]	BLM	Second bullet, First sentence: "The Basal Saline Unit: in some drilling locations…" The text in this bullet should cross reference Table 2-4 so the drilling locations where this unit (Tsu) is encountered can be further assessed in the drilling and geophysical logs. In Table 2-4, seven borings are designated as having encountered the basal unit (Tsu). The geophysical logs (Appendix A4) do not provide any stratigraphic correlation so validation based upon the information provided in the RFI is difficult.	Table 3-1 and Section 3.4.1.2 provides clarification on the definition and criteria for teriray Alluvium and the revised unit name "Basal Alluvium" (referred to in the Feb. 2005 RFI report as The Basal Saline Unit).	M
24. Page 2-5 Section 2.3.3.2 [1-24]	BLM	Further, the geophysical log for MW-20-130 is such poor quality interpretations are nearly impossible. Please provide a better quality log or if none exists, create a new log using the existing data. If quality of log is so poor that interpretation is impossible, the log data should not be used.	Appendix C2 presents the geophysical logs that were collected inside cased-wells. Cased-well logs are affected by the metal centralizers used in well construction and hence, is limited in usability. Appendix C2 includes this explanation.	M
25. Table 2-3 [1-25]	BLM	Table 2-3 states well MW-27 is an "Alluvial Well," but is located immediately adjacent to the river and is only 17 ft deep. At this location, it is highly unlikely this is an Alluvial Well, but rather a Fluvial Well; the borehole logs shed no light on the matter other than it is completed in "loose sand." A simple extrapolation from Cross Section A-A' suggests that it is a Fluvial Well. Please provide explanation to why the well is designated an Alluvial Well instead of a Fluvial Well.	Table 4-2 has been updated with this correction of Well MW-27-20 as a fluvial well.	M
26. Table 2-4 [1-26]	BLM	A well MW-40D is suggested to have encountered Tsu; however, only well MW-40 is presented in Appendix 3 (boring logs). The well and boring identification process should be consistent so verification of the document's conclusions is possible. A simple manner in which boreholes (BH) are designated apart from a Monitoring Well (MW) is needed. See Comment No. 34 for additional comment for Figure 2-12.	Table 4-2 Some of the drilling and geophysical logs used simplified field identifications for borings, like MW-40. The boring and well log compilations (Appendix B) and geophysical logs (Appendix C) contain explanation listings of the field log and final well identifications.	M

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27. Page 2-6 Section 2.3.3.3 [1-27]	BLM	Third bullet: The approximate depths are provided for all the fluvial units except for the Older Fluvial Deposits. For clarity, the depth of the Older Fluvial Deposit should be presented.	Table 3-1 is used to summarize the features and field occurrence descriptions for the updated site hydrostratigraphic units (HSUs).	M
28. Page 2-7 Section 2.3.4 [1-28]	BLM	Second full paragraph, third and fourth sentences: "…the Alluvial Aquifer is about 100 ft thick in the floodplain and thins to the south…" and "In the western portions of the study area…the saturated Alluvial Aquifer is over 200 ft thick." The RFI should avoid oversimplifying statements such as these and provide more detailed discussions of its data. For example, the thickness of the alluvial aquifer in the floodplain is as much as 130 ft (MW-28-90) and thins to the south to as thin as 5 ft in MW-22. See Figure 2-14. The RFI needs to provide clarification of the statement, "western portions of the study area" by referencing a well location where this greater depth is found. An explanation of potential reasons for the occurrence of this greater depth should be provided. See Comment No. 18 for similar request. Because the bedrock surface is a significant hydraulic boundary and controls the flow of groundwater, it needs to be discussed in detail within the RFI. A top of bedrock map and/or an isopach of the Alluvial Aquifer need to be presented in the RFI. This would easily present the location of potential hydrologic boundary relevant to containment of the plume, particularly where the Miocene conglomerate pinches out within the site. Such a map further highlights possible data gaps in the current distribution of monitoring wells. The RFI should incorporate these maps into the next draft.	Volume 2 provides a re-structured presentation of the site hydrogeology: Section 3.4 and Table 3-1 describe the HSUs, and general features and distribution in the study area. Section 5.1.2 presents the site hydrogeologic details in cross-sections. Section 5.1.2 presents the updated Miocene bedrock structure map and the thickness (isopach) maps of the Alluvial Aquifer and fluvial HSUs.	M
29. Page 2-9 Section 2.4.2 [1-29]	BLM	First full paragraph, third sentence: "Groundwater is recharged by the river during this time…" This statement contradicts page 13-2 (second paragraph, line 7: "…groundwater is primarily recharge from local precipitation rather than from the River.") It stands to reason that the River has a major role in the recharge of the Alluvial Aquifer considering the **miniscule** precipitation rates in the region. The RFI needs to be consistent in its conclusion.	The wording has been modified in the revised Report to make the discussion of recharge clearer (refer to Section 3.6). Stable isotope data support the conclusion that most of the groundwater beneath the Topock Site is recharged by local precipitation rather than Colorado River water or river-influenced groundwater. Although most groundwater in the Mohave Valley basin does originate in the Colorado River, nearly all of this groundwater discharges back to the river	M

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			upstream of the Topock Site, as predicted by the most recent calibrated model. We note that the text refers to a 4-month period (February-May) in which the river recharges groundwater at the site. Over the rest of the year, groundwater discharges to the river (under natural conditions), so that there is not a net recharge to groundwater in the site area from the river.	
30. Page 2-9 Section 2.5.2 [1-30]	BLM	First sentence: "This section summarizes…" The RFI document is confusing in stating where the most detailed discussion of the hydrogeologic setting can be found. Section 13 has less detail than Section 2. The last sentence of section 2.5.2 incorrectly states the groundwater quality is presented in Section 12, it is actually found in Section 13. Though Section 2 is suppose to be the "Physical Setting" groundwater quality discussions are found. The existing RFI needs to rely upon better cross referencing to where supporting information can be found.	The revised Report has been restructured to present the regional and site hydrogeologic setting and hydrostratigraphy in Section 3.3 and 3.4, respectively. The results of drilling and hydrogeologic characterization are presented in Sections 5.1 and 5.2.	M
31. Page 2-10 [1-31]	BLM	Last bullet: Correct the typo that occurs for the USGS, it is misspelled USOS. Last paragraph, Hydrogeologic Section A-A': Geologic information is provided for well PGE-8 in this cross section, but the log is not found in Appendix A3. If information from the PGE series of wells is being utilized by the RFI, the logs should be incorporated into the Appendix A3.	Appendix B2 contains the drilling and well logs for all wells used for the RFI/RI characterization, including PGE-8 and other pre-RFI wells. No detailed logs are available for PGE-6, PGE-7, and PGE -8, but the available drilling records are included in Appendix B2.	E
32. Page 2-10 Section 2.5.2.2 [1-32]	BLM	To better represent the data collected, and the spatial distribution of the monitoring wells, separate maps of wells completed in the various hydrostratigraphic units (upper, middle, lower) should be provided as well as for the bedrock information. See comment for page 2-14 regarding TDS. Due to the sparse data referencing in the RFI document, a reviewer must search the document for relevant information from which to confirm or develop their own understanding. The RFI needs to generate separate maps for each unit, e.g., the upper, middle, lower Alluvial Aquifer, as well as bedrock zones. A basis for separation of these units should be provided. This will provide a better understanding and potentially identify data	Section 4.2.1.2 describes the monitoring zone designations that are used to display the groundwater characterization data, specifically, groundwater elevation maps (Figures 5-11/-12), TDS (Figure 5-17/-18), groundwater temperature (Figure 5-19), and Cr(VI) (Figures 6-2a,b,c). The well location map (Figure 4-5) and the data tables presenting the drilling, hydrogeologic, and all chemical data similarly identify the monitoring zones.	M

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		gaps. Such an approach is used in Section 13 for Cr.		
33. Page 2-11 Section 2.5.2.2 [1-33]	BLM	First paragraph, Hydrogeologic Section B-B': The logs for the CB borings are not provided in the Appendix A2. Because information from these logs is used in the RFI they should be included into the appropriate Appendix. The last sentence mentions that a buried bedrock ridge (paleo-ridge or fault block) extends northward from the Chemehuevi Mountains. A contour map depicting the bedrock surface (the surface of the Tmc) needs to be incorporated into this RFI. This map would provide useful information regarding the location and depths to this important hydraulic boundary and were potential data gaps exist. In addition, an isopach of the saturated zone of the Alluvial Aquifer needs to be incorporated into the RFI. The RFI needs to discuss the deepening of the bedrock surface to the west (MW-40D), as previously mentioned on page 2-7 of the RFI.	Appendix B3 contains the Caltrans log summary plate with the lithologic logs for the I-40 bridge borings.. Figure 5-9 and 5-10a,b present the Miocene structure map and aquifer isopach maps, respectively.	M
34. Figure 2-12 [1-34]	BLM	Hydrogeologic Section B-B': The logs for the CB series of borings are not provided in the Appendix A2. Because information from these logs is used in the RFI they should be included in the appropriate Appendix. Information from well MW-24 is used in this cross section; however the log for this well is not found in any appendix. Though this is likely well MW-24BR, this and other unnecessary well identification assumptions need to be eliminated from the RFI document by incorporating an accurate well identification system.	Appendix B3 contains the Caltrans log summary plate with the lithologic logs for the I-40 bridge borings. See response to Comment #26 regarding well identification explanations.	M
35. Page 2-11 Section 2.5.2.2 [1-35]	BLM	Hydrogeologic Section C-C', First sentence: *"…extends from MW-26…"* The text is incorrect in stating that well MW-26 is the westernmost well, it's actually MW-25.	The revised Report includes additional and modified cross-sections Well references have been confirmed. Will correct this wording.	E
36. Figure 2-13 [1-36]	BLM	Hydrogeologic Section C-C' : The geophysical logs presented for TW-2 are not the same logs shown in Appendix A4 Geophysical Logs (Figure A4-2). The correct geophysical logs need to be incorporated into Figure 2-13. In the legend of Figure 2-13, under the Notes category, a reference to Appendix A4 should be provided so the scale of the geophysical logs is known. Otherwise the scale of each log	See response to Comment #26 regarding well identification explanations to be included in the appendices..	M

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		needs to be incorporated into this figure. Appendix A4 presents a well TW-2 whereas Figure 2-13 uses TW-2D and TW-2S. Clarification is need to assure these are the same well because in Appendix A4 (Geophysical Logs) there are no geophysical logs provided for TW-2S or 2D. The nomenclature system in the RFI for the identification of wells and borings needs to be clear.		
37. Page 2-11 Section 2.5.3.1 [1-37]	BLM	Second paragraph, fourth sentence: "Hydraulic testing at MW-23 and MW-24BR has yielded very low hydraulic conductivities…" Appendix A5 (Aquifer Test Data) indicates these wells were never tested for their hydraulic properties. Though Table A5-1 (Summary of 2004 Aquifer Test Data) suggests this appendix may only contain the test preformed in 2004, the text offers little clarification of where the data can be found. The results of all hydraulic tests performed for this investigation need to be presented in an appendix of this report or cross referenced to previous report(s). The RFI must be comprehensive and accurate in its data presentation, description, and its conclusions.	The revised Report provides references to or copies of all aquifer test data in the RFI/RI report Appendices.	M
38. Page 2-12 Section 2.5.3 [1-38]	BLM	Alluvial Aquifer-Fluvial Deposits, first sentence: "Over 25 monitoring wells have been completed…" The exact number of alluvial wells that have been installed in the alluvial aquifer is known and needs to be stated in this text.	Section 5.1.1 summarizes the number of wells installed by well category. See Table 4-2 and 4-4 for specific wells and sampling locations.	M
39. Page 2-12 Section 2.5.3 [1-39]	BLM	Alluvial Aquifer-Fluvial Deposits, Third paragraph, last two sentences: The text provides a justification of why the short duration pump tests are better than the slug test but avoids discussion of the accuracy of the development/purge tests. Based upon Table 2-4, there is a total of 29 hydraulic tests. Of these 29 tests, only 5 are slug test; 7 are pump tests; and 17 are based upon observations during the development and purging of a well; a potentially less accurate method than the slug tests. To better asses the accuracy of these development/purge tests a cross reference to a previous documents where the method can be	The revised Report states in Section 5.1 that the superior aquifer test data are from the extended aquifer tests at wells listed in Table 5-2, and these data will be used to calibrate the model. The slug and purge tests are provided for documentation.	M

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		found needs to be stated in the RFI.		
40. Page 2-12 Section 2.5.3 [1-40]	BLM	Alluvial Aquifer-Alluvial Fan Deposits, First paragraph, last sentence: "*Selected tests are discussed below and summarized in Table 2-4*." This statement suggests only "selected" tests are presented in Table 2-4. The RFI needs to present or cross reference all the data collected. Moreover, if selected, the selection criteria should be discussed.	The revised Report summarizes the testing activities and provide references to or copies of all aquifer test data.	M
41. Page 2-12 Section 2.5.3 [1-41]	BLM	Alluvial Aquifer-Alluvial Fan Deposits, Second paragraph, first sentence: "…best estimates of hydraulic properties…due to higher pumping rates that can be obtained from these wells" [TW-1 and TW-2]. The RFI needs to explain why these greater pumping rates are possible in these two wells, otherwise it can be inferred that these locations are not representative of the Alluvial Aquifer. Though not cross referenced in the text of the RFI, information found in Tables 2-3 and 2-4 indicate these wells have a much greater screen interval and that it may not be due to unique locations of greater permeability. Page 2-13 does provide a better explanation for TW-1, but not for TW-2 wells. The RFI is inconsistent in referencing well names. For example, Table 2-3 refers to well TW-1 as TW-01. This inconsistency needs to be corrected.	The revised Report includes an explanation regarding the greater pumping rates in wells designed for extraction versus small diameter monitor wells. The revised Report was checked for consistency in well naming.	M
42. Page 2-13 Section 2.5.3 [1-42]	BLM	First paragraph, last sentence: The data for the spinner test is not provided in Appendix A5, as stated in the text. Moreover, the text should not "select," but provide all the data and results in the appendices, at a minimum. If some data cannot logistically be provided in the RFI, accurate references to previous documents must be provided.	The revised Report provides references to, or copies of, all spinner log test data.	M
43. Page 2-13 Section 2.5.3 [1-43]	BLM	Second paragraph: A cross reference to the pump test of the MW-20 wells needs to be provided. The data are not found in Appendix A5.	The revised Report provides references to, or copies of, all aquifer test data.	M
44. Page 2-13 Section 2.5.3	BLM	Fourth paragraph: See previous Comment No. 40 regarding the presentation of "selected results." The velocity (spinner)	The revised Report provides references to, or copies of, all spinner test data.	M

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[1-44]		data for the TW-2 wells are not provided in Appendix A5. This data needs to be accurately cross referenced or provided in the RFI.		
45. Page 2-13 Section 2.5.3.1 [1-45]	USGS	Alluvial Aquifer – Alluvial Fan Deposits, third paragraph, third sentence: Change “interval very” to “interval of very.”	The revised Report text has changed so specific wording is different.	E
46. Table 2-3 [1-46]	USGS	Under “Borings in Study Area,” boring CB-08 is listed. In Figures 2-9 and 2-10, boring CB-08 could not be found, only boring CB-07 is in the figure. Please add CB-08 to the figures.	Table 4-2 and Appendix Table B1 list all the I-40 bridge borings information. CB-08 is shown on Figure 4-2 and Appendix B figures.	M
47. Page 2-14 Section 2.5.3.2 [E-comment 1-47]	BLM	First paragraph, Figure 2-15: The information presented in Figure 2-15 is misleading as the wells used to represent the distribution of TDS in Figure 2-15 are biased towards wells which have greater concentrations of TDS, except those few wells adjacent to the River. Shallow wells having less significant concentrations not presented in Figure 2-15 have much less TDS concentration for the same area. These shallower wells tend to have a TDS (closer to 1,000 mg/L) versus those used in the figure; which are well over 2,500 mg/l. The RFI needs to accurately represent the spatial distribution of TDS results as well as other indicator parameters that will assist in evaluating the lateral extent of groundwater impacts and the overall dynamics of the groundwater flow regime. TDS and other parameters are useful indicators and therefore should be mapped in detail per the relative aquifer depths or well completions in order to accurately assess a parameters spatial distribution. Isopleths of various groundwater quality parameters need to be incorporated into the RFI, and be constrained to the specific zones of the aquifer, e.g., shallow, middle, deep and bedrock as needed. Secondly, the characterization and discussions should also focus on background conditions not solely potential standards. The background TDS concentrations are not mentioned or cross referenced on this page, but are found in Table 2-5 of the RFI, specifically wells MW-16 (705 mg/L) and MW-17 (1,293mg/L). These concentrations are inconsistent with those provided in Table 13-5; MW-16 (784mg/L) and MW-17 (1320mg/L). This inconsistency needs to be corrected and the	Section 5.3 of the revised Report provides discussion and figures addressing the areal and depth distribution of TDS, and plume TDS is compared with non-plume TDS in Section 6.5. Background Study TDS data are also included.	M

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		discussions of groundwater quality need to include comparisons to background. Nonetheless, many naturally occurring constituents are found in the background wells, and need to be assessed relative to the concentration found beneath the study area.		
48. Page 2-14 Section 2.5.3.2 [1-48]	BLM	<u>Reducing Conditions Associated with Fluvial Sediments:</u> Figures 13-9, -10 and -11 provide information regarding the spatial distribution of the redox data and should be cross referenced in the discussion on this page (page 2-14 of the RFI).	The revised Report has been re-organized so that the groundwater redox and other geochemical conditions at the site are discussed and appropriately referenced (Sections 5.3 and 6.5).	M
49. Page 2-14 Section 2.5.3.2 [1-49]	BLM	<u>Stable Isotope Distribution:</u> The RFI text needs to cross reference Appendix C so the results of the stable isotope study can be reviewed. In reviewing the stable isotopic data, information exists for well MW-28-20; however, this well cannot be found on Figure 2-9 (well location map) or in the drill log appendices. The information presented in the RFI falls short of using this information to its fullest. First, the text fails to recognize the alluvial end member (MW-20-70) has a significant concentration of Cr6, and is in the Cr (VI) plume of concern (well MW-20-70 has 14.4 mg/L of Cr (VI); see page 13-5). The stable isotope results are actually showing the mixing of the River water and the Plume water, not simply the alluvial ground water and the River, as discussed in the RFI. Taking this available information further, the mixing of the plume and the native alluvial ground water should be possible or at least evaluated with conclusions presented in the RFI. The RFI needs to correctly represent the available data.	The revised Report includes clarification and cross-reference information for the well numbering modifications necessitated by additional well installation. The revised Report includes an expanded water quality characterization discussion, including incorporating stable isotope data from the more recent groundwater sampling events 2005-2007. Refer to Sections 5.3 and 6.5.	M
50. Page 2-15 Section 2.5.3.2 [1-50]	BLM	First paragraph, first complete sentence: Selecting end-members isn't simply choosing those at opposite ends of the graph. There are three basic water types in which end members must be defined so the percent mixing can be determined. The three basic water types are: the Cr contamination plume, clean alluvial groundwater and River water, the two bedrock wells only offer a point of reference. Each of these water types has undergone different evaporative process thereby imprinting a unique isotope signature. The	The revised Report discusses these end members in Section 6.5.	M

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		RFI needs to provide a comprehensive discussion of this data.		
51. Page 2-15 Section 2.5.3.2 [1-51]	BLM	Bedrock Units: The logs for the PG&E series of wells need to be included in the appendices.	No detailed logs are available for PGE-6, PGE-7, and PGE -8. The available historical information for these wells are included in Appendix B.	M
52. Page 2-15 Section 2.5.3.2 [1-52]	BLM	Last sentence and Figure 2-16a: Well MW-23 needs to be identified in Figure 2-16a. Alluvial Aquifer – Alluvial Fan Deposits: First paragraph, second sentence: "*As with any dissected alluvial fan, water chemistry can vary…*". A scientific literature reference is needed to support this claim. All aquifers possess a certain degree of spatial variability, and assessing this variability should be an objective this groundwater characterization.	The revised Report identifies well MW-23 on the labeled isotope plot in Appendix F. The statement on variation of water quality within an alluvial fan was removed.	M
53. Page 2-15 Section 2.5.3.24 [1-53]	BLM	First paragraph, last sentence: The RFI needs to explain the rational for the well completion zones within the Alluvial Aquifer. Second paragraph, last two sentences: The logs for MWP series of wells need to be provided in an appendix. The RFI needs to acknowledge the uniqueness of this water chemistry (last sentence) is likely caused by that of the Plume from the Former Evaporation Pond.	Alluvial Aquifer well screen intervals were selected to provide depth discrimination of water quality data within the aquifer. Approved work plans and drilling completion reports for each monitoring well installation program contain the specific reason why an individual well was screened at a certain depth. The drilling and well logs for these wells are included in Appendix B. The chemistry data from pre-RFI groundwater sampling projects is not included in Volume 2 as discussed in Section 4.3.	M

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54. Page 2-16 Section 2.5.3.2 [1-54]	BLM	Fourth paragraph: This detailed discussion should be found on page 2-14 (Isotopic Distribution). A reference needs to be provided which will support the claim that "stagnant groundwater" will have a heavier isotopic signature. In addition, the RFI should not imply MW-20-100 and MW-39-70 have a heavier isotopic composition because it is screened in lower-permeability zone. Unequivocal evidence exists that confirms these well are within the Cr (VI) plume, and therefore, should contain a signature of evaporated water, specifically that caused by the former evaporation ponds. The RFI needs to provide a comprehensive assessment of the distribution of the stable isotope results as the heaviest water occurs with detections of Cr (VI), and Cr (VI) detections in deeper wells have similar stable isotope ratios as the relatively non-impacted water.	A more comprehensive and updated discussion is applied in the revised Report. Refer to Section 6.5.	M
55. Page 2-16 Section 2.5.3.2 [1-55]	BLM	Last paragraph, last sentence: "They are believed to represent stagnant groundwater…" The drill log for well MW-30-30 indicates the lithology is silty sand, a sediment type that is permeable. The RFI needs to provide multiple possible explanations for outlier results.	The description of groundwater at this well has been modified in Section 5.3.	M
56. Page 2-17 Section 2.5.3.2 [1-56] [1-56]	BLM	First sentence: The RFI does not clearly distinguish which MW-28 well is being discussed for shallow screening. The MW-28 well log in Appendix A2 differs from the MW-28 well log in Appendix A3. There should be some discussion in text about which well is MW-28-25 and MW-28-90 and what the numbering system means.	Table 4-2 and 4-4 list the final well identifications, Appendices B1 and B2 provide additional explanation listings for the RFI/RI well numbering used over several phases of drilling (see Figure 4-1).	M
SECTION 9 (Implementation of the RFI)				
89. Table 9-1 [1-89]	BLM	**Table 9-1**: What is the "Driller Well Depth" mean? Is this the depth recorded by the driller and if so, explain why there is a difference between this and the total boring depth.	Table 4-2 lists the well screen depth intervals for all wells in the RFI/RI network. Appendix Table B-1 provides a complete listing information for the wells and borings, including: "Total Boring Depth" refers to the total depth of the boring, and "Well Depth" refers to the depth of the well that was completed within that boring.	M

[a] Comment Types: M = Mandatory, S = Suggested, E = Editorial

Comment No./ Location	Agency	Comment	Comment Response	Type[a]
		SECTION 11 (Conceptual Site Models)		
101. Page 11-1 Section 11.0 General	BLM	For AOCs that don't identify the groundwater as a complete exposure pathway: The groundwater is known to have been impacted by the activities and releases from the facility but the actual sources are only speculative. Why wouldn't all the identified AOCs or SWMUs be considered potential sources of groundwater contamination until the data supports the elimination of this pathway?	Section 5 of Volume 1 of the revised RFI/RI Report (submitted to DTSC and the federal agencies on September 6, 2006) describes the closure activities, confirmation samples, and status of all SWMUs and AOCs within the site investigation and closure process. Section 5 presented the rationale and conclusions for which SWMUs and AOCs would be carried forward in the RFI/RI process. As part of the upcoming Work Plan for RFI/RI soil investigation, Part B (sites within the Compressor Station property), PG&E does plan to drill some deep soil borings at the facility as part of the investigation of AOC 13 (Unpaved Areas within the Compressor Station) and may complete one or more of these borings as monitoring wells if groundwater is encountered. The feasibility of incorporating the results of proposed additional drilling/evaluation of the groundwater pathway within AOC 13 in the revised Report will be assessed after the Work Plan for the Part B soil investigation is submitted and approved by the agencies.	S
101. Page 11-5 Section 11.7	BLM	The East Ravine is located along the detachment fault which is known to be fractured. Though depth to bedrock beneath this AOC is not provided in the RFI, it could be assumed to be relatively shallow (see Figure 2-4) as the bedrock (Tmc) surface rises to the south and is exposed (see Section 2 and 13, as well various cross sections). Several aerial photographs show standing water within these impoundments (1964 and 1967) and the USGS topographic map shows them as water bodies. Based upon the available evidence, including the limited number of sediment samples, there is a potential groundwater pathway associated to these impoundments. This pathway needs to be characterized.	The revised Report indicates that an additional groundwater investigation is planned to characterize the groundwater conditions of bedrock formations in the East Ravine and MW-23 area. The work plan for the East Ravine groundwater investigation, dated December 11, 2007, was submitted to DTSC and DOI. Following implementation, the results of this investigation will be reported in the RFI/RI Volume 3, data summary reports, or monitoring reports, as appropriate given the nature of the data and the affect on RFI/RI conclusions.	M

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		The CSM should also include known and potential routes of migration.		
		SECTION 13 (Groundwater & Surface Water)		
133. Section 13 General [E-comment # 1-135]	BLM	The RFI must provide a comprehensive understanding of the groundwater plume and the processes controlling its migration. Moreover, inadequate delineation of the plume and these processes may lead to inadequate IM and CMS/FS designs. To simply define the plume by the spatial distribution of Cr is oversimplifying the potential problem(s). Indicator parameters provide valuable information regarding the transport processes at any site, and mapping and understanding these processes is of high priority. Though many of these indicator parameters are non-toxic, when detected from a known source, they add confidence that a monitoring network (surface water and/or ground water) is properly assessing a pathway. The title of this section doesn't represent its content which focuses only on the characterization of the contaminants. Other characterization data and information are found in Section 2 of Volume 1.	The revised Report has been re-formatted to be a stand-alone comprehensive RFI/RI report for groundwater and surface water. To provide more useful results presentation, more discussion of the occurrence and distribution of other groundwater indicator parameters (TDS/SC, ORP, nitrate, etc) are discussed in Sections 5.3. The new RFI Report has been re-organized to present the hydrogeologic and groundwater and surface water characterization data in the single report (Volume 2), whereas the February 2005 draft report presented the characterization data in separate volumes. The revised Report has been updated with the additional hydrogeologic and groundwater and surface water data collected through October 2007.	M
134. Section 13 General [1-136]	BLM	General Comment: There is a constant change in the units used to express the Cr concentration in the groundwater. Some are expressed in µg/L, some as presented in mg/L, while other are presented and ppm or ppb. This is a little confusing and the units should be standardized.	The concentration units for chromium and trace metals are in units of ug/L, throughout the revised Report, consistent with the Topock monitoring reports 2005 to present.	S
135. Section 13 General [1-137]	BLM	Is it possible to try and correlate the AOC or SWMUs that are suspected or confirmed to have Cr(VI) as a COPC with the location of the groundwater contamination to determine if any other potential source of groundwater contamination other than Bat Cave Wash exist? For example what other SWMUs or AOCs are near MW-20 and do any of these units have a history of chromium being used or released?	There is no evidence of historical chromium usage, or identified SWMU or AOC near well MW-20. The locations of the SWMUs are identified in the Final RFI/RI Volume 1, issued September 2006. The distribution of Cr(VI) in groundwater (maximum at MW-20 cluster) is consistent with migration from Bat Cave Wash discharge area.	S
136. Page 13-1 [1-138]	BLM	The RFI needs to better present the site's hydrogeologic, geologic and water quality information. See various comments	Section 5.1 provides detailed discussion of site hydrogeology using seven intersecting cross-	M

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		on Section 2. Because significant site specific information is spatially orientated, contour maps of the bedrock surface, an isopach of the Alluvial Aquifer's thickness, and various water quality indicator parameters must be presented in this RFI.	sectionsbedrock structure map, and the thickness (isopach) maps for the Alluvial Aquifer.	
137. Page 13-2 [1-139]	BLM	Second paragraph, fourth sentence: *"…groundwater flow directions … are predominately north to northeasterly*." Potentiometric surface maps and isopach maps of the Alluvial Aquifer are needed to assist this discussion, particular to show where the effects of bedrock occurs and the effects of the River on flow direction. The interaction of the groundwater and the River are not discussed in detail. A cross reference(s) should be provided to where this information is provided.	The revised Report was re-formatted to be a stand-alone RFI/RI Report for groundwater and surface water, so a summary section is no longer needed. This comment has been addressed in the updated hydrogeologic and groundwater flow characterization in Section 5.1.	M
138. Page 13-2 [1-140]	BLM	Second and third paragraphs: "*Groundwater at Topock is recharged by primarily from local precipitation*…" while the 3rd paragraph states "*The Colorado River is by far the greatest influence on groundwater levels at the site*." And "*very dynamic*" These statements appear to be contradictory. If the River has the greatest influence on groundwater levels, and on wells as far away as several hundred feet, than its must also have a significant impact on recharge. Moreover this recharge is likely seasonal and/or occurs locally within the network of wells; however, such discussions are not provided in this text. The RFI should be more comprehensive in its presentation. If this information is available within the RFI, it should be cross referenced.	Previously published isotope data, along with isotope data for this project, support the signature of local recharge rather than river water. The revised Report clarifies this in an updated discussion on the isotope data. As previously discussed in the response to BLM comment #29, the river influences the water level fluctuations in the floodplain, but because of daily and seasonal changes, the ***net*** recharge/discharge from the river is very small. This discussion is clarified in the revised Report.	M
139. Page 13-3 Section 13.1.2.1 [1-141]	BLM	*Natural Sources of Chromium:* This discussion should recognize the background information provided in Table 2-5 of this RFI. The work plan and schedule for the future characterization of background conditions should be provided to all the agencies. In this brief discussion of naturally occurring concentrations, the statement "*modest amounts*" when referring to the potential background concentrations of background Cr (VI) should be defined.	The revised Report incorporates the data and statistical upper tolerance limits of background concentrations of COPC metals. Qualitative statements have been eliminated. Refer to Section 6.2.	M

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140. Page 13-3 Section 13.1.2.2 [1-142]	BLM	The highest concentrations of Cr (IV) in the groundwater seem to be beneath areas where previous discussion suggested that the groundwater was not impacted. Is it believed that the plume, that is expected to have originated from the Bat Cave Wash discharges, has migrated this far?	The distribution of Cr(VI) in groundwater (maximum at MW-20 cluster) is consistent with migration from Bat Cave Wash discharge area. The revised Report provides a more complete discussion of the evolution of the plume over time in Section 6.6.	S
141. Table 13-2 [1-143]	BLM	The data suggest that the hexavalent chromium samples were not filtered to provide dissolved Cr (VI) values but show total Cr (VI). The total dissolved Cr concentrations seem to be filtered. How are these data compared? What is the ratio between the total Cr and the hexavalent Cr for filtered samples?	By the nature of the analytical method, all Cr(VI) data are dissolved concentrations. Because of the change in filtering procedure for Cr(T) samples(initiated June 2005), The Appendix H2 chemical data report includes explanation on filtering methods (lab versus field). Appendix F5 includes cross-plots of dissolved Cr(T) vs. dissolved Cr(VI) for the RFI/RI groundwater data. For the Topock site data set as a whole, there is no statistically significant difference between Cr(VI) and Cr(T) values on filtered samples.	S
142. Table 13-3 [1-144]	BLM	Do the blank columns and rows indicate that there were no samples collected? If so, this should be indicated in the table footnotes.	The table used in Feb. 2005 RFI report is not used in the revised Volume 2 report.	M
143. Figure 13-2 [1-145]	BLM	The CSM only shows that the blowdown water discharged into Bat Cave Wash is the potential source of the Cr in the groundwater. What about the other potential sources and AOCs? What would prevent these other sources for contributing to the groundwater contamination? The figures that show the concentrations of the Cr in the groundwater are located (down gradient) from Bat Cave Wash with the highest concentrations being close to the river. Based on the hydrologic properties of the aquifer would the plume have moved that far since the discharge was stopped?	Information on materials and waste management practices at the Topock Compressor station indicate that discharge to Bat Cave Wash is the source of Cr(VI) in groundwater. Waste management practices at the other SWMUs and AOCs are discussed in the Final RFI/RI Volume 1. The distribution of Cr(VI) in groundwater (maximum at MW-20 cluster) is consistent with migration from the Bat Cave Wash discharge area. The revised Report includes a more complete discussion of plume migration from the source area to the present configuration in Section 6.6.	M
144. Figure 13-3 [1-146]	BLM	The general groundwater flow direction should be included on this figure.	Figures 5-11a and 5-12a present the overall groundwater flow direction for the shallow aquifer zone. The legend on Figure 6-2a cites these figures and text for discussion of groundwater flow direction. Groundwater flow direction in the mid-depth and deep zones is similar but can not	S

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			be depicted on the site-wide maps equivalent to Figures 6-2b, and 6-2c.	
145. Figure 13-3, Figure 13-4, and Figure 13-5 [1-147]	BLM	Without any indication of the direction of groundwater flow, the figures suggest that the groundwater flow is to the northeast based on the configuration of the plume. If this is the case, then the highest concentration of Cr(VI) are side-gradient to the potential source (Bat Cave Wash). Please provide the groundwater flow direction on the figures and add some discussion of the groundwater flow direction with respect to the concentration of chromium to support that the source of the chromium is mainly Bat Cave Wash.	Figures 5-11a and 5-12a present the overall groundwater flow direction for the shallow aquifer zone. The legend on Figure 6-2a cites these figures and text for discussion of groundwater flow direction. Groundwater flow direction in the mid-depth and deep zones is similar but can not be depicted on the site-wide maps equivalent to Figures 6-2b, and 6-2c.	M
146. Figure 13-6 [1-148]	BLM	Well PGE-7: Is this the only well completed in the Miocene Conglomerate from which data was included in the delineation of the extent of contamination? This well would seem to represent the lower portion of the alluvial aquifer since it is screened across the interface and the CR(VI) concentration are very close to the adjacent well which was complete only in the lower portion of the alluvial aquifer. Is the hydraulic conductivity or permeability very different between the alluvial material and the conglomerate? If the conglomerate values are much lower then the water collected from the well would probably represent the lower portion of the aquifer or at least a mixture of the Cr (VI) concentrations in the two units. This should be included in the discussion in the text.	Based on available logs and reports, the wells that are completed in Miocene conglomerate bedrock formations are MW-23 and PGE-7 (uncased interval in Miocene conglomerate and pre-Tertiary metamorphic/igneous rock). Based on a video log of PGE-7, it is known that this well is partially open to the base of the Alluvial Aquifer. PG&E agrees with DOI that the concentrations in water from this well are likely to represent conditions in the lower part of the alluvial aquifer. The text in the revised Report (Section 5.1) clarifies these points. Regarding hydraulic conductivity of the Miocene bedrock, purging records for MW-23 confirm this unit is very low permeability, considerably less permeable than the Alluvial Aquifer. The revised Report also discusses the data from recent PGE-8 testing in Section 5.1.	S

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147. Page 13-4 Section 13.1.3 [1-149]	BLM	Second paragraph, first sentence: "*For this characterization, the chromium plume is defined as chromium bearing groundwater that exceeding the state MCL for Cr(T) of 0.05mg/L*." Nearly all RFI discussions focus on the distribution of Cr (VI). The RFI needs to provide a statement/discussion which justifies the distribution of Cr (VI) as being representative of Cr (T), and the most conservative, e.g., spatially extensive, parameter at this site. Though Cr may pose the greatest risk, other parameters may provide better information regarding the dynamics of the flow system; indicate where the Cr may be moving; and provide better knowledge and effective IM designs.	Appendix F5 includes cross-plots of dissolved Cr(T) vs. dissolved Cr(VI) for the RFI/RI groundwater data. For the Topock site data set as a whole, there is no statistically significant difference between Cr(VI) and Cr(T) values on filtered samples.	M
148. Page 13-4 Section 13.1.3 [1-150]	BLM	Second paragraph: Though it is appropriate to delineate a plume based upon a risk level, the overall characterization should not be based upon a single parameter (Cr). Valuable information regarding the overall dynamics of the hydrologic system can be obtained by delineating indicator parameters such as TDS, Nitrate, Cl- , SO4 etc. The RFI does use indicators, but not in a comprehensive manner. The RFI groundwater characterization should include detailed assessments of other parameters and their spatial distribution, and because many of these occur naturally, background conditions need to be better characterized. Because of their greater mobility, several indicator parameters often provided a better assessment of hydrogeologic conditions and will assist in a more effective remediation effort. The RFI needs to fully characterize the hydrogeologic system by including an assessment the spatial distribution of indicator parameters.	The revised Report presents an updated summary of hydrogeologic conditions and the concentrations and distribution of the indicator parameters (e.g., ORP, nitrate, etc) and the implications of this information for plume delineation in Section 6.5.	M
149. Page 13-4 Section 13.2 [1-151]	BLM	First paragraph: The reference to Table 9-1 (Drilling and Construction Summary) is incorrect. The correct table to reference is Table 9-2 (Sampling Record).	The tables in the revised Report have been confirmed with text references.	E
150. Page 13-4, 13-5 Section 13.2.1 [1-152]	BLM	*Present Distribution of Chromium in Groundwater*: Though somewhat relevant, the elevation criterion for the upper, middle and lower Alluvial Aquifer completion zones is more applicable to the overall characterization and should be placed or cross referenced in Section 2 or 13.1.1 as these sections fail to provide this information. Further, a discussion	Section 4.2.1.2 describes the monitoring zone designations that are used for presenting the groundwater characterization data.	M

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		of the completion zones should also include the average screen lengths used for this characterization and reference Table 2-3 for a summary.		
151. Page 13-5 Section 13.2.1.1 [1-153]	BLM	Second paragraph: The reference to the distribution of the Cr (VI) in the middle unit is not clear. The figure (13-4) doesn't show a good representation of the distribution of the Cr (VI) that exceeds the standards. Why was the 0.05 mg/L isocontour drawn the way it is?	Section 6.3.3 describes the chromium plume delineation. The plume limits shown for the mid-depth zone of the Alluvial Aquifer (Figure 6-2b) incorporate plume distribution interpretation based on cross sectional displays Figures 6-3, 6-4, and 6-5.	M
152. Page 13-6 [1-154]	BLM	Second paragraph, second sentence: "*Table 13-3 summarizes …Cr(6)… in groundwater … at seven of the well clusters*." The text should mention that these [7] clusters are the clusters containing the greatest concentrations of Cr (VI). The text also suggests there are 15 clusters; however 16 are found on Figure 9-2. This includes MW-41 cluster found in the northern portion of the monitoring network. No additional information can be found for the MW-41 series; no well logs, or groundwater data. The Figure or the text need to be corrected for the incorrect number of clusters.	The revised Report does not include a summary table of sampling results for well clusters as included in the Feb. 2005 RFI report. Section 6.3.2.1 provides a summary of the vertical chromium distribution trends observed at selected well clusters as shown on the hydrogeologic cross-sections (Figures 6-3, 6-4, and 6-5). NOTE: sampling results are shown for the MW-41 well cluster on Figure 6-4.	M
153. Page 13-7 Section 13.2.1.3 153. Page 13-7 Section 13.2.1.3 [1-155]	BLM	Last paragraph: Is there a correlation between the TDS and the Cr (VI) concentration in the lower portion of the surficial aquifer? If so, this should be discussed.	Both the data used for the Feb-05 draft Report and the data collected subsequent do not indicate a consistent correlation between Cr(VI) and TDS in the lower depth interval of the Alluvial Aquifer. There are many locations where high TDS and low to non-detect Cr(VI) are found. It is noted in Section 6.5 that high-TDS areas of the plume tend to be somewhat higher TDS than the deep non-plume alluvial areas. However, shallow plume zones are of similar, lower, TDS to shallow alluvial non-plume zones.	M
154. Page 13-8 Section 13.2.1.4 [1-156]	BLM	First paragraph, fourth sentence: "*This is considered representative of alluvial groundwater…*" . The text should not refer to this (MW-20-70) as being representative of alluvial groundwater because the water quality found in well MW-20-70 is known to contain elevated concentrations of Cr (VI), and therefore is representative of the Cr plume.	The revised Report has been altered to note this. An isotopic end member of plume water was not identified in the original text because there are several other wells that show similar isotopic signatures to natural alluvial groundwater and yet contain elevated chromium. The revised Report identifies industrial, non-industrial, and river water end members in the isotope section (Section	M

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			6.5.2).	
155. Page 13-9 Section 13.2.2 [1-157]	BLM	Third paragraph: If the plume demonstrates stable conditions why are the highest concentrations of Cr (VI) not located below Bat Cave Wash where the source of the chromium was indicated to be? Was the movement of the elevated concentrations of Cr (VI) caused by the pumping? Is the stability caused by the reducing condition in the alluvial material adjacent to the river? Additional explanation is necessary to support the statement that the plume is stable.	The early industrial supply PGE-1 and PGE-2 well pumping is believed to have played a role in the distribution of the Cr(VI) observed today. The modeled flow of the discharge water in groundwater is discussed in Section 6.6.	M
156. Page 13-10 [1-158]	BLM	Second full paragraph: Before the RFI can claim that the former water supply wells "*captured and prevented further migration of most or all of the chromium plume*", the well completion(s) of these wells must be provided in the RFI. Moreover, to say it could have captured "all of the plume" without knowing the dynamics of the hydrogeologic system is presumptuous.	The revised Report summarizes the data and information available for the former water supply wells. This statement was based on model simulations of the active period of PGE-1 and PGE-2. Particle tracking from the disposal area indicated all applied water was within the capture zone of these wells during the time that they were pumping. Evolution of the discharge-affected groundwater between Bat Cave Wash and these wells following the wells' shutdown is discussed and illustrated in Section 6.6.	M
157. Page 13-10 Section 13.2.3 [1-159]	BLM	First full paragraph: The statement is made that the groundwater is expected to move relatively slowly at this site. Is the data available to calculate a flow velocity and estimate the time it would take the Cr (VI) released into Bat Cave Wash to travel to the monitored locations? Provide flow velocity data to support the statement that the groundwater moves slowly.	The revised Report includes average flow velocity in Section 5.1 Modeling simulations used to estimate travel time and direction of discharge water is discussed in Section 6.6.	M
158. Page 13-10 Section 13.2.3 158. Page 13-10 Section 13.2.3 [1-160]	BLM	First full paragraph, last sentence: Would the groundwater mound that is stated to have been created by the discharge into Bat Cave Wash have created radial flow from the source? Would this have moved contamination outside the projected boundary of the plume? Provide some additional discussion as to why the plume does not extend radially from the discharge point.	Model simulations using measured site parameters indicate that the relatively high permeability of the materials in and below Bat Cave Wash allowed the applied discharge water to flow along the gradient towards the northeast without excessive spreading. The most recently calibrated groundwater model was used for particle-tracking simulations of the potential gradients produced by the historical pumping of PGE-1 and PGE-2. The degree to which Cr(VI) dispersed laterally during discharge is not known, but its present distribution in this area is	M

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			considered to be reasonably well defined. These points and the results of groundwater modeling simulations are discussed in Section 6.6 of the revised Report.	
159. Page 13-10 Section 13.2.3 [1-161]	BLM	Second full paragraph: Using the pump test data is it possible to estimate the effect on the aquifer from the pumping of these two wells at approximately 70 gpm? Is the 70-gpm rate adequate to create a cone of depression that would capture all the Cr (VI) that was release? Additional discussion is needed supporting this statement.	Section 6.6 presents the conceptual model of chromium plume migration. The modeling evaluation presented in the Feb 2005 report has been updated in the revised Report using particle track model simulations of the active period of PGE-1 and PGE-2 pumping as described in Section 6.6.	M
160. Page 13-12 [1-162]	BLM	*Other Trace Metals*: The background wells were not sampled for the Title 22 metals list (Table 2-5). The background groundwater conditions should be adequately characterized for naturally occurring constituents.	The revised Report utilizes the Revised Background Study results in the discussion of COPC metals in Section 6.2.	M
161. Page 13-14 Section 13.3.2 [1-163]	BLM	The RFI needs to provide a more rigorous assessment of the surface water quality, more than simply comparing concentration ranges of dissimilar amounts of data from various stations. As previously mentioned in groundwater comments, indicator parameters provide valuable information regarding the transport processes at any site, and mapping and understanding these process is of high priority. Though many of these indicator parameters are non-toxic, when detected from a known source, they add confidence that the monitoring network (surface water and/or ground water) is capable of properly assessing a pathway. At a minimum, Chloride, Nitrate, and Sulfate need to be added to the routine surface water monitoring program. These parameters are very inexpensive. In the copper discussion, the RFI states the upstream concentrations of copper range from 5.8 to 6.3µg/L. Table 13-10, however, shows the maximum detection to be 6.04µg/L. The RFI needs to correct this inconsistency.	The only surface water body available for water quality characterization is the Colorado River. Colorado River sampling for characterizing the nature of indicator parameters and what they indicate about transport processes for COPCs from the site would not be meaningful given that dynamic nature of water movement in the river (i.e., the samples would reflect “ambient” upstream water quality). Chloride, nitrate, sulfate are included in the periodic annual or every 2-year general chemistry GMP sampling; these parameters do not warrant routine monitoring. The revised Report has corrected the surface water data presented. The data presented has been updated with the more recent surface water sampling data.	M
162. Table 13-11 [1-164]	BLM	Interstitial Water Sampling Results: Appendix 3 shows that Phosphate was the parameter	The revised Report has corrected the inconsistency in the interstitial water data	M

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		analyzed, whereas Table 13-11 states Phosphorus was analyzed. The RFI document needs to be consistent.	presented.	
163. Page 13-15 [1-165]	BLM	Second paragraph, last sentence: "*None of the other metals or general chemistry parameters were detected…at concentrations exceeding surface water quality criteria (Table 13-4)*". The RFI needs to explain why these naturally occurring constituents were not detected in these samples when they are detected in upgradient surface water and background groundwater quality. Table 13-4 doesn't present water quality criteria as suggested by the reference. The correct table needs to be referenced.	The 2005 draft Report text should have referenced Table 10-4 for surface water criteria. The revised Report has updated the text discussion and correctly reference the surface water data presented.	M
164. Page 13-15 Section 13.3.3 [1-166]	USGS	Analyses presented in Table 13-11 show concentrations of iron greater than 1 mg/L in interstitial sediment-water for samples W-27, W-29, and W-30. If these concentrations represent dissolved iron the oxidation state would be Fe (II) indicating that conditions in these sediments are reducing enough to reduce Cr (VI) to Cr (III). This may further support statements made elsewhere in this chapter that reducing conditions in floodplain sediments could limit transport of Cr (VI) to the Colorado River.	Agree. The revised Report includes additional pore water geochemistry discussion and incorporates the data and findings from the December 2005-January 2006 Pore Water Study investigation.	S
165. Page 13-15 Section 13.3.3 [1-167]	FWS	Please resample and reanalyze for Cr(VI) because the analysis occurred outside the 24-hour holding time for Cr(VI) analysis. If the samples cannot be reanalyzed, then explain how the results were used, how they were interpreted, and how conclusions were derived given the analysis was outside the holding time.	The revised Report includes an updates the pore water evaluation and incorporates the data and findings from the December 2005-January 2006 Pore Water Study investigation.	M
166. Page 13-15 Section 13.4 [1-168]	BLM	Second full paragraph, third sentence: The statement is made that the discharge of blow down water into Bat Cave Wash is the primary source of the Cr (VI) contamination. What other potential sources are there? The previous chapters and discussions have eliminated the other SWMUs and AOC as potentially impacting groundwater. Provide some additional discussion as to why the other AOCs or SWMUs are not potential sources of Cr (VI) contamination.	Materials handling and waste disposal practices the Topock Compressor Station are documented in the Final RFI/RI Volume 1, issued September 2006. Sources of information include company records, interviews with current and former employees, and review of government agency files. Information on materials and waste management practices at the Topock Compressor station indicate that discharge to Bat Cave Wash is the source of the Cr(VI) in groundwater. The distribution of Cr(VI) in	M

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			groundwater (maximum at MW-20 cluster) is consistent with migration from Bat Cave Wash discharge area.	
167. Page 13-16 Section 13.5 167. Page 13-16 Section 13.5 [1-169]	BLM	General comment: There needs to be an evaluation of risk performed to determine the risk to human health and the environment. Without the risk assessment it is not possible to know how to establish the clean up level that will adequately protect human health and the environment in the future.	A risk assessment for groundwater separate from the RFI/RI is being prepared that will assist in establishing clean up levels for the site.	
168. Page 13-16 Section 13.5 [1-170]	BLM	First bullet: Though focusing on information in the area of the IM is important, delineation of the total extent of the plume is essential to a successful remediation design. The RFI needs to delineate the entire plume and focus some attention on the East Ravine. Second Bullet: Not only estimating the depth to bedrock, but its 3-dimensional characteristics is extremely important to a successful groundwater remediation. This should include areas in the western portion of the study area, where the bedrock is assumed to deepen. Third bullet: Indicator parameters need to be added to the parameter list. Fourth bullet: Results or status of this model was not previously discussed or mentioned in this RFI. This model would benefit from the additional bedrock information obtained from bullet #2.	The revised Report presents the results of the groundwater characterization data through October 2007 and has the site conceptual model for the chromium plume in groundwater. The data and results presented will be incorporated in the groundwater flow model for the site. The revised Report indicates that additional groundwater investigation is planned after October 2007 to further delineate the groundwater plume in areas on the east side of the Colorado River, and to further characterize groundwater conditions in the East Ravine area.	M
169. Page 13-17 Section 13.5.1 [1-171]	BLM	See previous comments. Due to the expense of seismic reflection, other surface geophysical methods should be evaluated.	The USGS river-borne geophysical survey provided useful information and will be included in the revised Report. Surface geophysical methods were evaluated in 2004 for data collection in the floodplain area but were not feasible due to site approval and permitting concerns.	S
Draft RFI Report (Feb-2005) APPENDICES				
172. Appendix-A2 (In response to	BLM	Appendix A2 has a well log MW-28 that differs from a well log MW-28 found in Appendix A3. Two MW-28 wells (MW-28-25	During the initial RFI investigation, a single shallow well MW-28 (screen depth of 25 feet bgs)	M

[a] Comment Types: M = Mandatory, S = Suggested, E = Editorial

Comment No./ Location	Agency	Comment	Comment Response	Type[a]
comment No. 56)		or MW-28-90) are depicted on Figures and Table 2-4 but the text on page 2-17 does not clearly distinguish which MW-28 well is being discussed. The RFI needs to clearly distinguish between multiple numbered wells (i.e., is MW-28-25 the log completed in 1999 and provided in Appendix A2?). Additionally, the RFI needs to provide a cross reference for wells in Figures to those in the Appendices.	was installed at this location. During the 2004 IM investigation, a second monitoring well was installed at the location with a screen depth of 90 feet bgs (designated MW-28-90). Accordingly, the designation of the original shallow well was modified in 2004 to MW-28-25. Table 4-2 and 4-4 list the final well identifications, Appendices B1 and B2 provide additional explanation listings for the RFI/RI well numbering used over several phases of drilling (see Figure 4-1).	
173. Appendix-A1	BLM	The location information X, Y, and Z coordinates need to be provided for all the logs.	Appendix Table B2 presents the well survey location coordinates and elevations for the wells in the RFI well network.	M
174. Appendix-A4	BLM	The type and depth of the casings used in MW-24BR needs to be presented in this figure.	Appendix B contains summary tables of well construction information that is relevant for log review.	M
175. Appendix-A6	BLM	Not all the relevant wells are used to prepare the potentiometric maps. For example, Figure 2-21 does not use MW-37S, MW-40S, to generate the groundwater elevation contours for the shallow interval. Water level elevation data for every well needs to be provided in Appendix A6.	Section 5.2 presents a summary of the groundwater gradients and flow conditions using groundwater elevation data collected at the site. Given the transient effects on groundwater elevations due to fluctuating river level, manual water level measurement data collected during a snap-shot event can only be used for accurately depicting horizontal gradient for the site. For this reason, For reference, a listing of groundwater elevation data for the RFI monitoring wells is provided in Appendix E5.	M
176. Appendix-A6		Figure A6-1 implies the wells/data are provided in Appendix A6. Data for MW-12 is found in A6-4 but his well is not shown in Figure A6-1. Wells shown in Figure A6-1, but no data found in A6 are: MW-40D, MW-40S, TW-2S and TW-2D and all of the R stations along the river (R19, -20, -22, -27, -28, -29 and the Vernal Pool). All the wells should have routine water level measurements and this data needs to be provided in the RFI.	See response to Comment #175 above. For reference, a listing of groundwater elevation data for the RFI monitoring wells is provided in Appendix E5.	M

[a] Comment Types: M = Mandatory, S = Suggested, E = Editorial

Comment No./ Location	Agency	Comment	Comment Response	Type[a]
177. Appendix-A7	BLM	Plots are not provided for all the wells. The RFI needs to add plots for all the wells so comprehensive comparisons can be made. The plots are grouped by TDS: Low, Moderate, and High. The text needs to explain how these terms are defined in terms of TDS concentrations.	The revised Report includes an updated listing of general chemistry analytical results and Piper groundwater quality graphic plots for comparison. The Stiff diagrams have been moved to Appendix F. Since the plotting scales are dependant on TDS levels, it is necessary to subdivide the wells into Low (TDS ≤40 milliequivalents/L for each major ion), High (≤ 180 milliequivalents/L) and Very High (≤ 400 milliequivalents/L). These categories are not assumed to have strict geochemical meaning; they are made to group similar TDS waters into the fewest number of groups as possible so the Stiff patterns may be more easily compared.	M
178. Appendix-C	BLM	Appendix C (Groundwater data) only shows the results for well MW-27-20. This well is not found anywhere in the RFI. Can this error be a typo within Appendix C with the real sample ID being simply MW-27?	Table 4-2 and 4-4 list the final well identifications, Appendices B1 and B2 provide additional explanation listings for the RFI/RI well numbering used over several phases of drilling (see Figure 4-1).	S

[a] Comment Types: M = Mandatory, S = Suggested, E = Editorial

A3 Tribal Outreach Comments on 2008 Draft RFI/RI Volume 2 Report

Responses to Tribal Comments
On the Draft Topock RFI/RI Volume 2 Report
PG&E Topock Compressor Station

Commenting Tribes:

Fort Mojave Indian Tribe (FMIT) June 13, 2008 Comments
Colorado River Indian Tribe (CRIT) June 16, 2008 Draft Comments

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FMIT Comments

FMIT GENERAL COMMENTS

The document presents the history of hydrogeologic characterization at the Topock Compressor Station and assembles all the relevant data into a usable format. It is essentially concluded that the hydrogeologic characterization program is complete with a few noted exceptions. To assert this, it is necessary to have sufficient information to (1) make a decision on the need for a remedy; (2) scope the remedy; and (3) evaluate the relative merits of reasonable alternative remedies against established criteria. The Tribe concurs with this position and, based on the information assembled, believes that there is sufficient information to proceed with the corrective measures and feasibility studies (CMS/FS).

However, it is understood that the document is not quite represented complete because of a few remaining studies that will provide additional information to be presented in the forthcoming RFI/RI Volume 3. Nevertheless, the Tribe would like to call PG&E's attention to a few issues that have been raised recently by other parties. While the Tribe has no particular concern over these issues, we believe that it is in all parties' interest to address these issues through careful consideration of all the available data. This will best assure whether these issues constitute real or perceived data gaps that might affect future project decisions.

For example, issues have been raised by other parties concerning detections of chromium above standards in the Colorado River. Indeed if this condition were real, the Tribe would have a concern over such contamination. Moreover, it has been suggested that there may be vertical migration pathways associated with, or in the vicinity of, the present or former bridge pilings. What evidence is there that either suggests potential for such an occurrence or allays this possibility? Is additional sampling needed to address this issue, or are existing data sufficient for resolution? The document should address such issues directly.

Another example that may relate more directly to the CMS/FS is the need for a solute transport model. This issue was raised in a recent meeting of the Technical Working Group (TWG). More specifically, there were questions surrounding the appropriateness of assumptions regarding the number of pore volumes required to flush out the existing plume. Such an assumption would be necessary in regard to use of a flow model for estimating the cleanup timeframe associated with alternative remedies or optimizing alternative configurations of a given remedial design. In the Tribe's view, the flow model will likely have the ability to provide information on the relative timeframes of alternative remedies, and represents a simpler approach, requiring specification of fewer parameters, and therefore requiring less additional data collection. This would be important both in terms of schedule efficiency and minimizing additional environmental disturbances.

As discussed in our teleconference of June 9, 2008, H+A has had discussions with PG&E staff and consultants with regard to the recently completed floodplain in situ pilot testing (ISPT). Additionally, we expect to have further discussions with regard to findings on the upland ISPT. The Tribe understands that the details of these tests are considered more appropriately within the scope of CMS/FS. However, recognizing the importance of proper interpretation of these testing results to the ultimate scoping and design of a remedy based on these technologies, the Tribe remains deeply invested in the results and, as suggested by PG&E, would like the opportunity to remain engaged in discussion of these studies as the results unfold. Similarly, the Tribe is actively interested in the anaerobic core studies as they relate to the potential applicability of natural attenuation as an alternative remedy.

RESPONSE: PG&E notes the Tribes comments and would like to reiterate our commitment to frequent and open communication on each of the issues raised and all other aspects of the project. No specific changes have been made to the report in response to the above General Comments. Section 7.0 of the report presents the results of chromium analyses in surface water, and discusses that no chromium has been found above standards in surface water samples collected in the Colorado River. Further discussion of the other identified topics (former bridge pilings, solute transport model, *in situ* pilot testing, and anaerobic core studies) will be presented in other RFI/RI and CMS reports.

FMIT SPECIFIC COMMENT 1

Section 6.3 Present Distribution of Chromium in Groundwater

Statement: For reference, Table 6-4 list the Cr (VI) and Cr (T) groundwater results for the RFI/RI wells for the period October 2006 through October 2007.

Comment: Table 6-4 list Cr (VI) and dissolved chromium results. Total chromium is not referenced on the table. Hexavalent and dissolved chromium results are listed. Table 6-6 *Results Summary* list chromium total (T).

RESPONSE: Tables 6-4, 6-11 and 7-3 have been revised to identify total chromium [Cr(T)] rather than dissolved chromium in the headings. Text in Section 4.2.3 has been added to clarify that total chromium is equivalent to dissolved chromium because it is filtered.

FMIT SPECIFIC COMMENT 2

Section 6.3.2.1 Vertical Chromium distribution at well clusters

Statement: *However, the current distribution of Cr (VI) in the floodplain wells have been strongly influenced by IM pumping since 2004*. This statement repeats in Section 6.4 *Chromium Concentrations Over Time.*

Comment: For clearer understanding of the influence due to IM pumping, a section summarizing current remediation activities (pump and injection) for each groundwater zone should be added to the report.

RESPONSE: A paragraph has been added to Section 6.3.2.1 to summarize current IM activities.

FMIT SPECIFIC COMMENT 3

Section 6.7.2 First paragraph

Statement*: Due to the absence of the alluvial aquiver, movement of the groundwater chromium plume associated with the Bat Cave Wash discharge through this area is highly improbable.*

Comment: Replace aquiver with aquifer.

RESPONSE: The report has been corrected.

FMIT SPECIFIC COMMENT 4

Section 6.7.2 Fate and Mobility in East Ravine

Comment: In the discussion of East Ravine investigation a figure showing the locations of the investigation for the East Ravine and Arizona side are recommended.

RESPONSE: A new Figure 6-14 has been added to show the Arizona drilling locations and the general areas of the proposed East Ravine groundwater investigation.

FMIT SPECIFIC COMMENT 5

Section 10.1.2.2 Conclusion

Statement: *Limited ongoing surface water monitoring program through implementation of the groundwater remedial action at the site is suggested.*

Comment: Does limited ongoing imply limited time period or a few key locations for an extended period of time?

RESPONSE: No specific proposal or agency direction has been provided on the long-term surface water monitoring program. At some future time, either reductions in time period or locations may be proposed. PG&E is committed to continuing the surface water program as needed for monitoring of the remedial action effectiveness as directed by DTSC or DOI.

FMIT SPECIFIC COMMENT 6

Section 10.1.2.1 Groundwater Characterization

Statement: It is therefore recommended that specific conductance not be carried forward as a COPC at the site.

Comment: While EC as a COPC might not be required, EC or TDS monitoring should continue. In Section 6.3.2.1 *Vertical Chromium distribution at well clusters, the statement:*

Sampling data for the vertical well clusters at the site show wide range in concentrations and no uniform trend of Cr (VI) concentration with depth in the alluvial aquifer. What is consistent is that TDS and/or EC increase with depth. These parameters identify vertical source of alluvial groundwater. Since the groundwater gradient is upward and toward the floodplain, this information could be important during remediation activities.

RESPONSE: Comment and observations are noted; no changes have been made to the report. The sampling programs for future remediation activities will consider the appropriate analytes for ongoing and future water quality monitoring, which may include TDS. It is anticipated that samples collected in the future will have field measurement of EC as a component of the sampling procedure, regardless of the targeted analytes for the samples.

CRIT Comments

CRIT COMMENT 1

Overall EMC found the RFI/RI Report to be well written, organized and followed a logical progression and presentation of information. In addition, we support the focus of the document on technical discussion and factual issues that support the investigation of activities.

RESPONSE: Comment noted and appreciated.

CRIT COMMENT 2

ES. 2 – If any SWMUs or AOCs related to historical discharge of wastewater from the facility were not carried forward from Volume 1 to this volume, it may be useful to reference them.

RESPONSE: There are no SWMUs or AOCs with COPCs related to historical discharge of wastewater from the Compressor Station that were not carried forward into Volume 2. Text has been added to Section 2.0 to clarify this.

CRIT COMMENT 3

ES 2.1 – Electrical conductivity seems to be an unusual COPC, while sodium chloride appears to be absent based on the statement "naturally-occurring inorganic (e.g. sodium chloride) in cooling water were concentrated".

RESPONSE: Electrical conductivity was identified as a site COPC in the 1996 DTSC Correction Action Consent Agreement. Text has been added in Section 2.1.3 to clarify that electrical conductivity is a representative indicator of dominant ions (such as sodium and chloride) and TDS in groundwater and therefore an appropriate characterization parameter for SWMU 1/AOC 1 and SWMU 2.

CRIT COMMENT 4

Are the reducing conditions consistent and continuous over a wide area? Does the thickness thin to the south or in another direction? Has previous dredging of the river potentially impacted reducing conditions? Can the current or former subsurface bridge footings provide a potential localized interruption in the reducing conditions?

RESPONSE: Sections 5.3.1.6 Groundwater Reductive Zones, Section 6.5.1 General Chemistry, and Figures 5-21, 5-22, and Figures 5-24 of the report provide more details on the reducing conditions at the site beyond what is summarized in the Executive Summary. The conditions measured at the site represent the current state of the site, whether on dredged materials or otherwise. Regarding the bridge footings question, there is no existing site data that supports the concern. As explained in Section 8.0, the pore water samples collected in 2006 adjacent to or downstream of the railroad bridge and the I-40 bridge all indicated reducing conditions. In addition, the groundwater monitoring results from the California slant wells and Arizona slant wells (to be reported in the RFI/RI Volume 2 Addendum) underneath the river show no detections of Cr(VI).

CRIT COMMENT 5

For Applicable or Relevant and Appropriate Requirements (ARARs), did DTSC and DOI previously request input from stakeholders to identify ARARs and provide them to PG&E? If so, was this a one time request? It may be useful to reference this action and information if it has been completed.

RESPONSE: The Department of the Interior (DOI) has the lead role under CERCLA to identify the ARARs. On April 28, 2006 DOI sent a letter to the Topock Consultative Working Group requesting input in identifying ARARs. The text in Section 1.3 has been revised in the report to clarify this.

CRIT COMMENT 6

3.5.1 – It would be helpful to provide a more detailed discussion in this section or another relevant section regarding the current and former bridges that crossed the river and the locations of the subsurface bridge footings to include the location information on an appropriate figure. In discussing and referencing surface water sampling locations, it would also be helpful to include this information on corresponding figures.

RESPONSE: Text has been added to Section 3.5.1 that cites the locations of the existing railroad and I-40 bridges at the Topock Site, as shown on the aerial photo (Figure 3-2). The current bridges are also shown on Figure 4-6, which provides a map of the surface water monitoring locations. Additional information on the former bridge, collected from historical records, will be discussed in the RFI/RI Volume 2 Addendum. Historic aerial photos that depict the former bridge can be found in RFI/RI Volume 1.

CRIT COMMENT 7

Section 6.3 – For figures that present the extent of groundwater contamination (i.e. Figures 6-1 to 6-9), it is difficult to get a clear understanding of what the actual defined limits and extent of groundwater contamination is; since the figures present colored dots that present concentration ranges rather than providing actual concentration contours of groundwater contamination. Where a single contour line is provided (i.e. Cr(VI)), it shows an outline only related to 50 ug/L. We would like to know if this approach is consistent with and achieves the RCRA and CERCLA objectives stated in Section 1.3 to define the nature, degree and extent of contamination. It is our opinion that appropriate contour maps would assist in this understanding .

RESPONSE: PG&E thanks the CRIT for their input on the report figures. The existing Section 6.3.3 provides the rationale for using the California Cr(T) maximum concentration limit drinking water standard for defining the extent of chromium and is consistent with the RCRA and CERCLA objectives and ARARs. Accordingly, no changes have been made to the report. The non-COPC metal maps (Figures 6-1 to 6-8) are intended to show the spatial variation of the selected metals using statistical average results over the 10-year sampling period. Because the concentrations are highly variable, we feel strongly that contouring of the data would not result in a more clear depiction of distributions, as is the case for Cr(VI). The groundwater distribution of the non-chromium metals are not related to one assignable source, and contouring the distribution would incorrectly imply their origin is from a single source.

A4 Agency and Stakeholder Comments on the July 2008 RFI/RI Volume 2 Report

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
General Comments					
U.S. Department of the Interior	DOI-1 M	Cover letter	RCRA Facility Investigation/Remedial Investigation, Volume 2 cannot be considered the final version until Stakeholder and Regulatory Agency comments have been addressed to the satisfaction of DOI and DTSC	Agree. These responses to comments and the changes to the RFI/RI Volume 2 Report described herein are intended to address the stakeholder and agency comments received and together will comprise the final version of RI/RFI Volume 2.	DOI accepts the comment response.
U.S. Department of the Interior	DOI-2 S	General	The BOR has been asking for several years now about the characteristic of storm water coming of the compressor station and down the washes. It is BOR's opinion that this should have been addressed in this volume of the RFI.	As described in Section 1.0, the purpose of RFI/RI Volume 2 is to complete the characterization requirements for past releases to groundwater from historical Topock Compressor Station operations, and to address federal agency comments on the February 2005 RFI/RI as they pertain to the nature and extent of hazardous waste and constituent releases in groundwater. RFI/RI Volume 2 focuses on the characterization of impacts to groundwater for the two SWMUs/AOCs carried forward from RFI/RI Volume 1 and associated with the past discharge of wastewater from the compressor station to Bat Cave Wash and injection well PGE-8. RFI/RI Volume 3 (forthcoming, after completion of additional characterization) will address the RFI/RI requirements for the remaining Topock Compressor Station operations, including results of soils investigation. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI accepts the comment response with the caveat that characterization of storm water runoff from the compressor station to Federal property remains a priority for DOI. DTSC recommends that the Part B investigation activities address the storm water concern since the Part B already has a component to evaluate on-site to off- site impacts.
U.S. Department of the Interior	DOI-3 M	General	There is no discussion of the DQOs or DQIs that assures the reader that the data is of acceptable quantity and quality to support the conclusions being presented. This needs to be incorporated either by reference or as an appendix and referred to in the appropriate sections.	A summary of analytical data review and evaluation is included in Appendix H1 of the RFI/RI Volume 2. As described in Section 4.0, the data included in the RFI/RI Volume 2 were collected during a series of investigations over 10 years, in accordance with the plans and procedures outlined in Table 4-1. In response to this comment, additional explanation of the data quality review and references to Appendix H1 will be added to Sections 4.2 and 10.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response, to include a discussion in the main document text of the data from a quality perspective.
U.S. Department of the Interior	DOI-4 E	General	At various locations in the document, the report is referred to as an "RFI report". The document is intended to address the requirements of both RCRA and CERCLA, and is titled "RCRA Facility Investigation/Remedial Investigation Report". Revise the document throughout to refer to it as the RFI/RI report.	As described in Section 1.0, this document is intended to meet the requirement of both the RCRA Facility Investigation and the CERCLA Remedial Investigation, as reflected in the title of the report. The document will be revised throughout to clarify that this is both an RFI and an RI.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-1	General	CRIT is one of two immediately affected downstream Tribes in the pathway for surface water carrying chromium contamination and may be directly affected by any contamination emanating from the PG&E Topock Compressor Station. CRIT is not only concerned for their Tribe and other downstream Tribes but are also concerned for the millions of people of Southern California and Arizona who rely on the Colorado River as a primary source of drinking water, agricultural water supply and recreational use.	PG&E shares the same concern as the CRIT in protecting water quality in the Colorado River and the health of Colorado River users. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI accepts the comment response. DTSC also accepts the comment response.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-2	General	EMC comments are based on the understanding that PG&E will conduct all future studies and investigations, including but not limited to, the Phase II soil and groundwater investigations, Soil Investigation, Work Plan Park B, East Ravine investigation, Risk Assessments, Corrective Measure Study (CMS), Environmental Impact Report (EIR) and other investigations and studies in an expedited manner and that the regulatory agencies will not allow any unnecessary delay or defer finalization of these investigations. It is important to note that each of these investigations and studies are fundamental and integral components in the identification and support of any proposed groundwater remedy. Without the continuation and completion of these activities, any proposed groundwater remedies would not be complete.	PG&E agrees that these future studies and investigations are important to support the selection of a final remedy. Language will be added to Section 2.0 to recognize the importance of these future studies and the need to incorporate any findings from these studies into the final remedy.	DOI directs PG&E to discuss the process for addressing a final remedy for any potential groundwater sources or effects identified during the additional studies. DTSC concurs with DOI's recommendation.
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-3	General	Were any specific actions, requirements or other obligations as a results of the DTSC or PG&E settlement agreements incorporated into the RFI/RI Report? Is so, please identify.	No response provided as directed by DTSC in their October 21, 2008 letter to PG&E.	
Regional Water Quality Control Board	RWQCB-1	Acronyms	Acronym for "Water Board" incorrectly indicates that the Water Board involved is the Lahontan Region. Please correct to read "Colorado River Basin Region".	The definition of the acronym will be changed to "California Regional Water Quality Control Board, Colorado River Basin Region".	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC agrees with the response.
Regional Water Quality Control Board	RWQCB-5	Figures	None of the figures depicting the major structures, such as the I-40 bridge and the BN&SF Railroad bridge, identify the I-3 gas pipeline bridge. It would be helpful to do so.	The I-3 gas pipeline bridge will be identified on Figures 1-3 and 3-2.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC agrees with the response.
Executive Summary					
U.S. Department of the Interior	DOI-5 M	General Executive Summary (ES)	In general, technical comments are provided for in the applicable main sections of the report and are not duplicated as comments to the ES. Revisions made to the document based on these comments must be conveyed to the related ES sections.	See responses to technical comments on the main sections of the report. The sections of the Executive Summary will be revised to reflect the changes to the applicable sections.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-1	ES	Based on comments contained in this memorandum, it is anticipated that the following sections of the Executive Summary would be modified: ES.6.1.1, ES.6.1.4, ES.6.1.6 (i.e., plume delineation to background versus 50 micrograms per liter), ES.10.1.3 (constituents of potential concern - COPCs), ES.10.1.4 (COPCs), and ES.10.2.1 (COPCs).	These sections of the Executive Summary will be revised to reflect the changes to the applicable sections.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-2	ES	Page ES-16, Section ES.10.1.3, Paragraph 1, Line 1: - The sentence (and others throughout the Report) concludes that constituents other than chromium (e.g., arsenic, molybdenum, selenium) that exceed regional background and/or groundwater applicable or relevant and appropriate requirements (ARARs) "…suggests local variability of naturally occurring groundwater in the basin."	Revisions to Section ES.10.1.3 will be made as needed to reflect changes to the applicable sections in the report. Additional discussion can also be found in Section ES.6.1.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
			However, evidence and discussion to make this conclusion is lacking, especially for those wells located within the area affected by the anthropogenic chromium plume. Revision to the Report is requested as directed in other COPC comments contained within this memorandum.		
U.S. Department of the Interior	DOI-6 S	Sec. ES.2.1, 2nd paragraph, Page ES-2	It is stated in this paragraph that untreated wastewater that was discharged to Bat Cave Wash from 1951-1964 included both Cr(III) and Cr(VI). If Cr was added to the cooling water as Cr(VI), then the Cr(III) presumably formed by reduction of Cr(VI). This would have altered the isotopic signature of Cr(VI) to some degree, depending on the amount of Cr(VI) that was reduced. Detailed consideration of this possibility is beyond the scope of this report, however, a sentence acknowledging this possibility should be considered for inclusion in the paragraph that mentions the isotope study on page 6-19.	This statement that the untreated discharge contained Cr(III) is in error. Prior to the initiation of the cooling water treatment process, there was no mechanism to reduce the Cr(VI) in the cooling tower blowdown to Cr(III) so the discharge would have contained little if any Cr(III). The reference to Cr(III) in the 1951-1964 cooling tower blowdown will be deleted to correct this error. After the treatment process was in place, it is possible that if some of the water received partial treatment there could have been some isotopically heavy Cr(VI) produced. A sentence acknowledging this possibility will be included in the last paragraph of Section 6.5.2 (Stable Isotopes).	DOI accepts the comment response and directs PG&E to add the additional explanation of the treatment process as discussed in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
Regional Water Quality Control Board	RWQCB-2	ES.2.2, p. ES-3, 2nd para., last sentence	This sentence states that wastewater sent to PGE-8 for subsurface injection was treated and that concentration levels were generally reduced to below 1 part per million of "chromium". Please clarify what type of chromium this was; e.g., Total Chromium?	In response to this comment, the text will be revised to indicate total chromium, evidenced by the wastewater treatment process. The two-step treatment process is described in the Closure Plan for the Hazardous Waste Management Facilities at the Topock Compressor Station, Revision 1, dated August 1986. In the first treatment step hexavalent chromium was reduced to trivalent chromium by lowering the pH of the wastewater using sulfur dioxide gas; in the second step, the trivalent chromium was precipitated by adding liquid sodium hydroxide and other flocculants (Poly Floc II and ferric sulfate) raising the pH and causing the formation of chromium hydroxide precipitate.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as proposed.
U.S. Department of the Interior	DOI-7 S	Page ES.3, last sentence, 2nd Paragraph	The sentence on wind direction and speed is not accurate. Wind speed and direction may be influenced by site topography, but are controlled by many factors, many of which are not related to site topography. The last paragraph of Section 3.2 provides a better discussion of wind direction and speed.	The general statement on wind direction and speed will be clarified to be consistent with the meteorology discussion in Section 3.2.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
Regional Water Quality Control Board	RWQCB-3	ES.3.3, p. ES-5, 2nd para., last sentence	This sentence refers to the I-3 bridge. It is not explained until Section 3.5.1.2, p. 3-11, that this refers to the name of the bridge for the gas pipeline. It would be helpful to make that clear in the Executive Summary here as well.	The reference to I-3 gas pipeline bridge will be added to Section ES.3.3.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as proposed.
U.S. Department of the Interior	DOI-8 S	Sec ES.3.3, 4th Paragraph. 2nd sentence, Page ES-5	Revise this sentence to clarify that recharge is not based on the site conceptual model, numerical modeling and groundwater chemistry data but that these things support the conclusion that the river is a gaining stream at the Topock site.	The sentence will be revised as suggested.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-9 S	Sec. ES.4, 1st Paragraph., Page ES-6	This statement implies that DOI has approved all of the previous planning documents even for the activities that were conducted prior to the consent agreement signed in 2005. If this is not the case,	In response to this comment, the third sentence in the 1st paragraph in Section ES.4 will be revised to state: "The work plans were implemented after approval by DTSC and (since 2004) by DOI agencies."	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
			please revise the sentence.		
U.S. Department of the Interior	DOI-10 M	Sec. ES.5, 5th bullet, last sentence, Page ES-7	DOI does not concur with this bullet. It is too over-arching in its conclusions and does not distinguish between those conclusions that are based on definitive data and those that are based on speculation or presumptions. While DOI considers the presence of reducing zones between the existing Cr(VI) plume and river as a beneficial limiting factor for contaminant migration under current conditions, and agrees that existing data support the conclusion that Cr(VI) is not currently adversely affecting the Colorado River, uncertainties remain in the distribution and extent of reducing zones. Moreover, the extent to which current reducing conditions provide a permanent barrier to Cr(VI) contaminant migration is uncertain. Legitimate questions remain about the total capacity of the sediments to reduce Cr(VI) to Cr(III), and the permanence of the immobilizing processes. Existing data are not sufficient to conclude that reducing conditions will continue indefinitely to preclude migration of Cr(VI) to the river in the future.	This bullet does not conclude that the reducing zone is in any way a ubiquitous or permanent barrier to Cr(VI) migration. It only states that there is data that support the conclusion that there is significant reduction capacity in the anaerobic materials to reduce and remove Cr(VI). It is not appropriate to cite all supporting data in an executive summary. We agree that there are still questions about the ultimate capacity and longevity of the reducing zone but believe that the statements in this bullet are not speculative but are firmly supported by data presented in Sections 5.1.3, 5.3.1.6, and elsewhere in the report. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI does not accept PG&E's response. This topic is of high importance to the river and its users, and it could be a critical factor in selection of a final remedy for groundwater. It is imperative that the characterization of naturally occurring processes that mitigate contaminant migration to the river be fully framed in terms of what is known based on measured data and what is scientifically speculated, including directly acknowledging the significant uncertainties in the understanding of those processes for reducing and immobilizing chromium in groundwater now and in the future. Revise this bullet to read: • The Cr(VI) groundwater plume extends from the former percolation bed in Bat Cave Wash to the floodplain area north of the railroad tracks. Within the plume, Cr(VI) is typically present at all depth intervals of the alluvial portion of the aquifer but is not present in samples from shallow and middle-depth wells in the fluvial portion of the aquifer near the river. The Cr(VI) groundwater plume is characterized by higher oxidation-reduction potential and a heavier oxygen/deuterium isotopic signature compared to river-influenced fluvial zone groundwater. Reducing conditions have been documented in shallow to mid-depth fluvial wells and sediments near and underlying the river. South of the railroad tracks, these reducing conditions are also encountered in deep wells near and beneath the river. The observed reducing conditions are characterized by the presence of organic carbon, dissolved iron, dissolved manganese, and ammonia in groundwater samples. Under non-pumping conditions, as Cr(VI) migrates in groundwater from non-reducing conditions in the alluvial and deep fluvial sediments to reducing conditions near and beneath the river, it undergoes chemical reduction and reverts to Cr(III) which is immobilized in the sediments, as evidenced by its absence in groundwater samples collected from fluvial wells screened in reducing material. Stable isotope data from floodplain monitoring wells indicate that the decrease in Cr(VI) concentration does not occur by dilution, and laboratory testing of fluvial anaerobic core samples provides direct evidence of the reduction reaction. • The general absence of Cr(VI) in reducing groundwater, and the results of laboratory testing in fluvial core samples indicate that there is significant capacity in the fluvial deposits underlying the river to reduce and remove Cr(VI) from groundwater (CH2M HILL, 2008g). This process is a beneficial factor limiting Cr(VI) migration to the river under current conditions.

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					• Uncertainties remain regarding the extent to which reducing conditions in fluvial deposits provide a pervasive and permanent barrier to Cr(VI) contaminant migration to the river.
U.S. Department of the Interior	DOI-11 M	Sec. ES.6.1.2, Page ES-8	Previous statements have suggested that these metals were possibly present in the groundwater due to wear on the equipment. This may not be acceptable to eliminate them because the distribution doesn't match the Cr. These metals are not subject to the reducing conditions as the Cr (VI).	The text will be clarified to state that none of these metals form a distribution that suggests a source area or areas consistent with the historical disposal of wastewater at SWMU 1/AOC1 or SWMU 2.	The revised text should clearly explain the rationale for concluding that the distributions of these constituents are not consistent with a potential discharge from SMWU 1 / AOC 1 or AOC 2. DOI defers acceptance of the comment response pending receipt and review of the revised language in a track changes revision to the document. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-12 M	Sec. ES.6.1.3, Page ES-8	The lack of TPH in the ground water does not necessarily eliminate it as a COPC in soil. Eliminating TPH as a groundwater COPC is acceptable but not for soils.	The media covered by this RFI/RI Volume 2 Report include groundwater, surface water, pore water and river sediment. The conclusions the document draws are for these media only. No conclusions to COPCs in soil are drawn. The RFI/RI Volume 3 Report will discuss the soil dataset and evaluate potential COPCs in soil. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI accepts the comment response.
U.S. Department of the Interior	DOI-13 M	Sec. ES.6.1.5, Page ES-9	Section ES.6.1.3 stated that the components of TPH gasoline, etc. were not detected in the GW. Were these components the VOC and SVOC fractions? If so then this section conflicts with the section on TPH.	No, the phrase "TPH components" was meant to refer to the specific analyses for gasoline, diesel, and motor oil range TPH, and not to refer to the VOC and SVOC components of TPH. The text in Section ES.6.1.3 will be clarified	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Metropolitan Water District	MWD-1	ES.6.1.6 Hexavalent and Total Chromium, page ES-10	At the end of the first paragraph the possible causes for variability in the distribution of chromium are listed. Possible density driven transport at the source may have also contributed early on to the chromium distribution and should also be listed as a possible contributing factor. We recommend that density driven transport be mentioned as a contributing factor early on in the groundwater contamination.	The paragraph will be revised to state "Density-driven flow may have played a role in the early stages of plume development, when blowdown water discharged to Bat Cave Wash was more saline than in later years. Whatever effect this had was likely diminished by the homogenizing action of the original site water supply wells, which were located near where I-40 crosses Bat Cave Wash, and by the facility limiting the number of cooling water cycles, thus lowering the discharge salinity."	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-14 S	Sec. ES.6.1.6, 2nd paragraph, Pg. ES-10	Even though this is the executive summary, the discussion of the plume geometry would be easier to understand with a reference to a figure.	A reference will be added directing the reader to Figures 6-12 a-c.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Regional Water Quality Control Board	RWQCB-4	ES.6.1.6, p. ES-9, 2nd para., 3rd and 4th sentences	3rd and 4th sentences read as follows: "The calculated statistical UTL of natural background levels for Cr(VI) in groundwater, obtained from sampling monitor and water supply wells surrounding the Topock site, is 31.8 µg/L (CH2M HILL, 2008b). The calculated site UTL Cr(VI) concentration is not dissimilar to the 50 µg/L California maximum contaminant level (MCL) for Cr(T), which is the ARAR standard applicable for Cr(VI)." It is not clear what is meant by the statement that the calculated site UTL of 31.8 µg/L "is not dissimilar to" the 50 µg/L California MCL. In what	The text in the Executive Summary, and elsewhere in the RFI/RI Volume 2 Report, will be revised to indicate that 32 µg/L (the calculated site background UTL of 31.8 µg/L for Cr(VI) rounded to whole unit) will be used to delineate the chromium groundwater plume.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC also accepts the comment response.

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			way is it not dissimilar to the MCL? If the meaning is as stated in the following sentence, that "the natural background level of Cr(VI) and the chromium MCL are similar enough that plume delineation with either defines similar plume size and shape", then it might be helpful to clarify the meaning of that phrase as follows: "The calculated site UTL Cr(VI) concentration is similar to the 50 µg/L California maximum contaminant level (MCL) for Cr(T), which is the ARAR standard applicable for Cr(VI), in that the plume size and shape of both are similar enough that either may be used to delineate the chromium plume."		
U.S. Department of the Interior	DOI-15 M	Sec ES.6.1.7, Page ES-10	See the comment on Section 10.1.2.1, page 10-2, 2nd bullet and revise accordingly.	Any changes made in Section 10.1.2.1 will be reflected in the corresponding section in the Executive Summary.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Metropolitan Water District	MWD-2	ES.6.2 Fate and Transport of Chromium in Groundwater, page ES-11	The third paragraph indicates the movement of chromium by density-driven flow "is not a significant transport mechanism." Density driven flow can occur with minor percent differences in fluid densities, which may have existed initially between the blowdown waste and shallow groundwater at the time of discharge to Bat Cave Wash. RFI/RI discussion in the first paragraph on page 6-21 and section 6.7.1 include the possibility of this transport mechanism, which should be carried forward in other sections. As stated above, we recommend that density driven transport be mentioned as a contributing factor early on in the groundwater contamination.	The paragraph will be revised to state "It is noted that during the earlier years of the operation of the compressor station, the cooling towers were operated differently than in later years. During this initial period of operations, the water was kept in the cooling towers longer between blowdown cycles, resulting in higher salinity. During the initial period of discharge to Bat Cave Wash, this blowdown water likely had greater density than native groundwater. Density gradients may therefore have been a factor in moving the higher salinity water downward through the upper, fresher portion of the aquifer during the earlier years of compressor station operations. During this same time, the pumping of fully-penetrating water supply wells located several hundred feet down the wash would have tended to mix the saline water throughout the aquifer thickness. After the earlier years of compressor station operation, density-driven flow would not be expected to be a significant process for groundwater transport given the relatively small range of groundwater density in the Alluvial Aquifer at Topock."	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-16 S	Sec. ES.7.1, Page ES-12	See section specific comments on the topic of COPCs and determination of site-related contamination for non-Cr constituents and modify text accordingly.	See corresponding responses to specific comments on COPCs and determination of site-related contamination for non-Cr constituents. The text will be modified accordingly.	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to consider all analyzed constituents as COPCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes.

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Metropolitan Water District	MWD-3	ES.8 Pore Water Characterization, page ES-14	The last paragraph makes some very strong and absolute statements about the natural reducing capacity of the fluvial sediments. The extent of the reducing capacity throughout the fluvial area may not be consistent and therefore the total capacity cannot be ascertained with 100 percent certainty. The capacity of the reducing zone cannot be accurately quantified. Therefore, Metropolitan recommends that the word "ubiquitous" in the second sentence be deleted. We recommend that the last sentence starting with "Based on the results…" be reworded to reflect the limitations of the reducing zone.	The language will be changed to reflect the extent of conclusions that can be made on the basis of collected data. The words "ubiquitous" and "any Cr(VI)" will be replaced with more accurate language.	DOI believes the last paragraph of this section to be too speculative. DOI defers acceptance of the comment response pending receipt and review of the revised language in a track changes revision to the document. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-17 M	Sec. ES.10.1.2., Page ES-15	Based on statements earlier in the ES, this GW volume only addresses the potential impacts to GW from SWMU 1 and AOC 1 and not the potential impacts from the East Ravine, other AOCs or SWMUs, or the compressor station. This should be made clear in this section.	The text will be revised to clarify that this document addresses characterization requirements for past discharge of wastewater from the compressor station to Bat Cave Wash (SWMU 1/AOC 1) and injection well PGE-8 (SWMU 2).	DOI accepts the comment response and directs PG&E to carefully review and revise the document to limit conclusions about contaminant site-relation to relation to SWMU1/AOC1 and SWMU 2 only. PG&E cannot draw conclusions about possible relation of contaminants to other potential sources until investigation of those sources has been completed and reported in subsequent volumes or addenda.
U.S. Department of the Interior	DOI-18 M	Sec. ES.10.1.3, Page ES-15	See section specific comments on the topic of COPCs and determination of site-related contamination for non-Cr constituents and modify text accordingly.	See corresponding responses to specific comments on COPCs and determination of site-related contamination for non-Cr constituents. The text will be modified accordingly.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Metropolitan Water District	MWD-4	ES.10.2.2 SWMU 2, page ES-17	The fourth bullet of this section states "…reducing conditions within PGE-8 that would have resulted in any Cr(VI) remaining in the water discharged to PGE- 8 after treatment at the compressor station …would have been removed from groundwater". There is no discussion or data presented in the report on the reducing conditions and environment in the bedrock. We recommend a discussion and some data be presented in a pertinent section of this report to show the reducing environment in the bedrock wells.	In response to this comment, additional discussion will be added to Section 5.3 discussing the reducing conditions in the bedrock aquifer.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response with the caveat that PG&E refrain from drawing broad conclusions about bedrock aquifer conditions based on the very limited bedrock data set available. DTSC awaits the actual revised language so that it can be reviewed and approved.
Section 1					
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-4	Sec 1.0	It is stated that PG&E is conducting investigative and remedial activities. It would be helpful to clarify the type of remedial activities that are being conducted and are associated with this RFI/RI Report. It should be clarified if these remedial activities are in the form of physical soil or groundwater remedial activities or studies that will support future remedial actions. It should be clear to readers that Interim Measures (IM) are not considered remedial activities.	There are no remedial activities associated with this RFI/RI Report. The first sentence in the report is intended to be a general introduction to PG&E's activities at the site. PG&E has performed remedial activities in the past (see RFI/RI Volume 1), is currently implementing interim remedial measures (see section 1.2.2 of the RFI/RI Report), and is planning future remedial activities. The objectives of the RFI/RI are outlined in Section 1.3 of the RFI/RI Volume 2 report; it is not the purpose of this document to outline future remedial activities. However, a sentence will be added to Section 1.2.2 to clarify that Interim Measures are not considered final remedial activities.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC accepts the comment response.
Department of Toxic Substances Control	DTSC-3	Sec. 1, Page 1-4, Section 1.2.1 - RCRA Facility Investigation/Re	For completeness, it is recommended that the description of the RFI/RI Volumes include a brief description of addendums already planned for	In response to this comment, the following sentence will be added to the first bullet in Section 1.2.1: "An addendum to the RFI/RI Volume 1 is planned that will include additional site background and history	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

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		medial Investigation, Bullets	certain volumes.	information for additional SWMUs and AOCs that may be identified due to ongoing operations of the Topock Compressor Station and remedial facilities, including the current interim measure treatment plant location, and the MW-20 and MW-24 bench." In response to this comment, the following sentence will be added to the second bullet in Section 1.2.1: "An addendum to the RFI/RI Volume 2 is planned for submission in early 2009. This addendum will include select data and information collected between October 2007 and September 2008, after the data cutoff period for RFI/RI Volume 2."	DTSC concurs with the proposed language, but also requests that the MW-24 Bench also be included in the RFI/RI Volume 1 Addendum (see insert). Additionally, the section should indicate that Volume 1 and the Addendum will only identify currently known SWMUs and AOCs. PG&E will need to continue to document any new units identified in the future and promptly notify agencies of any new discoveries.
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-5	Sec 1.1	It is stated that the PG&E property on which the compressor station was built was owned by the State of California and from 1950 to 1965, PG&E leased the property from the State. Since the State was an owner of the property and leased the property when PG&E discharged wastewater containing Cr(VI) to the surface of Bat Cave Wash (SWMU 1/AOC 1) and allowed the contamination to penetrate the soil column and migrate to the water table, we would like to know if the State is, or could be considered, a responsible party under RCRA or CERCLA.	No response provided as directed by DTSC in their October 21, 2008 letter to PG&E.	
Metropolitan Water District	MWD-5	1.1 Site Location and Description, page 1-2	The second sentence states the Topock Compressor Station is located 12 miles southeast of Needles, whereas, it states 15 miles in section ES.1. Which is correct?	In response to this comment, the first sentence in Section 1.1 will be revised to state that the Topock Compressor Station is located about 15 miles southeast of Needles, California.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC accepts the comment response.

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Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-1	Sec. 1.1.3	The Tribe requests that the first paragraph in this section be replaced with the following text which more closely reflects the relationship of the land with the tribal cultural and spiritual values. "The compressor station is located on a sparsely-populated, rural area, comprising a series of benches and terraces overlooking the Colorado River floodplain. The land surrounding and including the compressor station, including the benches and terraces on both sides of the river, the floodplain, the river itself, and the surrounding hills and mountains, comprises a cultural landscape that figures importantly in the traditional spiritual and cultural life of the Aha Makav or Fort Mojave Indian Tribe. One important component of this landscape, known as the Topock Maze, directly surrounds and includes the compressor station. The maze is a complex of windows raked in the desert pavement, running in several directions for many tens of meters. Although portions of this site have been disturbed by construction and unsympathetic land use (as have some other parts of the cultural landscape surrounding and including it), the Maze and its surroundings continue to play significant roles in the lives and cultural beliefs of the Fort Mojave Indian Tribe and other tribes along the Colorado River. The Fort Mojave Indian Tribe has expressed the opinion that whatever happens in the overall cultural landscape is of concern to the Tribe, which wishes to be consulted about all activities planned or proposed in the area."	No response provided as directed by DTSC in their October 21, 2008 letter to PG&E. As stated in the letter: "DTSC believes the statements currently in the Report reflect the importance of the area to all tribes. Additional clarifications and cultural significances of the area by specific Native American Tribes should be a topic of documentation for the up coming Environmental Impact Report."	
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-6	Sec. 1.1.3, First Paragraph	It would be helpful to have further clarification and determine PG&E's basis for these statements including the source of information and the referenced documents that support these statements.	No changes to the RFI/RI Volume 2 are proposed in response to this comment. As stated in DTSC's letter dated October 21, 2008, DTSC believes that the statements in this section reflect the importance of the area to all tribes, and additional clarifications of cultural significance of the area by specific Native American tribes should be a topic of documentation for the upcoming Environmental Impact Report.	DOI understands that further communication is expected from the tribes on this issue. DTSC: DTSC agrees that discussion regarding cultural significance of the project area can be further clarified in the upcoming EIR. The purpose of the RFI, is to identify the nature and extent of site contamination. DTSC does not want to delay the finalization of the RFI document by further refining this language.
U.S. Department of the Interior	DOI-19 M	Sec 1.2.1, Page 1-4, 2nd bullet,	This document does not address all potential releases to groundwater from the Topock Compressor Station and does not necessarily complete the RFI/RI requirements for groundwater. The second sentence of the paragraph should be deleted and reference should be made to the upcoming East Ravine groundwater investigations.	In response to this comment, the second sentence in the second bullet in Section 1.2.1 will be deleted. In addition, the following sentence will be added to the second bullet in Section 1.2.1: "The purpose of this document is to complete the RFI/RI requirements for groundwater impacts associated with the past discharge of wastewater from the compressor station." Reference to the East Ravine groundwater investigation will not be included in Section 1.2.1, but is documented elsewhere in RFI/RI Volume 2. Section 1.2.1 is a general overview of the status of the RFI/RI and is not intended to provide status of individual investigations. As stated in Section 4.2, there are several groundwater investigations planned for	The proposed revision is not acceptable. Revise the 2nd bullet of Section 1.2.1 as follows: "This document contains the hydrogeologic characterization and results of groundwater and surface water investigations to address past historical releases to groundwater from wastewater discharged at Bat Cave Wash and injection well PGE-8 at the Topock Compressor Station. The purpose of this document is to complete the RFI/RI requirements for groundwater impacts associated with the past discharge of wastewater from SWMU 1/AOC 1 and SWMU 2. "

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				implementation after October 2007 and the groundwater and surface water monitoring programs will continue after 2007. The additional groundwater and surface water data to be collected after October 2007 will be reported in an addendum to the RFI/RI Volume 2, RFI/RI Volume 3, data summary reports or monitoring reports, as appropriate.	
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-7	Sec 1.2.2	It is stated, as defined by DTSC, the performance standard for the IM No. 3 facility is to establish and maintain a net landward hydraulic gradient, both horizontally and vertically, that ensures the Cr(VI) concentrations at or greater than 20 ug/L in the floodplain are contained for removal and treatment. It would be useful to state if this required performance measure has been achieved during all reporting periods.	In response to this comment, text will be added to the second paragraph in Section 1.2.2 stating the following: “The Interim Measures Performance Monitoring Program is a separate and unique monitoring program to evaluate the performance of the Interim Measure to achieve the performance standard. The results of the Interim Measures performance Monitoring Program are published in routine monitoring reports. The performance standard has been achieved for all monitoring periods since the current standard was established in February 2005.”	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC directs PG&E to incorporate this discussion in the text rather than as a footnote.
U.S. Department of the Interior	DOI-20 M	Section 1.2.3, page 1-6, 9th bullet	Revise or remove this bullet to reflect PG&E’s current intention to use the existing groundwater flow model (without reconfiguration and recalibration) to support CMS/FS analysis	In response to this comment, the 9th bullet in Section 1.2.3 will be revised to add the following: “For purposes of the CMS/FS, PG&E plans to use the most recent fully-calibrated model (the “5-layer model”) originally documented in the *Groundwater Model Update Report, Topock Compressor Station, Needles California,* prepared by CH2M HILL for PG&E, dated July 2005. The model had been calibrated against observed data through early 2005. Further refinements have been made to the model to reflect data collected between 2005 and 2008.”	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the proposed language, but alerts PG&E to Comment DTSC-6.
U.S. Department of the Interior	DOI-21 M	Sec. 1.4, Page 1-8, 2nd Paragraph., last sentence	The text states that additional requirements pertaining to a CERCLA RI report, if not adequately addressed, will be addressed in future documents. It should be recognized that there are certain CERCLA requirements that drive the acceptability of the RI other than the risk assessment being conducted independently. Requirements of a CERCLA RI report that are not being addressed by this RFI/RI report must be identified, along with how those requirements will be addressed in the future before this document can be deemed acceptable.	Other than the risk characterization, there are no other requirements of the CERCLA RI that are not addressed in RFI/RI Volume 2 for characterization of contamination associated with the past discharge of wastewater from the compressor station to Bat Cave Wash and injection well PGE-8. In response to this comment the last sentence in the second paragraph in Section 1.4 will be removed.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Section 2					
Department of Toxic Substances Control	DTSC-4	Sec. 2, Page 2-1, Section 2.0 -Summary of Wastewater Discharge Activities Associated with Groundwater Contaminants, Paragraph 4	The section indicates that there are no other Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) associated with the historical discharge of wastewater from the Topock facility. The section should mention that assessment of groundwater from potential sources within the facility fence line has been planned as part of the Part B Soils Investigation Workplan. Additionally, groundwater assessment planned for the East Ravine, where fluids of unknown composition were impounded in the 1960s, should also be	In response to this comment, the text will be added to the fourth paragraph of Section 2.0 of the RFI/RI Volume 2 Report: A groundwater investigation at the East Ravine is planned for late 2008 or early 2009, as described in the *Revised Work Plan for the East Ravine Groundwater Investigation near the Pacific Gas and Electric Company (PG&E) Topock Compressor Station* dated July 11, 2008. Results of the East Ravine groundwater investigation will be provided in an investigation summary report and/or RFI/RI Volume 3. In addition,	DOI directs PG&E to remove the first sentence of Paragraph 4 of Section 2 as being unnecessary and possibly incorrect depending on the outcome of additional studies. Also, discussion of the details of the East Ravine field program, as proposed in the response, are not necessary. Include the following discussion of the East Ravine study and Volume 3: “A groundwater investigation at the East Ravine is planned for late 2008 or early 2009, as described in the

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			acknowledged.	assessment of groundwater impacts from potential sources within the Topock Compressor Station is planned. Results of the groundwater investigation within the Topock Compressor Station will be provided in an investigation summary report and/or RFI/RI Volume 3.	*Revised Work Plan for the East Ravine Groundwater Investigation near the Pacific Gas and Electric Company (PG&E) Topock Compressor Station* dated July 11, 2008. Results of the East Ravine groundwater investigation will be provided in an investigation summary report and/or RFI/RI Volume 3. In addition, assessment of groundwater from potential sources within the Topock Compressor Station is planned. Results of the groundwater investigation within the Topock Compressor Station will be provided in an investigation summary report and/or RFI/RI Volume 3. DTSC concurs with DOI's direction above. Revised language should be inserted into the Report as text, not as a footnote.
U.S. Department of the Interior	DOI-22 M	Sec 2.0, Page 2-1, 1st sentence.	This statement is incorrect. Additional AOCs have been identified in the East Ravine since preparation of Volume 1. Revise this statement to "...based on the historical information available at that time." And add this sentence, "Since then, AOCs in the East Ravine have been identified based on additional site historical information."	The East Ravine (AOC 10) is identified in the *Revised Final RCRA Facility Investigation/Remedial Investigation, Volume 1 - Site Background and History,* dated August 2007, approved by DTSC and DOI. No additional AOCs have been identified in the East Ravine. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI accepts the comment response.
U.S. Department of the Interior	DOI-23 M	Sec 2.0, Page 2-1, last sentence.	Add a paragraph describing the impending East Ravine groundwater investigations explaining how those investigations will be conducted and documented separately from this RFI/RI and providing justification for this.	The following footnote is proposed to be added to the first sentence in the fourth paragraph of Section 2.0: "A groundwater investigation at the East Ravine is planned for late 2008 or early 2009, as described in the Revised Work Plan for the East Ravine Groundwater Investigation near the Pacific Gas and Electric Company (PG&E) Topock Compressor Station dated July 11, 2008. Results of the East Ravine groundwater investigation will be provided in an investigation summary report and/or RFI/RI Volume 3. In addition, assessment of groundwater impacts from potential sources within the Topock Compressor Station is planned. Results of the groundwater investigation within the Topock Compressor Station will be provided in an investigation summary report and/or RFI/RI Volume 3."	As discussed above for comment DTSC-4, include the following discussion of the East Ravine study and Volume 3: "A groundwater investigation at the East Ravine is planned for late 2008 or early 2009, as described in the *Revised Work Plan for the East Ravine Groundwater Investigation near the Pacific Gas and Electric Company (PG&E) Topock Compressor Station* dated July 11, 2008. Results of the East Ravine groundwater investigation will be provided in an investigation summary report and/or RFI/RI Volume 3. In addition, assessment of groundwater from potential sources within the Topock Compressor Station is planned. Results of the groundwater investigation within the Topock Compressor Station will be provided in an investigation summary report and/or RFI/RI Volume 3.
U.S. Department of the Interior	DOI-24 M	Sec 2.1.2, Page 2-3, 2nd sentence	The extent of AOC-1 will be determined based on the results of soil and groundwater investigations. The historical photographs used for the preliminary AOC-1 delineation presented in Volume 1 and on Figure 2-1 may not have captured the full downstream extent of the discharge. While it may be appropriate to state that the historical photographs reviewed for Volume 1 do not show wastewater to have migrated beyond the railroad tracks, this is not a definitive basis on which to conclude the AOC does not extend beyond the railroad tracks.	PG&E agrees that the extent of AOC -1 is based on the results of soil and groundwater investigations. Sampling locations have been determined based on multiple lines of evidence, including historical information, site physical characteristics, and results of multiple investigations that build on previous data collection. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI does not agree with the response and directs PG&E to revise Section 2.1.2 to read: "The aerial extent of AOC 1 has not been formally delineated; however, by definition, it is considered to consist of the floor of Bat Cave Wash in the area surrounding the location of the discharge area (SWMU 1). It also includes the downstream floor of Bat Cave Wash affected by discharge from SWMU 1. Portions of AOC 1 are located on PG&E property, and portions are located on property owned by the HNWR." The actual extent of AOC-1 will be determined based on the results of soil and groundwater investigations. DTSC concurs with DOI's direction above.
Metropolitan Water District	MWD-6	2.1.3 Constituents of Potential	In the top paragraph there are two sentences that mention "effluent". The effluent pertains to the OWS effluent. The sentences should be changed to: "An	In response to this comment, fourth and fifth sentences in the fourth paragraph of Section 2.1.4 will be changed to: "An OWS effluent sample collected in November	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

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		Concern – SWMU 1/AOC 1, page 2-4	OWS effluent sample collected in November 1986 …" and "The OWS effluent may also …"	1986 …" and "The OWS effluent may also …".	DTSC accepts the comment response.
Section 3					
U.S. Department of the Interior	DOI-25 E	Sec. 3.3.1, Page 3-2, 1st paragraph, 1st sentence.	The word "in" seems to be missing from this sentence between "are the".	The text will be corrected to add in the missing "in".	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-5	Sec. 3, Page 3-7, Section 3.4.1.2 - Tertiary Alluvium Units, Paragraph 1	Reference to Figure 3-1 is incorrect and should be changed to either Figure 3-7 and/or Table 3-1.	The text will be corrected to reference Table 3-1.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the proposed change.
U.S. Department of the Interior	DOI-26 M	Sec 3.5.1.1, Page 3-10	This section discusses the impact of the Hoover Dam and Parker Dam on the Morphology of the Colorado River adjacent to the site. But in Section 3.5.1.3 it is stated that the Davis Dam is the primary influence on the flow of the river at the site. Specify when the Davis Dam was constructed and how its construction impacted the morphology of the river at the Topock Site. Also describe how much of the fluctuations discussed in this section are controlled by the Davis Dam.	PG&E is not aware of any studies done to evaluate the influence of Davis Dam on channel morphology at the Topock site. Text will be added to Section 3.5.1.1 noting the date that Davis Dam was built. The relative influence of Davis Dam release on groundwater levels at Topock will be briefly discussed in Section 3.5.1.3.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-6	Page 3-12, Section 3.6 - Hydrologic Budget, Paragraph 4	The last sentence on the page indicates that the current model will be recalibrated beginning in mid-2008, yet this has not happened. This section, as well as other sections discussing model calibration (e.g., Sections 1.2.3, 3.6.1, 3.6.2, 3.6.4, 4.2.7, 5.1.4.1, 5.1.4.2, and 5.1.4.3) should be revised to indicate what is currently proposed regarding model recalibration. The model used will need to be evaluated by DTSC and other stakeholders.	The text and figures will be changed to reflect the fact that the previously calibrated 5-layer model will be used for the CMS/FS, based on DTSC's suggestion. The model discussion will be presented in Section 4.2.7. Discussion of the 10-layer model development and schedule will be deleted.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: Also include discussion on when the 10-layer model will be evaluated for inclusion in the project rather than dismissing it entirely in the Report. Indicate what is currently proposed regarding model recalibration. Within the Report, PG&E should document its endorsement of the 5-layer model and merits and limitations the model poses. If not endorsed by PG&E, then the 10-layer model, or other model, should be utilized.
U.S. Department of the Interior	DOI-27 M	Sec 3.6, Page 3-12, last two sentences	Based on recent communications by PG&E, re-calibration of the groundwater flow model is being postponed beyond 2008 and may not occur because PG&E judges it unnecessary to support the CMS/FS comparative evaluations. Remove the next to last sentence. Revise the last sentence to read: "Table 3-2 summarizes the values assigned for the water budget components."	Now that the existing 5-layer model will be used in the CMS, the text and figures will be changed to describe this version of the model.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-2	Sec 3.6.2	This section discusses the approach to calculating pre-IM discharge to the Colorado River and an estimate provided in Table 3.2. It would be useful to have an estimate of the amount/rate of groundwater discharge that would enter the Colorado River along the reach where the projection of the hexavalent chromium plume exists (please refer to Figure 5-21, which shows the "approximate limit of	As a surrogate for estimating the average groundwater discharge in the plume area over time, PG&E proposes to calculate the resulting concentration in the river if the entire mass of Cr(VI) in the plume were mixed with the volume of water flowing down the river over 40 years, the approximate period of time the plume took to grow to its present size. Because it takes many times longer to flush contaminants from an aquifer than it does for	DOI accepts the comment response and directs PG&E to conduct the proposed analysis and revise the document as indicated in the response. DTSC will allow PG&E to proceed with this calculation; however, DTSC believes that the contaminant should be kept away from the Colorado River.

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			reducing groundwater"). The Tribe understands that this rate has been previously calculated and was used to determine the groundwater extraction rate for the IM. However, this calculation should be revisited and reported in the current document either here or perhaps in Chapter 6.	contaminants to be distributed, this would represent a hypothetical worst case for average Cr(VI) concentrations in the river if the reducing zone were not present, and the plume was ever able to reach the river. This discussion will be presented in Section 6.6.	As directed by DTSC in an January 29th e-mail, PG&E will not include the a hypothetical scenario in the Volume 2 Report as originally stated in the response to the comment.
Department of Toxic Substances Control	DTSC-7	Pages 3-14 and 15, Sections 3.6.3.1 - Historical and Current Injection in Wells and 3.6.3.2 - Historical and Current Groundwater Extraction from Wells	The sections indicate that historical groundwater injection and extraction will be discussed, but the sections only addresses current / recent usage. Additionally, the current and historical volume of groundwater extracted from the nearby Smith and Sanders wells should be documented in the section to provide the reader with some idea of the volume of groundwater extracted from the closest neighboring private water wells. Revision of the section is requested.	The section will be revised to report available pumping records.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-28 S	Sec. 3.6.4, Page 3-15	There is a strong use of vague terms like "vast majority"," minor amounts", "modest recharge." These terms are difficult to define and add to the uncertainty of the discussion. Where possible, efforts should be made to quantify these components.	Where possible, the text will be revised to quantify these terms.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Metropolitan Water District	MWD-7	3.6.4 Summary, page 3-16	The second bullet states: "The vast majority of discharge in the area is directed to the Colorado River, with most discharge occurring upstream of the Topock site." Is this true that most of the groundwater discharges to the river upstream of the site? Later in the document it states that the groundwater basin in the Topock area is a losing stream and exhibits a net discharge to the river. We recommend some additional description of the groundwater hydrology of the Mohave Valley in Section 3.0 to better describe the hydrologic budget in the valley.	The statement referred to the majority of groundwater discharging from the Mohave Valley Basin, not from the Topock site. Some groundwater is believed to have discharged to the river under natural (pre-IM3 pumping) conditions in the vicinity of the site, but the Topock area represents only a small portion of Mohave Valley groundwater. The text will be revised to clarify this discussion.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-29 M	Section 3.6.4, Page 3-16, last sentence	Based on recent communications by PG&E, re-calibration of the groundwater flow model is being postponed beyond 2008 because PG&E judges it unnecessary to support the CMS/FS comparative evaluations. Clarify the discussion of model recalibration to reflect this planned postponement.	In response to this comment, the text will be modified to reflect the planned use of the existing 5-layer model in the CMS/FS.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: See DTSC-6
U.S. Department of the Interior	DOI-30 E	Figure 3-2	The southern boundary of the APE extends off the aerial photograph in this figure. Please modify the figure.	Figure 3-2 will be revised to show the southern boundary of the APE on the figure.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Section 4					
U.S. Department of the Interior	DOI-31 M	Sec 4.1.1, Page 4-1. and fig 4-1.	This section is entitled "Summary of RFI/RI Hydrogeologic Investigations." It would, therefore be appropriate to revise this section and the related figure for consistency and to remove soil and air related activities from Figure 4-1.	In response to this comment, Figure 4-1 will be revised to remove references to soil and air data collected during RFI Phases 1, 2, 3, and 4.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of	DOI-32	Sec. 4.1.1.5,	For clarity, reference a figure showing the locations	In response to this comment, the following sentence is	DOI accepts the comment response and directs PG&E

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the Interior	S	Page 4-2	of the specified wells.	proposed to be added to Section 4.1.1: "Figure 4-2 shows the locations of the RFI/RI wells and drilling locations and additional PG&E monitoring and supply wells that provided data for the RFI/RI."	to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-33 M	Section 4.2.7, Page 4-8	Cite references for detailed technical documentation of the groundwater flow model.	In response to this comment, the text will be revised to reference the existing 5-layer model, as documented in the *Groundwater Model Update Report, Topock Compressor Station, Needles, California,* dated July 2005.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-34 M	Sec. 4.2.7, page 4-8, 2nd paragraph. Last two sentences.	The correlation between the nine model layers and hydrostratigraphic units (HSUs) described in Section 3.4 is not clear. Text or a figure should be provided to describe the relationship.	Now that the existing 5-layer model will be used in the CMS, the text and figures will be changed to describe this version of the model.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: See DTSC-6 above.
Department of Toxic Substances Control	DTSC-8	Sec. 4, Page 4-8, Section 4.2.7 - Groundwater Flow Modeling, Paragraph 5	The paragraph discusses model grid spacing becoming finer-spaced in steps of 100-, 50-, 30-, and finally to a 7-foot spacing. Figure 4-9 is referenced in this paragraph, yet some of the grid spacings pictured in the figure (i.e., 20 and 60 feet) do not correlate with those cited in the text. The text and/or figure should be revised to correct or clarify this issue.	The figure will be revised to reflect grid spacing in the existing 5-layer model.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E's proposed change.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-3	Sec 4.2.7	The last sentence of this section commits to the process of continuing model calibration as new data becomes available. The Tribe understands that at some point a model revision will be reported. Where does this model report fit in with the overall decision document schedule for the RCRA/CERCLA document? Specifically, the Tribe requests that a schedule for all pending studies that are determined to be needed for the FS and risk assessment be developed.	The text and figures will be changed to reflect the fact that the previously calibrated 5-layer model will be used for the CMS/FS, based on DTSC's suggestion. Discussion of the 10-layer model development and schedule will be deleted.	DOI has concurred with PG&E's intent to use the 5-layer model for comparative analyses in the CMS/FS with the caveat that PG&E demonstrate in the CMS/FS report that the 5-layer model is a suitable tool for CMS/FS evaluations. DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the proposed language, but alerts PG&E to Comment DTSC-6.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-4	Sec 4.3	This section refers to other investigations and studies that report on data applicable to the hydrogeology scope of the RFI/RI. The ISPT studies are referred to, but not the investigations on the Arizona shore or the anaerobic core testing. While it is understood that the omission of these two studies was probably based on the October 2007 data cutoff, which would overlap some of the ISPTs, the applicability of these other investigations, which were well known before the cutoff, should at least be mentioned.	In response to this comment, the following paragraphs are proposed to be added to Section 4.3: "Several phases of laboratory testing of cores collected from fluvial sediments near and beneath the Colorado river have been performed to evaluate various properties including the ability of the core materials to reduce Cr(VI) to Cr(III). The first phase of anaerobic core testing was performed on samples collected from floodplain wells in 2004 and was reported in the Summary of Results - Anaerobic Core Hexavalent Chromium Uptake Capacity at the PG&E Topock Compressor Station, Needles, California (CH2M HILL 2005c). The second phase of anaerobic core testing was performed on samples collected in February 2007 from slant well clusters drilled on the western edge of the Colorado River and reported in the Phase II Anaerobic Core Testing Summary Report, PG&E Topock Compressor Station, Needles, California (CH2M HILL 2008z). Because of the unique testing	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC accepts the comment response.

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				program, the laboratory data collected during the core testing program is not repeated in this RFI/RI. A hydrogeologic investigation was performed near the shore of the Colorado River in Arizona in March and April 2008. The purpose of the investigation was to supplement the site conceptual model, to complete the groundwater characterization of the potential eastern extent of the groundwater plume, and further characterize the hydrogeologic conditions beneath the river channel downstream of the chromium plume observed in the California floodplain. The results of the investigation are documented in the Installation Report for Wells on the Arizona Shore of the Colorado River at Topock Arizona, dated August 12, 2008 (CH2M HILL 2008xyz). Hydrogeologic and water quality data collected during this investigation will be reported in the RFI/RI Volume 2 Addendum Report."	
Department of Toxic Substances Control	DTSC-9	Page 4-9, Section 4.3 - Related Site Investigation and Studies, Paragraph 4, Last line	Reference to Table 4-3 appears incorrect and should be changed or clarified.	In response to this comment, the reference to Table 4-3 in the second and third paragraphs of Section 4.3 will be changed to Table 4-4 (Sampling Record for Groundwater Monitoring Locations).	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E's proposed change.
U.S. Department of the Interior	DOI-35 S	Sec. 4.4.2, Page 4-11	This section discusses the studies conducted by other agencies and that the data were not included in the Topock data set. If these studies were used in the RFI/RI planning or requirements for sampling under the Topock program, this should be identified.	In response to this comment, the second sentence in the first paragraph in Section 4.4.2 will be modified as follows: "Studies and data conducted within the study area by others were reviewed and referenced in this report, and considered during the planning of field activities; however, the data collected by others are not presented in this report as part of the RFI/RI data set." MWD has verbally indicated that additional data have been collected within the Colorado River near Topock that were not included in MWD's letter to PG&E dated August 6, 2007. As a result, PG&E proposes to obtain the additional, unpublished data directly from MWD and add an appendix to RFI/RI Volume 2 that will include the unpublished data collected by MWD.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-5	Sec 4.4.2	The second paragraph contains a discussion of pore water samples collected in the Colorado River. Could the low detections by both MWD and PG&E be considered background (i.e. were any detected upstream from the Site groundwater plume interface with the River)?	No changes to the RFI/RI Volume 2 are proposed in response to this comment. As stated in Section 4.4.2, sample results for Cr(T) and Cr(VI) from the MWD sampling were similar to sampling by PG&E, with most results less than analytical detection limits, and a few low detections both upstream and downstream of the Topock site. Sample results for surface water and pore water collected by PG&E both upstream and downstream of the Topock site are presented in Sections 7 and 8, and show no discernable difference in Cr(T) and Cr(VI) concentrations upstream vs. downstream of the site, and therefore the low detections by both MWD and PG&E are interpreted to be background concentrations in the River.	DOI accepts the comment response. DTSC accepts the comment response.
Department of	DTSC-10	Page 4-11,	The paragraph discusses the Arizona groundwater	In response to this comment, the second sentence in	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the

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Toxic Substances Control		Section 4.4.2 - Studies by Others, Paragraph 5, Line 6	study and refers to a chromium Maximum Contaminant Level (MCL). For clarity, the numerical value for the MCL should be cited since the California MCL for chromium differs from the MCL utilized in Arizona.	the second paragraph of Section 4.4.2 will be revised to state: "The study found that low levels of chromium were detected throughout the study area; however, the chromium concentrations did not exceed the Arizona MCL (100 ug/L), and chromium concentrations in wells nearest the PG&E Topock site were similar to those more distant from the site."	changes to the document as indicated in its response. DTSC concurs with PG&E's proposed change.
Department of Toxic Substances Control	DTSC-11	Page 4-12, Section 4.4.2 - Studies by Others, Paragraph 3, Line 6	For completeness, the paragraph should discuss DTSC split samples collected from well MW-23 on June 27, 2007.	In response to this comment, the following paragraph is proposed to be added to Section 4.4.2: "In June 27, 2007, DTSC collected split samples during a multiple step sampling program to evaluate chromium concentrations in MW-23. Because the split samples were collected outside the RFI/RI analytical and data review program, these data have not been compiled or included in this RFI/RI report."	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E's proposed change.
U.S. Department of the Interior	DOI-36 M	Section 4 figures	For clarity, include the APE outline on each of the map figures.	In response to this comment, the APE outline will be added to Figures 4-2, 4-4, 4-7, and 4-8.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Section 5					
Metropolitan Water District	MWD-8	5.1.1 Hydrogeologic Information, page 5-2	The last bullet lists the USGS seismic survey from 2004. USGS conducted a seismic survey in 2007 (as presented at the TWG meeting on October 16, 2007). We recommend a brief discussion on why the 2007 survey results were not used.	The 2007 USGS seismic survey results were not included in the RFI/RI report because USGS budget constraints and the schedule for the installation of wells in Arizona precluded the USGS's timely completion of processing and analysis of the data. A final report, with completed geophysical interpretation displays, was not available to PG&E for the RFI/RI Report. The USGS subsequently revised the interpretation of the seismic survey based on data obtained from the Arizona drilling program. This revised interpretation is consistent with PG&E's current conceptual model. The revised seismic profiles provided by the USGS will be included in the Addendum to RFI/RI Volume 2 Report. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI directs PG&E to add a footnote stating: "The results of USGS seismic surveys conducted in 2007 were not available in time for inclusion in Volume 2 of the RFI/RI. The unpublished seismic profiles from the 2007 surveys, which are similar to the 2004 results, will be included in the Addendum to RFI/RI Volume 2 Report." DTSC: DTSC concurs with DOI's direction above.
Metropolitan Water District	MWD-10	5.1.2 Hydrogeologic Cross Sections	Figure 5-1 Location of Hydrogeologic Sections does not show the Cross Section designated C-C'.	Cross-section C-C' will be labeled on Figure 5-1.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E's proposed change.
Department of Toxic Substances Control	DTSC-12	Sec. 5, Page 5-4, Section 5.1.3.1 - Top Miocene Bedrock Structure Map, Line 4	The GSU understood that a gravity survey had also been used to control bedrock contours in Figure 5-9. Clarification is requested.	A USGS gravity map for the regional southern Mojave groundwater basin was reviewed to constrain the approximate (order-of-magnitude) depth to bedrock for groundwater modeling purposes. The interpreted bedrock structure depicted on Figure 5-9 is consistent with the regional basin-wide gravity data, but gravity data was not specifically used for this display. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	Pending DTSC concurrence, DOI accepts the comment response. DTSC appreciates PG&E's clarification of this issue and concurs that no associated changes are needed in the Report.
Metropolitan Water District	MWD-9	5.1.3.1 Top Miocene Bedrock Structure Map, page 5-4	It states "The interpreted bedrock elevation map (Figure 5-9) was prepared using date from the RFI/RI and ISPT drilling investigations and the 1962 Caltrans' Topock I-40 bridge exploratory borings…" As stated above, we recommend a brief discussion	The text will be revised to clarify that a 2007 seismic survey was performed but not completed in time for use in this report (as discussed in response to MWD-8 comment above).	As discussed for comment MWD-8 above, DOI directs PG&E to add a footnote stating: "The results of USGS seismic surveys conducted in 2007 were not available in time for inclusion in Volume 2 of the RFI/RI. The unpublished seismic profiles from

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			on why the 2007 survey results were not used.		the 2007 surveys will be included in the Addendum to RFI/RI Volume 2 Report.” DTSC: DTSC concurs with DOI’s direction above.
U.S. Department of the Interior	DOI-37 M	Section 5.1.4.1, page 5-6, 2nd paragraph, last sentence	The sentence implies that the model results are used to adjust calculated estimates of aquifer hydraulic properties that are based on measured data. Clarify the process being used and confirm that the results of field measurements are not adjusted to fit the model, but rather the model hydraulic properties values are adjusted during calibration within constraints imposed by the measured values.	The text will be revise to clarify that aquifer parameters derived from analysis of aquifer test data are only estimates, and those estimates are fine-tuned once in the model, as the model provides a more realistic simulation of complex groundwater flow conditions than the simple analytical equations used in conventional aquifer test analysis. Directly measured data are not altered (i.e., drawdown, water level fluctuations, etc.)	Measured data are properly used to constrain the model during calibration within reasonable error boundaries for the measured data. Extreme caution should be used when overriding measured data in favor of modeling assumptions and results during calibration. DOI cautions PG&E about conclusions that the model is more “realistic”. A model constitutes a conceptual and mathematical hypothesis of groundwater flow conditions. While the model provides a flexible and powerful tool for evaluating groundwater flow, it is only “realistic” to the extent that it is consistent with site data and observations at a level needed to meet project objectives. DOI understands that PG&E considers the current 5-layer model to be consistent with measured data and to provide reasonable flow fields for the Topock site groundwater system at a level needed to support project RFI/RI and CMS/FS decision making.
U.S. Department of the Interior	DOI-38 S	Sec. 5.1.4.2 Bedrock Units 1st Paragraph.	The yield of the bedrock units is reported as very little to moderate. These terms should be quantified.	In response to this comment, text will be added to describe observed well purging data and quantify the yield of the bedrock for wells where data are available to do so.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-39 S	Sec 5.1.4.2	This section describes the hydraulic testing that was completed on various wells within the study area. Provide a summary within Sec 5.1.4.2 that identifies the estimates considered most representative of the hydraulic properties of the HSUs.	Although all HSUs are believed to vary significantly in hydraulic properties, the existing Table 5-2 provides the estimated hydraulic parameters of the aquifer based on observation well data collected during aquifer tests.	DOI’s comment was intended to request that PG&E provide some context to the hydraulic testing results in terms of representative site conditions. From that perspective, any table or text added should aid the reader in understanding which testing results are considered by PG&E to be most representative of the large scale hydraulic properties of the aquifer DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-40	Sec. 5.2.1, Page 5-11	The hydraulic gradient suggests that the movement of water is relatively slow. Describe how the calculated rate of 45 ft/yr corresponds with the location of the center of the plume, assuming that the infiltration beds in Bat Cave Wash were the source.	The calculated average groundwater velocity stated in this section is based on present-day groundwater gradients and is not considered appropriate for projecting the location of the plume. During the years when the discharge occurred in Bat Cave Wash, the plume was moving under much steeper gradients due to the effects of the infiltration in Bat Cave Wash and the pumping from former production wells. A discussion of the evolution of the plume is presented in Section 6.6. A sentence will be added to this section referring the reader to Section 6.6.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response with the caveat that the evolution of the hydraulic gradient should also be addressed in Section 6.6.
Metropolitan Water District	MWD-11	5.2.1 Horizontal Gradients in Alluvial Aquifer, page 5-11	The fourth paragraph provides an estimate of the average groundwater velocity as about 45 feet/year. Because of the variability in the inputs to this estimate, the velocity would be better stated as a range. For example, estimating that the chromium	A range of gradients will be provided based on model distributions under ambient conditions. The 75 ft/yr average stated in the comment includes the artificial “boost” from (a) the mound created in Bat Cave Wash by the original discharge, and (b) the pumping of	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response with the caveat that the evolution of the hydraulic gradient should also be addressed in Section 6.6.

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			plume moved about 3,000 feet from Bat Cave Wash to the flood plain adjacent the Colorado River in less than 40 years would result in a groundwater flow velocity equal to 75 feet/year, which may be more representative of average flow conditions. We recommend that the groundwater velocity be expressed as a range.	original supply wells PGE-1 and PGE-2 during the 1950s. These effects were modeled and presented in Section 6.6. A sentence will be added to this section referring the reader to Section 6.6.	DTSC: DTSC concurs with DOI's direction above.
U.S. Department of the Interior	DOI-41 M	Section 5.1.4.3, page 5-10, last sentence	Clarify that model values for storativity will be adjusted during model calibration within the constraints imposed by the measured storativity data	The text will be revised to reflect that storativity was estimated from aquifer test data with an external software package, then adjusted during model calibration of both the aquifer test and monthly fluctuations of groundwater in response to the river.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-42 E	Section 5.2.1, page 5-11, 2nd paragraph; Section 5.2.3, page 5-13, 1st partial paragraph	Flow is parallel to the alluvium/bedrock contact if the bedrock is a no-flow boundary, not perpendicular. The potentiometric contours are perpendicular to the contact if it is a no-flow boundary.	In response to this comment, the word "parallel" will be substituted for "perpendicular".	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-13	Sec. 5, Page 5-16, Section 5.3.1.4 - Total Dissolved Solids Distribution, Paragraph 5	Additional discussion of Total Dissolved Solids (TDS) distribution is requested for the shallow and deep alluvial wells in the vicinity of Bat Cave Wash. Figure 5-12a of the Report illustrates that groundwater flow in the shallow zone is essentially from the west to the east with lower TDS upgradient of the chromium discharge area in Bat Cave Wash. Discussion is requested regarding how TDS could increase along a flow path originating upgradient of the MW-9 through MW-11 well area. The more rigorous discussion of TDS distribution is requested as salts (i.e., electrical conductivity) have been identified as a COPC within the former Bat Cave Wash discharge area. This section should be revised to compliment Section 6.5.1 (page 6-17, paragraph 3) which concludes that historic discharges may have contributed a lingering higher TDS to the plume area compared to non-plume portions of the aquifer.	A more rigorous discussion of TDS distribution will be provided in the revised Section 5.3.1.4 In addition, Section 6.5.1 will be reviewed and revised as needed to ensure that the discussion of TDS is consistent through out the document. The generalized shallow groundwater elevation contours the comment references from Figure 5-12a were meant to show this general west-to-east groundwater flow direction across most of the site, but in the southern Bat Cave Wash area, the gradient is mostly northward, following the surface drainage down the wash from the Chemehuevi Mountains. Text in Section 5.2.3 (Groundwater Flow Directions) will be revised to reflect the localized northern gradient. The discussions in Sections 5.3.1.4 and 6.5.1 will be expanded to discuss how there is a correlation between well screen height above bedrock and TDS. Because many of the deep plume wells are screened closer to the bedrock, on average, than non-plume wells, the plume wells are biased upward in TDS. This will be discussed as another viable explanation for the difference in TDS between the two groups of wells.	DOI understands that DTSC and PG&E have discussed the distribution of TDS further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report. DTSC: The Report should clearly state and include the basis for northerly flow in the Bat Cave Wash area as this is new to the conceptual model which states a flow to the east/northeast. The Report should indicate if this is merely an assumption or is it based on certain data points. For the bedrock / well screen discussion, reference to existing or new cross-sections or new illustrations would assist in the discussion. DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-14	Sec. 5, Page 5-17, Section 5.3.1.5 - Groundwater Temperature, Paragraph 4, Line 1	The GSU has noted that groundwater temperatures measured in the field at the Topock site can be affected by ambient air temperature. Groundwater in spooled purge lines can become heated during hot summer sampling events well above actual in situ temperatures. The Report should briefly comment on the general reliability of the field temperature measurements.	The text will be revised to acknowledge the uncertainty in groundwater temperature measurements.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-6	Sec 5.3.1.5	This section discusses the variation of groundwater temperature across the site. Does the change in groundwater temperature with depth (geothermal gradient) follow a more or less typical one degree Fahrenheit per 100 feet of depth profile? Does the	Measurement of geothermal gradients in relatively shallow wells requires very sensitive temperature monitoring equipment with low thermal mass. We have not collected any temperature profile data with sufficient accuracy to determine the magnitude of the	DOI accepts the comment response DTSC: Since data was not collected to determine the magnitude of the geothermal gradient, DTSC agrees that no change to this document is necessary. Also

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			temperature gradient vary across the site for any reason?	geothermal gradient at this site.	see Comment DTSC-14 above.
Metropolitan Water District	MWD-12	5.3.1.6 Groundwater Reductive Zones, pages 5-18 to 5-19	It states at bottom of page 5-18 "Subsequent IM No. 3 extraction has drawn shallow fluvial groundwater westward and downward in this area, so that by the end of 2007, many of the deeper wells have become reducing (Figure 5-22)." Figure 5-22 does not clearly demonstrate reducing conditions at the deeper wells. Well 36-100 shows an ORP of -61.7 and nitrate at 0.5 with low amounts of manganese and iron, while the shallower zones (36-40, 36-50, and 36-90) show more negative ORPs and higher concentrations of manganese and iron. We recommend that proper references be included to show the trend that deeper wells are becoming more reducing (especially in the pumping area). The last paragraph in this section discusses the tests and report on the anaerobic cores. We recommend that the "Phase II Anaerobic Core Testing Summary Report" dated June 2008 be referenced.	The text provides a discussion of the fact that MW-36-100 is an exception to the trend of decreasing ORP. This section of text will be expanded to describe specifically which wells the decreasing ORP trends have been observed in. The existing cross section figure will be replaced with a new figure that presents graphs of chromium and ORP for the wells in cross section F-F'. This figure will better demonstrate the reducing conditions in the deeper wells. In response to this comment, the last sentence of Section 5.3.1.6 will be modified as follows: "The results of the additional core testing more precisely quantified the reducing capacity of the anaerobic fluvial material, and calculations suggest that there is sufficient capacity within the floodplain and beneath the river to reduce at least a significant portion of the Cr(VI) plume were the plume to come in contact with these sediments (CH2M HILL 2008z)."	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved. DOI does not concur with the proposed revision, which draws too broad a conclusion about the reducing capacity of the floodplain based on a limited number of core samples. DTSC: DTSC recommends that PG&E simply reference the report as proposed by MWD instead of inserting the proposed response language.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-7	Sec 5.3.1.6	a. Please provide a reference for the statement in the second paragraph that states: "By comparison, thermodynamic data indicated that Cr(VI) is transformed into Cr(III) at more oxidizing condition than those that initiate the reduction of nitrate." b. Last paragraph of the same section as above. Refer to Comment No. 4 re the applicability of related investigations and studies. It should also be mentioned where/when the results of the analyses of the "additional anaerobic cores" will be reported. c. Perhaps an Eh-pH stability field diagram would be a useful figure in this section.	a. The reference will be provided. b. The reporting document will be identified. c. The comment is appreciated, but PG&E felt that inclusion of an Eh-pH diagram would introduce a chemically technical figure to the report that would require significant explanation, and could cause confusion for most readers.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E's proposed responses.
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-8	Sec. 5.3.1.6	Previously, the following questions were asked and a response was provided by PG&E in Appendix A. *Are the reducing conditions consistent and continuous over a wide area? Does the thickness thin to the south or in another direction? Has previous dredging of the river potentially impacted reducing conditions? Can the current or former subsurface bridge footings provide a potential localized interruption in the reducing conditions?* While we appreciate PG&E's response, we do not feel that PG&E fully answered out questions. *Are the reducing conditions consistent and continuous over a wide area? Does the thickness thin to the south or in another direction?* While the	The maps and cross section provided in Figures 5-21 and 5-22 depict the extent of data defining reducing conditions in fluvial material. It is stated in the text that fluvial material extends throughout the floodplain, beneath the river, and beneath the floodplain on the Arizona side. This is based on geologic interpretation of where fluvial material would be deposited, given the geologic history of the Colorado River floodplain prior to channelization. In the California side floodplain, reducing conditions are found throughout the shallow and medium depths of fluvial materials, and extend down to bedrock in the southern part of the floodplain, as defined by groundwater indicator parameters in Figure 5-21. The same indicator parameters collected from pore water samples several feet below the river	DOI has provided comments regarding the need for PG&E to carefully frame its conclusions regarding the presence of reducing conditions and the potential for those reducing conditions to limit Cr(VI) migration in terms of what is known based on measured data, and what is scientifically speculated to be occurring in areas away from measurement points. DOI has also directed PG&E to explicitly acknowledge the uncertainties regarding the extent and permanence of reducing conditions as a process factor for mitigating Cr(VI) migration. DOI has reviewed PG&E's memorandum titled "Summary of Colorado River Bridge Pier Construction and Hydrogeologic Assessment" and concludes that

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			response and deferral to Figures 5-21, 5-22 and 5-24 were helpful, it does not fully respond to our comment in an attempt to understand if reducing conditions are continuous over a wide area or if reducing conditions could terminate as sediments thin and the bedrock surfaces to the south in the vicinity of MW-22 and MW-23 (Figure 5-9) and to the east along the bedrock interface. In addition, as dredged material was removed from the areas to the south, it would have further removed materials in areas where sediment was thinning to the south. Another way to approach this comment is to map where the shallow fluvial zones of the Alluvial Aquifer do not exist or are not of a sufficient thickness (i.e. 20 feet) to support effective reducing conditions. The extent of groundwater contamination above background levels can then be overlaid and compared. *Can the current or former subsurface bridge footings provide a potential localized interruption in the reducing conditions?* PG&E response is that no existing data supports this concern. While PG&E's statement that no existing data may support this concern, it is EMC's opinion that the existing data is insufficient to evaluate this concern. Based on the construction and demolition techniques used for the bridge footings, it would appear that the bridge footings most likely do not maintain the same immediate reducing conditions as the surrounding area. PG&E does recognize and states that reducing conditions in groundwater monitoring wells have changed over time. Therefore, to assume that reducing conditions around the bridge footings are not potentially impacted based on the lack of data does not seem to be supported. EMC had previously expressed our concern regarding the lack of reducing conditions surrounding the bridge footings, in addition to the possible preferential pathway that may exist. We understand that DOI is in the process of evaluating this concern and anticipates providing a response letter shortly. Upon receipt of this response from DOI, EMC will be able to make additional comments regarding any further investigation actions or proposed revised surface water sampling locations. While EMC has previously expressed this concern to the DTSC, we have not received any formal written response that DTSC has evaluated our concerns. Therefore, EMC is formally requesting that DTSC Geological Services Unit (GSU) evaluate this concern and present a formal written response.	bottom also indicate reducing conditions. It would be reasonable to assume that some level of reducing conditions extend at least through the shallow and middle depth intervals of all fluvial materials, given the common geologic environment of the deposits. In the slant borings, the reducing fluvial conditions were found to extend through all depths, to the contact with bedrock. As to the question of dredging effects on the reducing zone: there does not appear to be a minimum thickness of fluvial material required to sustain reducing conditions: the boring for well MW-22 indicates a depth to bedrock of less than 20 feet, and the well shows reducing conditions consistent with other shallow fluvial wells. Based on seismic surveys conducted by the USGS, the fluvial material beneath the river is thinnest In the area where the river enters the gorge near the I-40 bridge. Even in this area, fluvial sediments extend approximately 100 feet below the bottom of the river, with reducing conditions prevalent through this entire thickness based on the slant wells drilled beneath the river. Dredging deepened the channel by 15 to 20 feet but over 80 feet of reducing material would remain even beneath the deepest dredged portion of the channel below the I-40 bridge. In response to DOI and DTSC request, PG&E submitted a 10/31/08 technical memorandum titled "Summary of Colorado River Bridge Pier Construction and Hydrogeologic Assessment". The submittal summarized the construction methods and records for the current and former bridge piers of the railroad/highway bridges that cross the Colorado River at the Topock site, and presented an evaluation of the potential for the bridge piers to serve as preferred pathways for vertical groundwater flow toward the Colorado River. PG&E's 2006 pore water study and 2007-2008 slant well drilling investigations have shown naturally reducing groundwater conditions exist in the river sediments in the vicinity of the bridge piers. Additionally, hexavalent chromium has not been detected in the groundwater monitoring wells or surface water stations in the vicinity of the bridge piers. Although localized interruption of groundwater conditions may have occurred during bridge construction, the natural reducing condition of the fluvial sediments would have re-established itself soon after pier construction. Based on the historical records and sampling data, it is concluded that the bridge piers do not pose a significant risk to act as preferential pathways for groundwater flow to the Colorado River.	PG&E has adequately demonstrated that the potential for Cr(VI) to migrate in groundwater to the river via a preferential pathway associated with current or former bridge footings is limited and does not pose a significant threat to surface water. DTSC: During a 2008 Meeting, PG&E indicated that fluvial sediments did not occur over all portions of river and that bedrock was exposed at the base of the river in certain area(s). The RFI Report should identify these areas. PG&E: With regard to DTSC's direction, PG&E would like to clarify that the location where bedrock may be exposed at the base of the river is speculative at this time. The opinion for the location mentioned was based on poor quality underwater video at a single location and to draw conclusions from this would be conjecture at this point.
Metropolitan Water District	MWD-13	5.3.2 Stable Isotopes, page 5-19 to 5-21	This section includes discussion of the stable isotopes for characterizing the groundwater sources. It includes discussion on Figure 5-23a and	Reference to Figure 5-24c will be added.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

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			5-23b but there is no citation in the text for 5-23c.		DTSC concurs with the comment response.
Department of Toxic Substances Control	DTSC-15	Sec. 5, Page 5-22, Section 5.4 - Site Hydrogeologic Conceptual Model, Paragraph 3	The paragraph contains the following statement, "TDS increases with distance away from the river and with depth, becoming more similar to alluvial groundwater quality." The statement is in disagreement with text in section 5.3.1.4 of the Report (page 5-16, paragraph 5). Figures 5-18a and 5-18c best illustrate that TDS within groundwater decreases away from the river on average. This sentence should be revised / clarified in this section as well as in the Executive Summary (page ES-7, paragraph 1).	This statement refers to TDS in fluvial groundwater in the floodplain, increasing westward and downward from shallow fluvial wells adjacent to the river (MW-27-20 and MW-28-25). The apparent conflict cited in the comment in a statement in Section 5.3.1.4 is actually a statement describing alluvial groundwater trends in deep wells. Note that additional TDS evaluations are underway and will be incorporated in the revised text (see response to comment DTSC-13). Text will be checked to ensure consistency in the revised document.	DOI understands that DTSC and PG&E have discussed the distribution of TDS further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report. DTSC: The cited sentence should be revised to clarify that the statement pertains to fluvial groundwater only.
U.S. Department of the Interior	DOI-43 M	Table 5-4	Provide further explanation of the column with the heading "# of Samples". Specify whether the number represents the number of analyses or detections for a given parameter.	Footnote #1 for Table 5-4 will be clarified to state that the '# of samples" refers to the number of individual samples (sampling events) or measurement dates, and excludes field duplicate samples.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-44 E	Figure 5-1	Hydrologic Cross Section C-C' is not shown on the figure.	Cross-section C-C' will be labeled on Figure 5-1.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-45 M	Section 5 Figures	The depth of well PE-01 in Figure 5-2 is listed as 105 ft, while well PE-1 on Figure 5-7 is shown to be 97 ft deep. Figure 5-1 does not show a PE-01 on either cross section A or F. Please explain and or correct the figures. In addition, there are discrepancies between the reported depths for well MW-36 on the two figures. All well data should be reviewed for each cross section to ensure that the accurate depths and other data are reported.	Well PE-01 and well PE-1 are the same well and the identification inconsistency on the cross-sections will be corrected. The boring depth for PE-01 is 97 ft below surface and the depths listed for this well will be corrected. The well data shown on the cross-sections will be confirmed.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-46 M	Figures 5-2 and 5-3	There seems to be an inconsistency between the two cross sections. Figure 5-2 shows the inferred fault near XMW-9, MW-09, and PGE-8 while Figure 5-3 doesn't show the fault but states that the Metadiorite bedrock is at 450 feet MSL. This figure also does not show PGE-8, which is closer to the cross section line B-B' than the A-A' line. Please review and explain. All cross sections should be reviewed for consistency and continuity.	For consistency, cross-section B-B' (Figure 5-3) will show the projection of well PGE-8 and the inferred fault location as depicted on Figure 5-2. Additionally, a qualifying note on bedrock geologic contacts and structure, as used on Figure 5-2, will be added to Figure 5-3. The drilling and well data on the cross-sections will be confirmed.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-47 M	Figure 5-13	This cross section is not labeled beyond a west to east configuration. Is this the same cross section as Figure 5-7? If so it should be labeled as such.	The cross-section presented in Figure 5-13 is a version of the hydrogeologic section F-F' (Figure 5-7) and will be identified as Section F-F'. A note referencing Figure 5-1 location map and this explanation will be added to Figure 5-13.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-16	Figure 5-24	The figure contains an error on the right side of the diagram where the Alluvial Aquifer is illustrated to include bedrock.	The label of the Alluvial Aquifer on the diagram will be corrected.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E's proposed change.
Section 6					
U.S. Department of the Interior	DOI-48	Section 6.0 – General	The discussion about the presence of various metals at elevated concentrations due to the	The discussion of colloid breakthrough is presented to help explain the highly variable concentrations of a	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in

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	M	Comment	colloidal affect is interesting but should it influence the discussion of the extent of contamination? The colloidal fraction will not readily settle out of suspension and therefore would be consumed in the same manner as dissolved material. Is this fact used to influence the discussion of the nature and extent or just to explain the presence of the random values?	trace metal in samples from a given well. A well with mostly non-detects and a few elevated detections is a typical example of colloid influenced concentrations. In some wells, calculated average values for trace metals are highly influenced by the few elevated detections, but the resulting averages are probably not representative of the dissolved metal concentration in the aquifer. Therefore, discussion of the source of these high values is warranted for understanding how these data should be used for identifying COPCs associated with the Bat Cave Wash discharge. It should be noted that the colloids discussed in the text are not assumed to emanate from the historic discharge in Bat Cave Wash, but rather are likely derived from natural mineral and rock fragments in the aquifer matrix. Colloids can travel long distances as suspended material in aquifers, however long distance colloid transport is more typical in fractured bedrock or clean sand and gravel aquifers and would not be expected in the mixed fine and coarse grained alluvial aquifer at Topock. The silt and clay that is present in the Alluvial Aquifer would be expected to act as an effective filter to attenuate colloids. A more common source of colloids is the neighborhood of the monitoring well itself, where colloids can be mobilized into the sample by the force of purging the well during sampling. Monitoring wells are not constructed or developed with the care that is applied to water supply wells. Consequently monitor wells typically produce water higher in colloids than drinking water wells. The text in the RFI (Section 6.2.1.3) will be modified to better explain the conceptual model for colloid influence on metals sample results.	its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-49 M	Section 6.0 – General Comment	A misunderstanding of the terms constituents of potential concern (COPCs) and chemicals of concern (COCs) seems to exist. All the chemicals and compounds initially identified in the sampling and analysis suites are considered COPCs. They were added because someone was concerned that they may be a problem. Through a screening process (comparison to background, screening levels, ARARs) these are either eliminated from further consideration or moved through the risk assessment where the COC are identified. The COCs are the chemicals or compounds that present an unacceptable risk to human health or the environment and need to be further evaluated through the CMS/FS. The entire discussion should be revised to reflect the RCRA and CERCLA process.	PG&E is agreeable to work with the agencies to use language that is most meaningful. The following provides background for the conventions and use of these terms based on previous Topock documents. For purposes of the RFI/RI, constituents of potential concern (COPCs) are those that were identified for each solid waste management unit (SWMU) and area of concern (AOC) at the PG&E Topock Compressor Station through a thorough review of site background, regulatory, and historic information about facility operations, chemical use, and waste management practices and documented in the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 - Site Background and History,* dated August 2007. The determined COPCs for SWMU 1/AOC 1 and SWMU 2 are repeated in Sections 2.1.3 and 2.2.2. The sampling and analytical program for groundwater characterization at SWMU 1/AOC 1 and SWMU 2 considered both COPCs (constituents likely to have been associated with wastewater discharge from the Topock Compressor Station based on historical research) as well as non-COPCs (no historic evidence of association with the wastewater discharge) in order	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to consider all analyzed constituents as PCOCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes. DTSC: DTSC understands that this directive will require PG&E to modify several sections of the Report where COPCs and non-COPCs terms were used, including Section 6.2. PG&E: As agreed with DTSC and DOI in subsequent discussions, all constituents that were not sampled for general chemistry or fate and transport assessment purposes would be considered COPCs at the beginning of Volume 2. Based on the conclusions of Volume 2, constituents that merit further consideration would be considered COPCs in groundwater for SWMU 1/AOC 1. Text has been revised in Section 2.1.3 and throughout the document.

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				to complete a thorough characterization of groundwater and to understand natural geochemical conditions (e.g., collection of stable isotope data). Those COPCs and non-COPCs that are found during the RFI/RI and risk assessment to warrant development of remedial action objectives will be carried forward into the CMS/FS as constituents of concern (COCs).	
Department of Toxic Substances Control	DTSC-17	Sec. 6, Page 6-2, Section 6.1.2 - Regulatory Standards for Groundwater, Paragraph 2	The text should identify limitations on the use of the groundwater background study outlined in the cover letter to the January 14, 2008 Revised Groundwater Background Study (CH2M Hill, 2008c).	In response to this comment, an additional paragraph will be added to Section 6.1.2 that reiterates the key points outlined in PG&E's letter to DTSC dated January 14, 2008 about the potential limitations for use of the groundwater background study results.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-18	Sec. 6, Page 6-2, Section 6.2.1 - Site COPCs	The Report needs to discuss and clarify the difference between indicating whether a constituent is a COPC for the RFI Report versus a COPC as part of the risk assessment (RA). At the Technical Workgroup Meeting (TWG) in August 2008, DTSC understood that the selection and elimination of the COPC differs between the Report and RA and that constituents are only eliminated through the RA process. Again, clarification in the Report is needed.	As discussed above in response to comment DOI-49, for purposes of the RFI/RI, constituents of potential concern (COPCs) are those that were identified for each solid waste management unit (SWMU) and area of concern (AOC) at the PG&E Topock Compressor Station through a thorough review of site background, regulatory, and historic information about facility operations, chemical use, and waste management practices and documented in the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 - Site Background and History*, dated August 2007. The COPCs for SWMU 1/AOC 1 and SWMU 2 are repeated in Sections 2.1.3 and 2.2.2. During the RFI/RI characterization, analytes included both COPCs (those associated with chemical use or waste discharge at the compressor station) and non-COPCs. All RFI/RI analytes will be evaluated in the risk assessment, whether the analytes are COPCs (those associated with chemical use or waste discharge at the compressor station) or non-COPCs. In response to this comment, the last sentence in Section 10.1.3 will be modified to state: "Consistent with RFI/RI requirements, the typical RCRA/CERCLA process and the specific agency requirements for this site, a risk assessment is being completed, as appropriate to finalize the list of constituents of concern (COC) to be carried forward to the CMS/FS."	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to consider all analyzed constituents as COPCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes. DTSC: See responses to Comment DOI-49. Inclusion of the revised paragraph proposed by PG&E for Section 10 is appropriate. PG&E: As agreed with DTSC and DOI in subsequent discussions, all constituents that were not sampled for general chemistry or fate and transport assessment purposes would be considered COPCs at the beginning of Volume 2. Based on the conclusions of Volume 2, constituents that merit further consideration would be considered COPCs in groundwater for SWMU 1/AOC 1. Text has been revised in Section 2.1.3 and throughout the document.
U.S. Department of the Interior	DOI-50 M	General Comment Sec. 6.2.1	This section makes many references to non-plume concentrations of various parameters and metals, suggesting that the Cr plume is the only one of consequence. The text should be clarified to note that the plume being referred to is the Cr(VI) plume. Although coincidence with the Cr(VI) plume is one factor in assessing whether metals detected in groundwater may be site-related, it is not the only criterion. Until the various organics or inorganics are determined not to exceed background or not to be site related they should be considered as COPCs and treated equally with the Cr. The reference to non-plume compound or chemical should be modified with the fact that they are not	In response to this comment, reference to the plume throughout this section will be changed to the Cr(VI) plume. It is acknowledged that co-location of elevated concentrations of metals with the Cr(VI) plume is one factor in evaluating whether the elevated concentrations of metals found in groundwater samples are related to past wastewater discharges from the Topock Compressor Station. Additional discussion will be added to reflect the conceptual model that because Cr(VI) is more mobile and abundant than any of the other COPCs and because groundwater flow directions have not changed substantially at the site over time, it	This response discussion is applicable only to constituents that were discharged at the SWMU 1 / AOC 1 or SWMU 2 source areas. PG&E has not completed characterization of soil contamination and therefore has not demonstrated that other sources of groundwater contamination do not exist at the site. DOI directs PG&E to review and revise the document to clarify that judgments about contaminant site relation and association with the Cr(VI) plume are relevant for discharges from SWMU 1 / AOC 1 and/or SWMU 2 only.

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			within the Cr plume. The discussion should also not eliminate these COPCs from further consideration and that they may have plumes of their own if they are determined to be site related.	would be expected that the distribution of any other COPCs released to SWMU-1/AOC-1 and SWMU-2 at the compressor station would lie within the boundaries of the Cr(VI) plume (that is Cr(VI) would act as a tracer delineating groundwater that had been affected by the Bat Cave Wash discharge from other groundwater not affected by this discharge).	
Department of Toxic Substances Control	DTSC-19	Sec. 6, Page 6-2, Section 6.2.1.1 - Hexavalent and Total Chromium, Paragraph 6, Line 2	The reference to the chromium groundwater data summary should be changed to Table 6-6 from 6-5.	The Table 6-5 reference will be corrected.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-51 E	Sec 6.2.1.1, Page 6-2, 2nd paragraph	Correct the reference to Table 6-5. This table is a summary of specific conductance and pH.	The Table 6-5 reference will be corrected.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-20	Sec. 6, Page 6-3, Section 6.2.1.2 - Specific Conductance and pH	See comment on TDS distribution above. Also, references on this page to Figures 5-17a - c should be changed to Figures 5-18a - c.	The reference to Figures 5-17a-c will be corrected.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Metropolitan Water District	MWD-14	6.2.1.2 Specific Conductance and pH, page 6-3	The last paragraph of this section states that the pH range for the slant well MW-53D/M are higher than other floodplain wells (including slant well MW-52). It is suspected that this is caused by construction and borehole sealing. We recommend including a possible explanation for the elevated pHs.	Additional discussion will be added regarding the possible reasons for the elevated pH.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-52 M	Sec. 6.2.1.2, Page 6.3. Last Paragraph.	Further explanation should be provided as to how the pH of the slant wells may be influenced by well construction and borehole sealing and possible effects on other analytical results.	Additional discussion will be added regarding the possible reasons for the elevated pH.	PG&E's response addresses only one of DOI's expressed concerns in the comment. Please also address possible effects on analytical results for other constituents from an elevated pH environment in the well.
Department of Toxic Substances Control	DTSC-21	Sec. 6, Page 6-4, Section 6.2.1.3 - Copper, Nickel, Zinc, and Lead, Paragraph 1	For completeness, this paragraph should indicate that additional trace metals data are being collected at several select groundwater wells and the resulting data will be presented in the Volume 2 RFI Report Addendum.	The text in Section 6.2.1.3 will be clarified as noted. In addition, addition discussions of nitrate will be added to Section 5.3.1.6 and vanadium will be added to Section 6.2.2 for consistency with the Risk Assessment.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: The suggested language change to Section 6.2.1.3 should also be included in the Section 6.2 heading where characterization results are introduced.
Metropolitan Water District	MWD-15	6.2.1.3 Copper, Nickel, Zinc, and Lead, page 6-4	The second full paragraph should be changed to include mention of chromium: "The detection frequencies in Table 6-6 for all metals except zinc and chromium are below 50%"	The text in Section 6.2.1.3 will be clarified as noted.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: Concurs with the comment response.
U.S. Department of the Interior	DOI-52 M	Section 6.2.1.3, page 6-4, 3rd complete paragraph, last sentence	Discontinue use of 50 ug/L as a basis for Cr(VI) plume delineation. 50 ug/l is not an ARAR for Cr(VI) nor is it the Cr(VI) background value. The Cr(VI) plume should be delineated based on values exceeding the calculated background concentration for Cr(VI) of 31.8 ug/L.	The text in Section 6.2.1.3 will be revised to state that the delineation of the Cr(VI) plume is based on 32 µg/L (the calculated site background concentration for Cr(VI) of 31.8 ug/L rounded to the whole unit).	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of	DOI-54	Section 6.2.1.3, page 6-4,	Include a statement that the maximum observed copper concentration (54.6 ug/L) is well below the	The text will be clarified as noted.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in

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the Interior	M	paragraph entitled “Copper”	chemical-specific ARAR of 1,000 ug/L, which is a secondary drinking water regulation.		its response.
U.S. Department of the Interior	DOI-55 M	Section 6.2.1.3, page 6-4, paragraph entitled “Lead”	The upper concentration range discussed should be those concentrations exceeding 15 ug/L, which is the relevant chemical-specific ARAR for lead. The 20 ug/L value has no relevance to ARARs or background, and is less useful and appropriate as a color criterion than the ARAR.	The 15 ug/L ARAR will be changed in the text and figure. The text will otherwise not be affected, and replacing the upper bound from 20 to 15 ppb on Figure 6-3 will not change the color of any of the plotted points.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-56 M	Section 6.2.1.3, page 6-5, paragraph entitled “Zinc”	Include a statement that the maximum observed zinc concentration (48.7 ug/L) is well below the chemical-specific ARAR of 100 ug/L.	The text will be clarified as noted.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-57 M	Section 6.2.1.3, page 6-6, paragraph entitled “Molybdenum”	Please note in the text that molybdenum has no California or Federal MCL according to Table 6-2.	The requested text will be added.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-58 M	Section 6.2.1.3, page 6-6, paragraph entitled “Selenium”	Please note the California and Federal MCL value for selenium of 50 ug/L according to Table 6-2.	The requested text will be added.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-22	Sec. 6, Page 6-5, Section 6.2.2 - Other Constituents Analyzed	A subsection should be added to this section to discuss and evaluate elevated fluoride concentrations at the site as they exceed MCLs. The subsection should include discussion and evaluation of the anomalously elevated fluoride concentrations occurring at well MW-10 located in Bat Cave Wash (concentrations ranging from 10 to 24.6 mg/L) that were previously mentioned by DTSC during the August 19, 2008 TWG meeting.	A discussion of fluoride concentrations and their distribution will be added. The subsection will include discussion and evaluation of the anomalously elevated fluoride concentrations at well MW-10 located in Bat Cave Wash. The statistical UTL calculated from Background Study data is 7.12 mg/L. The only site wells with average fluoride exceeding this UTL are MW-10, MW-33-40, and MW-6. Although the source of fluoride in well MW-10 is not clear, it does not appear to be related to the Bat Cave Wash release, since there is no apparent plume-like distribution of this chemically conservative element. Time series graphs depicting chromium concentrations and fluoride concentrations in well MW-10 are provided in Appendix F3.	DOI understands that DTSC and PG&E have discussed the distribution of fluoride further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC’s response and any proposed revisions to the report. DTSC: Please include time series graphs comparing chromium to fluoride concentrations in well MW-10 to support non-association of fluoride with the Bat Cave Wash release.
U.S. Department of the Interior	DOI-59 M	Sec 6.2.2.1	The term non-COPC metals is a little misleading. If these metals were added to the analytical suite they should be considered COPCs, not non-COPC metals. The results of the sampling can eliminate them from further consideration as COPCs because they don’t exceed a preliminary action level.	As discussed above in response to comment DOI-49, for purposes of the RFI/RI, constituents of potential concern (COPCs) are those that were identified for each solid waste management unit (SWMU) and area of concern (AOC) at the PG&E Topock Compressor Station through a thorough review of site background, regulatory, and historic information about facility operations, chemical use, and waste management practices and documented in the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 - Site Background and History,* dated August 2007. The COPCs for SWMU 1/AOC 1 and SWMU 2 are repeated in Sections 2.1.3 and 2.2.2. The sampling and analytical program for groundwater characterization at SWMU 1/AOC 1 and SWMU 2 considered both COPCs (constituents likely to have been associated with wastewater discharge from the	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to consider all analyzed constituents as COPCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes PG&E: As agreed with DTSC and DOI in subsequent discussions, all constituents that were not sampled for general chemistry or fate and transport assessment purposes would be considered COPCs at the beginning of Volume 2. Based on the conclusions of Volume 2, constituents that merit further consideration would be considered COPCs in groundwater for SWMU 1/AOC 1. Text has been revised in Section 2.1.3 and throughout the document.

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				Topock Compressor Station based on historical research) as well as non-COPCs (no historic evidence of association with the wastewater discharge) in order to complete a thorough characterization of groundwater and to understand natural geochemical conditions. Those COPCs and non-COPCs that are found during the RFI/RI and risk assessment to warrant development of remedial action objectives will be carried forward into the CMS/FS as constituents of concern (COCs). PG&E is agreeable to work with the agencies to use terminology that is most meaningful.	
Metropolitan Water District	MWD-16	6.2.2.1 Non-COPC Trace Metals, page 6-5 to 6-6	The second full paragraph on page 6-6 mentions that manganese exceeds the ARARs in 1% of the data, but manganese is not included on Table 6-8. A discussion and data should be presented for manganese	Manganese and antimony were not discussed because the average concentration of each metal exceeded its ARAR in only one well. The discussion is focused on those metals that exceed the ARAR for more than 1% of all samples and have an average concentration exceeding the ARAR in more than one well. However, additional text has been added discussing manganese and antimony concentrations with respect to chemical-specific ARARs in Section 6.2.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: The RFI Report should briefly indicate the wells and concentrations where manganese and antimony ARARs were exceeded.
Department of Toxic Substances Control	DTSC-23	Sec. 6, Page 6-6, Section 6.2.2.1 - Non-COPC Trace Metals, Arsenic, Paragraph 4	Review of the arsenic data set in Figure 6-6 should reveal that the regional background upper tolerance level (UTL) of 24.3 ug/L is not a good measure of arsenic background for the Topock area. A background of approximately 5 ug/L appears appropriate for much of the site, while the New Ponds area is higher. This arsenic background limitation was previously described to PG&E (DTSC, 2008), yet is not acknowledged in the Report. The Report should discuss the distribution of arsenic in each zone (shallow, middle, and deep) and Figure 6-6 should be modified to have the blue dots represent concentrations less than 5 ug/L and green dots illustrate concentrations from 5 ug/L to the MCL of 10 ug/L. This will illustrate that a group of wells within the chromium plume exhibit intermediate arsenic concentrations near the former discharge area in Bat Cave Wash. A more robust discussion of arsenic occurrence is requested to address the highly elevated arsenic concentrations at well MW-12 located at the southeast portion of the chromium plume and the elevated/fluctuating arsenic at well MW-10 located in Bat Cave Wash. The Report should discuss the relationship between chromium and arsenic concentrations from well MW-12. The Report should indicate that the well MW-12 data (CH2M Hill, 2008b) indicates that a distinct inverse relationship exists between arsenic and chromium and comment if this suggests that the two constituents are from different sources. The Report should contain a time-series graph illustrating this arsenic/chromium relationship. A similar arsenic/ chromium graph should be prepared for well MW-10 to show that arsenic tracks with chromium	The background UTL for arsenic was calculated using all of the approved well selection, sampling, and statistical methods put forth in the Background Study. In addition, DTSC required PG&E to eliminate the three wells with highest arsenic concentrations from the background study data set. Note that these three wells are located in similar settings to MW-12 (that is adjacent to the freeway and/or railroad right of ways). DTSC's February 2008 comment on the Background Study report was noted, but the historical data do not provide a defensible method of lowering the background UTL. Given the analytical chemistry challenges associated with arsenic in the Topock site groundwater matrix, distinguishing between 5 and 10 µg/L is not likely possible with the current analytical data set because of issues on aqueous matrix interferences and reproducibility of results. Therefore, assigning a 5 µg/L background value for the site is not only against the criteria set forth in the Background Study, but is not defensible given the historical dataset. Many of the samples were reported as non-detect at the 10 µg/L level; this is the lowest concentration that may be used with some certainty to distinguish arsenic analyses due to the issues described above. The only plume wells with samples that exceeded 10 µg/L were MW-12, MW-10 (two out of 14 samples) and two wells recently affected by in situ pilot studies, MW-24A and PTI-1S. Given this analytical limitation in site data, the complete Background Study dataset, and the fact that arsenic use at the facility is not documented, the propensity of data do not indicate a source of arsenic in groundwater at the site. Text will be added to support this. The time-series plot for well MW-12 does show an apparent inverse-trend relationship between arsenic and	DOI understands that DTSC and PG&E have discussed the distribution of arsenic further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report. DTSC: As originally requested, DTSC requests that Figure 6-6 be modified to have the blue dots represent concentrations less than 5 ug/L and green dots illustrate concentrations from 5 ug/L to the MCL of 10 ug/L. The response contends that arsenic use at the facility is not documented. However, the RFI Report Volume 2 should discuss the many releases to Bat Cave Wash, some of which exhibited elevated arsenic concentrations. The following releases to Bat Cave Wash contained in the Volume 1 Report include: the September 2002 Grit Tank Release reached Bat Cave Wash and soil samples from the Grit Tanks yielded elevated metals including arsenic, chromium and, molybdenum; One fluid sample collected from the December 27, 2005 Bat Cave Wash Wastewater Release detected 6,700 ug/L molybdenum. Documentation of spills prior to 1995 do not exist. Other documented releases to Bat Cave Wash: June 1996, August 1998, December 2000, August 2001 (elevated chromium, molybdenum and possibly arsenic), April 2003, and August 2005. Based on the number of documented releases to Bat Cave Wash since 1995 and the unknown number of releases to the wash prior, the RFI Report V2 should identify that the elevated MW-10 metal detections might be from some of these former releases. DTSC awaits revised language so that it can be reviewed and approved. See also Comment DTSC-26 and DOI-64.

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			and whether it suggests that the two constituents are related in this area. Finally, arsenic concentrations in fluvial versus alluvial site wells should be discussed in the Report.	chromium between 2005 and 2006, suggesting different sources (either anthropogenic or natural). In well MW-10, the trends between chromium, arsenic, and molybdenum have been similar since arsenic samples were first collected in 2004. The reason for these fluctuations is unknown, but is suspected to be caused by slight perturbations in groundwater flow direction coupled with a steep concentration gradient in one or more directions. Under this scenario, when groundwater shifts direction in response to an event (perhaps a recharge event), higher-concentration groundwater may be directed to flow into the well area. It is not clear where the source of this groundwater lies, nor if arsenic and molybdenum are definitely associated with the higher concentrations of Cr(VI). In the case of the two peak events (10/3/05 and 12/14/06), Cr(T) is greater than Cr(VI), especially in the second peak event. This suggests that colloidal material is making up the difference between the two, since Cr(III) is not stable in dissolved form. The same colloids that add to the Cr(T) may also be supplying arsenic and molybdenum. It is not clear whether there is a relationship between the trends in MW-10 and MW-12. Because these associations, either within each well or between wells, cannot be proven, this discussion was not included in the RFI/RI Report. Text will be added to reflect these ideas, along with the requested time-series graphs as Appendix F3.	
Department of Toxic Substances Control	DTSC-24	Sec. 6, Page 6-6, Section 6.2.2.1 - Non-COPC Trace Metals, Molybdenum, Paragraph 5	Molybdenum should be added to the time-series graphs requested for arsenic/chromium at wells MW-10 and MW-12 as a relationship also appears to exist for this constituent in these wells. Evaluation of the relationships should be discussed in the Report.	Please refer to the response to DTSC comment #23. Molybdenum has been added to the time series graphs in Appendix F3.	DOI understands that DTSC and PG&E have discussed the distribution of molybdenum further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report. DTSC: Please ensure that the molybdenum time-series graphs requested are included in the RFI V2 Report and discussed/evaluated in Section 6. Also see DTSC's response to Comment DOI-64.
U.S. Department of the Interior	DOI-60 M	Section 6.2.3.1, page 6-7, 1st paragraph	There are no California or federal MCL values for Cr(VI). Revise the text to state that Cr(VI) and Cr(total) exceed the calculated background values for the Topock site, and Cr(total) exceeds the CA and Federal MCLs. The text states that Cr(VI) and Cr(total) will be carried forward in the RCRA process. Topock is regulated under both RCRA and CERCLA; therefore the CERCLA process is also applicable to Cr contamination.	The text will be revised as requested.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-25	Sec. 6, Page 6-8, Section 6.2.3.2 - Specific Conductance and pH, Paragraph 1	The paragraph concludes that specific conductance should not be carried forward as a COPC at the site. This is counter to discussion on TDS in the Report (see page 6-17) indicating that, "in general, the TDS of alluvial plume wells tends to be greater than that of non-plume alluvial wells." This section	The comparison of plume TDS vs. non-plume TDS was made at the specific request of DTSC, and based on simple inspection of depths intervals, it was acknowledged that there appeared to be a tendency for plume wells to have higher TDS than non-plume wells Upon more detailed evaluation of the data, it is	DOI understands that DTSC and PG&E have discussed the distribution of specific conductance further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report.

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			should be revised to compliment Section 6.5.1 of the Report which concludes that historic discharges may have contributed a lingering higher TDS to the plume area compared to non-plume portions of the aquifer. Based on the additional assessment requested in comment 13 above, the section may be revised to conclude that specific conductance/ TDS/electrical conductivity be carried forward as a COPC at the site. Also see above comments on Section 5 regarding TDS.	apparent that there are other factors that also could have played a role in the observed TDS difference between plume and non-plume wells. Many of the plume monitoring wells are screened closer to the top of bedrock, due to the facility's location at the alluvial-bedrock interface at the foot of the Chemehuevi Mountains. In general, TDS increases with depth and proximity to the top of bedrock across the site. Among the lower-depth interval wells, the height of the screened interval midpoint above bedrock in deep plume wells ranges up to 62 feet, whereas in non-plume deep wells this height ranges up to 292 ft, since bedrock is much deeper in many areas of the site. While a statistical t-test comparison of plume and non-plume deep well TDS concentrations overall indicates that there is a significant difference between the groups, if deep non-plume wells screened greater than 70 feet above bedrock are removed from the comparison, then the same statistical test shows no significant difference, both assuming 95% significance. This suggests that the plume well data set is biased towards wells screened closer to bedrock, and therefore with higher TDS. In conclusion, the TDS observed in plume wells is within the range observed in both onsite and offsite non-plume wells. There is no clear evidence that high-TDS discharge water has significantly impacted groundwater TDS at the site. Text will be added to the section to provide additional support for this conclusion.	DTSC: DTSC awaits revised language so that it can be reviewed and approved. As part of the TDS evaluation, DTSC requests that PG&E evaluate groundwater wells that exhibit trends in TDS and chromium and determine if relationships exist between the two. PG&E: As discussed with DTSC and DOI on December 17, 2008 this addition analyses will be provided later in the RFI/RI Volume 2 Addendum.
U.S. Department of the Interior	DOI-61 M	Sec. 6.2.3.2, Page 6-8, 2nd paragraph, last sentence	This statement as well as the one for specific conductance should be more conclusive. The decision to not carry these measurements forward should be based on the fact that they are naturally occurring (needs to be demonstrated) have no toxicity values and therefore the risk cannot be evaluated (also needs to be discussed), rather than the elevated reading are from non-plume wells. In addition, the reference to the limited ability of the background study to accurately determine whether these are naturally occurring variations adds some uncertainty to the entire background study, suggesting it is biased toward condition that are not representative of the native groundwater environment.	The text will be modified with additional discussion of the TDS distribution as per the response to DTSC Comment 25 above.	DOI accepts the comment response pending review of DTSC's response to earlier comments on this topic and proposed revisions agreed upon by DTSC and PG&E.
U.S. Department of the Interior	DOI-62 M	Sec 6.2.3.3. Page 6-8.	This section refers to the non-plume wells. This should be clarified to state that the concentrations of these metals where exceedances occurred are outside the currently defined Cr plume. The argument that these are not site related metals because the data don't suggest a source is somewhat vague. Is there any evidence that these metals were not used at the site and is there a reference for the colloidal discussion presented?	In response to this comment, reference to the plume throughout this section will be changed to the Cr(VI) plume. Please refer to the response to comment DOI -50 which explains how co-location of elevated concentrations of metals with the Cr(VI) plume is one factor is evaluating whether the elevated concentrations of metals found in groundwater samples are related to past operations at the Topock Compressor Station. Elements such as lead that would not be mobile under site groundwater conditions would	This response discussion is applicable only to constituents that were discharged at the SWMU 1 / AOC 1 or SWMU 2 source areas. PG&E has not completed characterization of soil contamination and therefore has not demonstrated that other sources of groundwater contamination do not exist at the site. DOI directs PG&E to review and revise the document to clarify that judgments about contaminant site relation and association with the Cr(VI) plume are relevant for discharges from SWMU 1 / AOC 1 and/or SWMU 2 only.

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				be expected to be confined to the original source area if they were co-disposed with Cr(VI) at SWMU-1; this is not the case. Conversely, mobile elements such as molybdenum would be expected to have a similar distribution to Cr(VI) if these elements were co-disposed. The distribution of molybdenum is also inconsistent with the expected pattern. Thus, comparison to Cr(VI) distribution along with application of geochemical properties is useful in assessing whether elements are likely to be associated with SWMU-1 or SWMU-2. References for colloid origin and transport will be added to the text, which will be expanded on this subject.	
Metropolitan Water District	MWD-17	6.2.3.3 Copper, Nickel, Zinc, and Lead, page 6-8	The last sentence in the first paragraph does not accurately describe the concentration distributions. From the Figures 6-3 to 6-5 it appears that most of wells above background are outside the lateral plume boundary or from shallow well depths above the vertical plume area. We recommend a revised discussion of the detection trends along with references to figures and data.	The text will be checked for accuracy and altered where necessary.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits any revised language so that it can be reviewed and approved.
Metropolitan Water District	MWD-18	6.2.3.5 Other Trace Metals, page 6-9	This section should also include discussion of manganese.	See response to MWD comment #16.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: See response to Comment MWD-16.
Department of Toxic Substances Control	DTSC-26	Sec. 6, Page 6-9, Section 6.2.3.5 - Other Trace Metals, Arsenic, Paragraphs 5 and 6	The paragraphs should be revised to indicate that the source of the elevated arsenic from well MW-12 is currently unknown. The statement that it is not related to facility operations is premature and truly unknown since characterization of the soils on and off the compressor station site (and groundwater onsite) have not been completed. Based on the arsenic assessments requested in comment 23 above, the Report may need to be revised regarding retaining arsenic for further consideration as a COPC (e.g., elevated arsenic in and around well MW-10 within the chromium plume). The Report should also acknowledge the lack of certainty regarding groundwater COPC selection due to the current lack of complete soils characterization at the facility.	There is no technical basis to retain arsenic as a COPC for the site. Arsenic is present at elevated levels in California soils and sporadically in groundwater where local geochemical condition is favorable for partitioning of arsenic from soil to groundwater. Well MW-12 constitutes one location of truly elevated arsenic in an area with no documented facility activity, along with no evidence of facility use of arsenic. This is considered to be a compelling preponderance of evidence against arsenic impacts to groundwater by the facility. DOI agrees with this discussion, as noted in DOI comment #63. In addition, three wells across the river from MW-23 are also elevated in arsenic and were eliminated from the background study at the direction of DTSC based only on these elevated concentrations. These wells are in relatively close proximity and similarly sited to MW-12 with respect to natural and anthropogenic sources. PG&E believes it is much more likely that the arsenic in MW-12 is either from a natural source or another source, such as arsenical herbicides known to be used on railroad rights of way or debris used for railroad grade construction, than from wastewater discharge from the TCS.	DOI understands that DTSC and PG&E have discussed the distribution of arsenic further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report. DTSC disagrees with several of PG&E's responses to this comment and would like to go on record refuting certain statements. 1) "no technical basis to retain arsenic as a COPC": Based on current data this is true. However, DTSC believes Compressor Station activities have impacted groundwater based on well MW-10 arsenic data that tracks with chromium contamination. Arsenic concentrations are no longer detected, but historically have exceeded MCLs in well MW-10. If arsenic values were to increase again in well MW-10 or downgradient areas, DTSC would be concerned. The exact source of the arsenic is uncertain, but PG&E has documented many recent releases to Bat Cave Wash including those where environmental sampling detected elevated arsenic (see Comment DSTC-23 and RFI Volume 1). 2) "MW-12 constitutes one location of truly elevated arsenic in an area with no documented facility activity": This statement is false as well

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					MW-12 is located in the AOC-11 area that received runoff from the station. 3) Three wells with elevated arsenic were eliminated from the background study at the direction of DTSC. This statement suggests that the three wells with elevated arsenic were inappropriately eliminated from the background study. Please note that the background study required wells that were not compromised by anthropogenic activities. PG&E argues that MW-12 may be impacted by railroad activities. As the three dismissed background wells were also in the vicinity of railroad/ right-of-way activities, the elimination is further supported.
U.S. Department of the Interior	DOI-63 S	Sec 6.2.3.5 Arsenic	The arsenic discussion present the information in a way that supports the fact that it is not site related although it still may be anthropogenic but not related to Topock activities. This approach should be taken for other metals.	This approach was comprised of noting the distribution of elevated values and relating them to potential site activity influence, discussing whether records indicate the chemical's use at the facility, comparing facility and non-facility area well values to the Background UTL. This was the same approach taken for the discussions for the other metals, where applicable. The text for the others will be checked to ensure it includes all pertinent information and follows the logic given for arsenic.	DOI understands that DTSC and PG&E have discussed the distribution of arsenic further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report.
Department of Toxic Substances Control	DTSC-27	Sec. 6, Page 6-9, Section 6.2.3.5 - Other Trace Metals, Molybdenum, Paragraph 6	The Report states, "As shown on Figure 6-7, there are elevated concentrations in the Bat Cave Wash area where the original chromium discharge occurred, and there are more wells with molybdenum above background within the plume (12) than outside the plume (7)." The significantly elevated MW-10 molybdenum concentrations that correlate with chromium plume concentrations strongly suggests that the molybdenum is associated with the chromium plume, at least in the MW-10 area. The Report should address this issue and, based on the response, molybdenum may need to be considered a COPC.	Additional text will be added to address these comments concerning molybdenum. The MW-10 area doesn't correspond to the plume as a whole. The highest concentrations of molybdenum have been observed at MW-10 (average of 140 µg/L including addendum samples). The one and only sample from well MW-46-175 had a concentration of 196 µg/L, but no other well has had a sample over 100 µg/L except one anomalous sample from MW-5. Other evidence is strong against association: (a) no documented use until the mid-1980s, long after any discharges to BCW ceased and after initial environmental investigations had commenced, and (b) the "plume" pattern for molybdenum shows the highest concentration in the MW-10 area, with generally decreasing concentrations extending down gradient. This is contrary to the pattern expected for a site-related release that occurred in conjunction with the BCW discharge, which would have the higher concentrations downgradient of the original source, as the Cr(VI) plume shows.	DOI understands that DTSC and PG&E have discussed the distribution of molybdenum further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report. DTSC: See DTSC's response comment below for Comment DOI-64. The RFI Report should acknowledge that the significantly elevated MW-10 molybdenum concentrations that correlate with chromium plume concentrations suggests that the molybdenum is associated with the chromium plume, at least in the MW-10 area.
U.S. Department of the Interior	DOI-64 M	Sec 6.2.3.5 Molybdenum	The lack of a clear documented source for the Mo is not a reason to eliminate it from further consideration. The fact that it does not correspond with the Cr plume is also not a reason to eliminate Mo. It may have a plume of its own. This metal should be carried forward to determine if the Mo presents an unacceptable risk to human health or the environment.	The preponderance of evidence was used to eliminate molybdenum from consideration, not any one observation. As stated in the response to DOI-50 and DOI-62, the plume and non-plume areas represent groundwater that had flowed from the vicinity of the facility from that which had not; there is no documented area outside of the plume except the East Ravine in which facility activities took place, so comparison of plume and non-plume wells is relevant. For molybdenum to have a plume of its own, one would have to assume that discharge of jacket water (with a documented Mo additive) occurred in Bat Cave wash during the 1980s or later, and there is no evidence that	DOI understands that DTSC and PG&E have discussed the distribution of molybdenum further and have agreed to retain molybdenum as an RFI/RI identified COPC. DTSC: DOI's understanding regarding molybdenum above is correct. DTSC awaits the actual revised language identifying molybdenum as a constituent related to releases from the Topock Compressor Station. PG&E's response to the left indicates that there is no evidence that molybdenum discharges to Bat Cave Wash occurred during the 1980s or later. This is

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				this occurred. Environmental investigations of the site were already underway at that time. It should be clarified that the Risk Assessment will evaluate the risk of all constituents, regardless of whether they are identified as COPCs in the RFI/RI.	incorrect. Review of the RFI Volume 1 Report documents many recent releases to Bat Cave Wash including those where environmental sampling detected elevated molybdenum. Documentation of spills prior to 1995 do not exist. The RFI/RI Volume 2 Report should acknowledge these and other undocumented releases as potential sources of the molybdenum detected in groundwater. Also see DTSC responses to Comments DTSC-23 and 24. DTSC awaits revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-65 M	Sec 6.3, page 6-10, 1st sentence.	The focus of the groundwater characterization should be to determine the magnitude and extent of potential contamination and not focus entirely on Cr. Although Cr is probably the most severe contaminant there hasn't been any data presented that would eliminate other chemical for consideration.	The wording for first paragraph of Section 6.3 (Present Distribution of Chromium in Groundwater) will be revised to clarify that this section (not the entire groundwater characterization program) is focused on the present distribution of chromium [Cr(VI) and Cr(T)] at the site.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-66 M	Sec 6.3, page 6-10, 1st sentence.	If the focus of this groundwater characterization was to present the distribution of chromium in the groundwater, why were parameters other than Cr included in the analytical suite?	In response to this comment, the first sentence in Section 6.3 (Present Distribution of Chromium in Groundwater) will be modified as follows: "This section focuses on the present distribution of chromium in groundwater at the site."	DOI accepts the comment response and directs PG&E to revise the sentence to read : "This section focuses on the present distribution of chromium in groundwater associated with releases from SWMU1/AOC 1 and AOC 2."
Envirometrix (on behalf of the Colorado River Indian Tribe)	EMC-9	Sec 6.3	EMC previously commented that for figures that present the extent of groundwater contamination (i.e. Figures 6-1 to 6-9) it is difficult to get a clear understanding of what the actual defined limits and extent of groundwater contamination is. Rather the figures present colored dots that represent concentration ranges rather than providing actual concentration contours of groundwater contamination. Where is single contour line if provided (i.e. Cr(VI)) it shows an outlined only related to 50 ug/L. We would like to know if this approach is consistent with and achieves RCRA and CERCLA stated objectives described in Section 1.3 to define the nature, degree and extent of contamination. It is our opinion that appropriate contour maps would assist in this understanding. PG&E response states that the existing Section 6.3.3 provides the rational for using the California Cr(T) maximum concentration limit drinking water standard for defining the extent of chromium and is consistent with RCRA and CERCLA objectives and ARARs. Accordingly, no changes have been made to the report. While PG&E feels strongly that contouring of data would not result in a more clear depiction of distributions, it is EMC's opinion that contouring of data provides more accurate representation of the lateral and vertical extent of groundwater contamination and would assist in the identification of any significant data gaps. Further, without the preparation of contour maps (i.e. Cr(T) and Cr(VI) to levels lower than 50 ug/L how do we know the	The Cr(VI) distribution maps (Figures 6-9a-c) will be revised to present the posted concentrations (color-classed dots) and the Cr(VI) isoconcentration contours for the Cr(VI) site background UTL of 32 ug/L, and internal contours of 100, 1,000, and 10,000 ug/L based on the comprehensive October 2007 groundwater sampling event. As noted in the response to RWQCB #4 comment above, the text statements comparing the Cr(T) ARAR to the site UTL for Cr(VI) are not needed given the revised Cr(VI) distribution maps. For the non-chromium metals (e.g., Cu, Ni, Zn, etc), the average-concentration results are posted by color-classed ranges to illustrate metals distribution over the full RFI/RI sampling record. Hence, isoconcentration contouring is not applicable for presenting the distribution of the average metals concentrations from long sampling periods.	DOI directed PG&E to prepare Cr(VI) plume maps that delineate the extent of Cr(VI) contamination in groundwater to the background UTL value of approximately 32 ug/L, and that include internal contours of 100, 1,000, and 10,000 ug/L. DOI concludes that such maps would satisfy CERCLA objectives for defining the nature and extent of groundwater contaminated from Cr(VI). DOI concurs with the use of the colored dot maps for depiction of the nature and extent of contamination in groundwater from other metals. DTSC concurs with PG&E's response.

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			actually extent of groundwater contamination and how will the effectiveness of any future groundwater remedial action be evaluated? Therefore, we are requesting that DOI and DTSC evaluate this comment and provide a response to CRIT and PG&E.		
Metropolitan Water District	MWD-19	6.3.1 Lateral Chromium Distribution in Alluvial Aquifer, page 6-11	In paragraph three and four it discusses “five mid-depth” and “five deep wells”, respectively. It is not clear from Figures 6-9b and 6-9c how many wells there are; the figures show three wells. We recommend a clarification of this discussion.	The text will be clarified to state that there are three discrete mid-depth and three discrete deep monitoring wells, and two dual-completion (mid-depth and deep) recirculation test wells in the uplands ISPT area.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with PG&E’s response.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-8	Sec 6.3.2.1	The discussion in this section of potential factors that combine to produce vertical variability in the distribution and trends of chromium in the site groundwater is helpful. It would also be helpful to depict the evolution of the vertical patterns observed in cross sections or at least one cross section through the IM wells in a graphic similar to Figure 6-19.	It was felt that the presentation of vertical chromium distribution in groundwater in the RFI/RI Report should be focused on the current site condition (e.g., 2007 vertical distribution data). The text does reference the Cr(VI) graphs on Figure 6-17 to illustrate the temporal changes in Cr(VI) concentrations that have been observed near the IM-3 pumping, Also, the concluding paragraph to Section 6.3.2.1 cites the changes in water quality that have been observed at monitoring locations near the IM extraction and injection wells and references the IM performance and compliance monitoring reports for the data (and temporal trends). Accordingly, no additional figure(s) are proposed to depict the evolution of changes in the vertical distribution of chromium.	DOI accepts the comment response. DTSC concurs with PG&E’s response.
Metropolitan Water District	MWD-20	6.3.2.1 Vertical Chromium Distribution at Well Clusters, page 6-12 to 6-13	The second paragraph on page 6-12 discusses the range of Cr(VI) concentration in the vertical well cluster for the in-situ pilot tests. Where is that data? It states that higher concentrations are exhibited in the shallow wells. Is there a table or figure? Also the possibility for density-driven transport early on near the source area may have contributed to higher concentrations at depth in the area and should be considered (RFI/RI page 6-21, first paragraph and Section 6.7.1). We recommend a clarification of this paragraph along with proper figure and data references. In addition, we recommend inclusion of density-driven flow as a possible contributing factor early on in the groundwater contamination.	Section 6.3.2.1 discusses the current (October 2007) vertical chromium distribution observed at well clusters, citing the data and clusters presented on the chromium results cross-sections. The uplands ISPT well clusters installed in June 2007 and the chromium distribution data are shown in Table 6-4. The text will be clarified for the location of the data and applicable cross-sections used to support the discussion of the 2007 vertical chromium distribution. The third paragraph to Section 6.3.2.1 discusses the factors that have contributed to the vertical distribution trends. The role of density-driven flow on the vertical distribution of chromium in the Alluvial Aquifer near the source area will be discussed.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-28	Sec. 6, Page 6-10, Section 6.2.3.5 - Other Trace Metals, Selenium, Paragraphs 5 and 6	The paragraphs conclude that selenium is not recommended for consideration as a COPC. Based on additional data collected after the October 2007 cut off date, it is recommended that selenium be carried forward as a COPC. This is requested due to confirmed selenium concentrations exceeding both regional background concentrations and/or the MCL. The selenium MCL is consistently exceeded at TW-1 and now at MW-24A located in the vicinity of TW-1. Selenium is also elevated above regional background in MW-24B, MW-26 and MW-51 (CH2M Hill, 2008a and 2008b). The elevated selenium in these wells occurs within the chromium plume and could have resulted from a historic release to Bat	The section will be updated to discuss selenium, but PG&E does not believe the distribution of selenium, warrants consideration as a COPC at this time. Well MW-24A was sampled three times between December 2007 and May 2008, and although one sample exceeded MCL, the other two were at or below the detection limit of 5 µg/L, one-tenth of the MCL. More data would be required to make a definite evaluation of the MW-24A well area. The one sample collected at MW-24B was 14.3 µg/L, only slightly above the background UTL of 10.3 µg/L. While the three recent samples from MW-26 and MW-51 (same geographic location, different depths) are above the UTL, the means of both sets of three data points are 15.3 µg/L,	DOI understands that DTSC and PG&E have discussed the distribution of selenium further and have agreed to retain selenium as an RFI/RI identified COPC. DTSC: DOI’s understanding regarding selenium above is correct. DTSC awaits the actual revised language suggesting selenium as a constituent related to releases from the Topock Compressor Station. DTSC concurs that additional selenium data is warranted to better understand its distribution and occurrence.

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			Cave Wash. Another source for the elevated selenium concentrations has not been identified. Revision to this section is therefore requested.	and similar UTL exceedances are found at non-plume well MW-5 (18.8 µg/L average from two samples). If selenium were to be further considered, additional data would need to be collected to make a stronger case.	
Department of Toxic Substances Control	DTSC-29	Sec. 6, Page 6-12, Section 6.3.2.1 - Vertical Chromium Distribution at Well Clusters, Paragraph 6	This paragraph, as well as the section, does not discuss vertical chromium distributions outside the plume. The paragraph should briefly indicate that low level chromium concentrations are noted to decrease with depth (to below detection limits) in the injection well field area.	The text will be clarified as noted.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-67 M	Sec. 6.3.2.1, page 6-13, 1st Paragraph. after bullets	Why would this explanation not apply to the other metals that were detected randomly throughout the area?	This explanation was predicated on the fact that Cr(VI) was discharged to Bat Cave Wash over a period of 14 years or more. Distributions of other metals were examined to see if their distribution would fit a plume-like pattern, the way Cr (VI) does.	DOI accepts the comment response. PG&E should, however, be aware this may be an issue in the future in regards to other potential groundwater sources or contaminants.
Department of Toxic Substances Control	DTSC-30	Sec. 6, Page 6-13, Section 6.3.3 - Chromium Plume Delineation, Paragraphs 1 and 2	Reference to ARARs and the 50 ug/L concentration limit as a defining component to chromium plume definition is not appropriate because defining the plume above background levels is routinely conducted to adequately assess risk. Also see the comment regarding Figures 6-9a, b, and c below. Modification to the paragraphs is recommended. Reference to ARARs in other sections (e.g., Section 10.1.2.1, page 10-2) of the Report may need to be modified to reflect plume delineation to background concentrations.	The text will be clarified and the Cr(VI) distribution maps (Figures 6-12a-c) will be revised to present the posted concentrations (color-classed dots) and the chromium plume delineation based on the site background UTL for Cr(VI). For practical presentation purposes, the isoconcentration line of 32 µg/L Cr(VI) (the Cr(VI) UTL rounded to whole unit) will be used on the results maps and internal contours of 100, 1,000, and 10,000 ug/L based on the comprehensive October 2007 groundwater sampling event. The text in Section 10.1.2.1 (Conclusions) will be updated accordingly.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-68 M	Section 6.3.3, Page 6-13	Discontinue the use of 50 ug/L as a basis for Cr(VI) plume delineation. 50 ug/l is not an ARAR for Cr(VI) nor is it the Cr(VI) background value. The Cr(VI) plume should be delineated based on values exceeding the calculated background concentration for Cr(VI) of 31.8 ug/L. Reasoning that the plume delineation will not differ substantially if 50 ug/L is used is not a technically defensible basis for continuing to use this criterion now that a background value has been established.	The text will be revised to indicate that 32 µg/L (the site background UTL of 31.8 µg/L for Cr(VI) rounded to the whole unit) will be used to delineate the chromium groundwater plume. As noted in the response to RWQCB #4 comment above, the text statements comparing the Cr(T) ARAR to the site UTL for Cr(VI) are not needed given the revised Cr(VI) distribution maps using the site background UTL for delineation.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-69 M	Section 6.3.3, Page 6-14, last paragraph	Revise the text to reflect that the Arizona well installation and sampling work has already been accomplished and will be reported in the Volume 2 Addendum. The current future tense language of this section is confusing given that this report is being submitted in 2008 after the Arizona well installation has been completed.	In response to this comment, the second and third sentences in Section 6.3.3. will be revised to state: "A supplemental groundwater investigation in March and April 2008 included the installation of additional monitoring wells (including a slant monitoring well) in locations along the east shoreline of the Colorado River in Arizona as described in the *Installation Report for Wells on the Arizona Shore of the Colorado River at Topock Arizona*, dated August 12, 2008 (CH2M HILL 2008)."	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-9	Sec 6.3.3	Refer to the general comment and other previous comments concerning identification of the disposition of outstanding studies and issues. The last sentence in this section is the type of statement that needs to be made with regard to each and	Comment is noted and the revised text will clarify the status and disposition of outstanding groundwater studies and issues.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC concurs with the response

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			every ongoing study and forthcoming document.		
U.S. Department of the Interior	DOI-70 M	Section 6.3.4, Page 6-14	This discussion makes no mention of the alluvium/bedrock contact and shallow bedrock related groundwater investigations to be conducted in the East Ravine or at the Compressor Station. Although the results of those investigations will be reported separately in the Volume 2 Addendum, they should be mentioned here to make clear that bedrock-related data gaps exist for the site and are being addressed by supplemental investigations.	Reference to the East Ravine alluvium/bedrock contact and shallow bedrock groundwater investigation, and citation of Figure 6-17 for location and Section 6.7.2 for site conceptual model, will be added to Section 6.3.4.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-31	Sec. 6, Page 6-15, Section 6.3.4 - Chromium Sampling Results for Bedrock Units, Paragraph 2	The conclusion for the MW-23 data assessment should indicate that elevated hexavalent chromium concentrations detected in well MW-23 are suggestive of a release to the shallow bedrock unit in the area that will be further evaluated through the East Ravine Work Plan. Based on all the currently available bedrock data, an unaffected bedrock well should not detect chromium and should exhibit negative oxidation reduction potential (ORP) values.	Section 6.3.4 summarizes the results of groundwater sampling of the site bedrock wells including shallow bedrock well MW-23. Reference to the East Ravine shallow bedrock groundwater investigation, and citation of Figure 6-17 for location and Section 6.7.2 for site conceptual model, will be added to Section 6.3.4.	DOI defers judgment on the adequacy of this response pending review of DTSC's response. DTSC: The RFI Report needs to acknowledge that even the lower level chromium concentrations detected in bedrock well MW-23 are suggestive of impact to bedrock. Based on the limited bedrock information currently available, an unaffected bedrock well should not detect chromium and should exhibit negative oxidation reduction potential. DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-32	Sec. 6, Page 6-16, Section 6.5 - Plume Geochemistry, Paragraph 3, Line 4	The sentence mentions the background hexavalent chromium value of 31.8 ug/L, but does not mention limitations associated with that number (e.g., fluvial formation waters should have a low to non-detect value – also see cover page to the January 14, 2008 Background Study Report). The section should mention the limitations on the use and interpretation of the hexavalent chromium background value and its affect on plume delineation. Additionally, the 2008a reference cited in this sentence does not correlate with the Section 11 reference. A review of the accuracy of Report references is therefore suggested.	The Background Study UTL is used in this paragraph as a general description term to introduce the section on Cr(VI) plume geochemistry. It is not intended to define distribution in all geochemical environments – as the section begins, this frames the plume "in the simplest sense." Reduced concentrations in the fluvial areas are discussed later in the section when a more detailed breakdown of distribution is warranted. In response to this comment, an additional paragraph will be added to Section 6.1.2 that reiterates the key points outlined in PG&E's letter to DTSC dated January 14, 2008 about the potential limitations for use of the groundwater background study results. The references will be checked for accuracy.	DOI recommends that PG&E address this comment in the same manner as proposed for comment DTSC-17. DTSC: DTSC concurs with DOI's recommendation.
U.S. Department of the Interior	DOI-71 M	Section 6.5.1, Page 6-16	This section makes numerous assertions regarding the presence or absence or organic carbon and its influence on the oxidizing/reducing conditions of the alluvial and fluvial sediments. If sample data on organic carbon content are available to directly support these assertions, then they should be cited. Otherwise, the text should make clear that these are speculative interpretations deduced from the observed distribution of oxidizing and reducing conditions, rather than direct observations of organic carbon content from sample data.	There are organic carbon data available from a limited number of core samples used in anaerobic core testing, and that report will be cited. It will be made clear that the microbial activity involving organic carbon as a substrate is the most commonly cited mechanism for chromium reduction in the environment.	DOI directs PG&E to clearly differentiate scientific speculation from known facts based on measured data when explaining its assessments.
Metropolitan Water District	MWD-21	6.5.1 General Chemistry, page 6-18	The first paragraph describes Cr(VI) variability. It is possible that density driven transport early on may have also contributed to the distribution and should be included. As stated above, we recommend inclusion of density-driven flow as a possible contributing factor early on in the groundwater	The paragraph will be revised to state "Due to the way the cooling towers were operated at the time, the density of the blowdown water in the early years of compressor station operations was likely significantly greater than natural groundwater. During this time the discharge would have tended to sink downward as it migrated through the aquifer. In addition, extraction	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response, but awaits the actual revised language so that it can be reviewed and approved.

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			contamination.	from the original facility supply wells PGE-1 and PGE-2, located about 800 feet downgradient, would be expected to spread the Cr(VI) concentration both laterally and vertically by pumping over a large perforated interval."	
U.S. Department of the Interior	DOI-72 M	Sec. 6.5.1, Page 6-17, 2nd full Paragraph.	Why is it necessary to differentiate between plume and non-plume wells for this discussion? This discussion also suggests that the TDS values are related to the operation of the facility over the years. Previous discussion has eliminated the TDS and being site related or needing further evaluation. Provide further explanation.	The discussion about TDS distribution in plume and non-plume wells was specifically requested by DTSC, in comments on the 2005 RFI/RI Report. The text will be modified to state the concepts put forth in response to DTSC comment #25.	DOI understands that DTSC and PG&E have discussed the distribution of TDS further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and review of any proposed revisions to the report. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-10	Sec 6.5.1	The last sentence in the second paragraph states: "In a high-concentration Cr(VI) area such as the plume, however, the small amount of reducing material has long been used up by the overabundance of anthropogenic Cr(VI)." What evidence supports this statement? b. Perhaps a series of figures showing the conceptual evolution of the Colorado River would help illustrate the points in the second paragraph on p 6-17.	This statement was based on the estimated Cr(VI) mass in the plume, coupled with measured total organic carbon (TOC) from the aerobic core study. The general chemical equation for Cr(VI) reduction by TOC was used to show that TOC would be used up by the overabundance of Cr(VI). This will be explained in the text. Diagrams of river evolution would bring details on a subject that are not key to the RFI/RI goals. The statement was made as a possible explanation, but is not a definitive explanation for the persistence of Cr(VI) at depth. We feel that the report already has an abundance of figures that depict known facts about the site, and adding one more that simply illustrates a theory is not warranted.	DOI directs PG&E to clearly differentiate scientific speculation from known facts based on measured data when explaining its assessment. DTSC concurs with the response, but awaits the actual revised language so that it can be reviewed and approved.
Metropolitan Water District	MWD-22	6.5.2 Stable Isotopes, page 6-18	There are five separate citations for Figure 5-22a which should be 5-23a.	The figure citations will be corrected.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as indicated.
Department of Toxic Substances Control	DTSC-33	Sec. 6, Page 6-20, Section 6.5.2 - Stable Isotopes, Paragraph 2	The paragraph makes several incorrect references to Figure 5-22a contained in section 5. The paragraph should be revised to reference the correct figure.	The figure references will be changed to 5-24a.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as indicated.
Department of Toxic Substances Control	DTSC-34	Sec. 6, Page 6-20, Section 6.6 - Site Conceptual Model of Chromium Plume Migration in Groundwater, Paragraph 4	The second sentence of the paragraph below does not make sense and should be revised. It is important to properly summarize the significant factors believed to have generated the current chromium plume configuration. "Stage 3 conditions have produced the present-day 50 µg/L Cr(VI) contour in the third panel of Figure 6-20. The plume groundwater has followed the influence of historical groundwater mounding beneath Bat Cave Wash caused by the discharge from early pumping in PGE-1 and PGE-2, and finally from the natural flow towards the floodplain	The sentence will be edited for clarity.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.

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			around a bedrock high in the southern part of the site."		
Department of Toxic Substances Control	DTSC-35	Sec. 6, Page 6-21, Section 6.7.1 - Mobility of Chromium, Paragraph 2, Line 2	The first sentence of the paragraph states, "Once Cr(VI) encounters reducing fluvial materials, it is quickly reduced to Cr(III)." This sentence should be revised to acknowledge the exceptions to this statement and that there are several site groundwater wells (e.g., MW-30-50, MW-33-90, MW-34-080, MW-34-100, MW-36-090, MW-36-100, MW-39-050, MW-39-060, and MW-45-095a) that monitor the fluvial portion of the aquifer that have detected hexavalent chromium.	The statement is true as worded; it is meant to describe the documented mechanism and kinetics of Cr(VI) transformation in the presence of reducing materials. It was not meant to imply that all measured groundwater samples will immediately reflect this mechanism. This will be clarified in Section 5.3.1.6. The list of monitoring wells that are completed in moderately reducing fluvial sediments and have Cr(VI) detections above laboratory reporting limits is presented in Section 6.5.1.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC is concerned that the cited sentence could be misinterpreted to suggest that chromium would not persist in fluvial wells for any length of time when actual site data illustrates that many fluvial wells have detected hexavalent chromium in groundwater. The Report should clearly indicate that hexavalent chromium persists or has routinely occurred in several fluvial wells. A list of these wells should be provided. The Report should discuss the mechanisms for chromium persistence in fluvial wells. DTSC will review the actual revised language for approval.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-11	Sec 6.7.1	Referring to Comment 7c, this again is where a diagram might be useful in explaining this discussion of geochemical thermodynamics.	See response to H+A-7c.	DOI accepts the comment response. DTSC concurs with the response.
Department of Toxic Substances Control	DTSC-36	Sec. 6, Page 6-22, Section 6.7.1 - Mobility of Chromium, Paragraph 1, Line 12	Reference to Figure 5-22a is incorrect and should be revised.	The figure reference will be revised.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as indicated.
Department of Toxic Substances Control	DTSC-37	Page 6-22, 6.7.2 - Fate and Mobility in East Ravine, Paragraph 3, Last sentence	The section states, "Due to the absence of the Alluvial Aquifer, movement of the groundwater chromium plume associated with the Bat Cave Wash discharge through this area [East Ravine bedrock] is highly improbable." (insert added) The statement quoted above is unfounded and even contradicted by the following text found on page 6-23 of the Report, "Concentrations of Cr(VI) similar to the sporadically-elevated concentrations found in MW-23 are found in the alluvial aquifer near well MW-12, approximately 500 feet from MW-23. The sporadically-elevated Cr(VI) concentrations in MW-23 may be related to intermittent groundwater flow through localized fractures that connect to the nearby alluvial aquifer." Section 10.1.2.1 also discusses that the source of chromium at well MW-23 may be from a connection to the alluvium. It is recommended that the first quote above (page 6-22) be deleted from the Report. If an additional groundwater chromium source is not identified as a result in the East Ravine groundwater investigation, then it must be assumed that the chromium detections in bedrock well MW-23 are related to the known plume (e.g.,	This section will be revised to clarify that all available data indicate bedrock permeability at the site is much lower than permeability in the alluvial aquifer and that upward gradients exist between bedrock and the alluvium. Therefore, the preferential flow path for groundwater from Bat Cave Wash would be through the alluvium to the area of MW-12 and not through the bedrock underlying the Compressor Station and the East Ravine to well MW-23.	Revise Section 6.7.2 as follows: "The site conceptual model developed for the RFI/RI reflects a collective understanding that the groundwater chromium plume is confined to the Alluvial Aquifer and is bounded, south and southeast of the compressor station, by the Miocene Conglomerate and older crystalline bedrock that underlie the site. This is based on the large contrast in permeability between the bedrock and alluvial aquifer, and the observed upward hydraulic gradient between the bedrock and the overlying alluvial aquifer. It is also noted that chromium is absent in the limited number of samples obtained from bedrock monitoring wells, with a few exceptions. The geologic map presented in Figure 3-5 shows the surface outcropping of the Miocene Conglomerate in the south and southeast of the site, and the cross-section presented in Figure 5-5 shows the limits on the Alluvial Aquifer to the south of the site. Within the framework of the RFI/RI site conceptual model, the presence of bedrock at the surface (i.e., the absence of saturated alluvial material) to the south and southeast of the compressor station precluded the installation of Alluvial Aquifer wells in this region. Due to the absence

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			neighboring alluvial well MW-12) reported to have originated from historic Bat Cave Wash discharges.		of the Alluvial Aquifer, movement of the groundwater chromium plume associated with the Bat Cave Wash discharge through this area has been considered improbable. Anomalous elevated concentrations of Cr(VI) have recently been observed sporadically in well MW-23 (detailed in Section 6.3.4). MW-23 is a shallow bedrock well located immediately north of the mouth of East Ravine. As discussed in Section 6.3.4, the origin of the sporadic and anomalously-elevated Cr(VI) concentrations in MW-23 is unknown. Concentrations of Cr(VI) similar to the sporadically-elevated concentrations found in MW-23 are found in the alluvial aquifer near well MW-12, approximately 500 feet from MW-23. The sporadically-elevated Cr(VI) concentrations in MW-23 may be related to intermittent groundwater flow through localized fractures that connect to the nearby alluvial aquifer. Because elevated Cr(VI) has not been detected in other bedrock wells or in the former injection well PGE-8, it is considered less likely that the sporadically-elevated Cr(VI) concentrations in MW-23 are related to flow through the bedrock from PGE-8. In contrast to other bedrock wells, MW-23 typically contains detectable Cr(VI) concentrations and often has a positive or only slightly negative ORP. This may be a further indication of a fracture connection between MW-23 and the alluvial aquifer. Currently, an additional groundwater investigation is planned to characterize the groundwater conditions of bedrock formations in the East Ravine and MW-23 area. Figure 6-14 shows the general locations of the proposed drilling sites for the East Ravine groundwater investigation. Results of this investigation will be presented in future reports." DTSC: DTSC concurs with DOI's modification above, but also wants to include the two large existing paragraphs in the Report that begins on the bottom of Page 6-22 (PGE-8 background) and ends on 6-23 with a paragraph discussing East Ravine background and concepts (e.g. aerial photographs). Also note change to section 6.3.4 in the DOI text above.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-12	Sec 6.7.2	This section also commits to reporting this information in forthcoming documents. However, it is not specific as to which documents and when.	The revised text will clarify the status and disposition of the planned East Ravine groundwater investigation.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-38	Sec. 6, Page 6-24, Section - 6.7.3.1 Salinity, Paragraph 1, Line 8	Reference to Figure 5-18 is incorrect and should be revised.	The reference in Section 6.7.3.1 to the cross-section figure with groundwater TDS results will be corrected.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as indicated.
Metropolitan Water	MWD-23	6.7.3.1 Salinity,	On page 6-24 there is a citation for Figure 5-18,	The reference in Section 6.7.3.1 to the cross-section	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in

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District		pages 6-24 to 6-25	which should be 5-19. On page 6-25, the third sentence in the second paragraph should read "The average TDS concentrations in these wells **in the deep interval** are …."	figure with groundwater TDS results will be corrected. Clarified wording to the prior sentence in the second paragraph will be added.	its response. DTSC concurs with the response.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-13	Sec 6.7.3.2	Minor edit: Centigrade should be replaced with Celsius.	The word correction will be incorporated.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response.
U.S. Department of the Interior	DOI-73 M	Table 6-4	How can the total chromium values exceed the hexavalent chromium values? Is the hex chromium part of the total chromium? Why are the pH values estimated? If the pH was taken with a meter at the time of collection, was there a problem with the meter?	Total chromium can exceed hexavalent chromium if there are colloids present in the sample that contain Cr(III). Additionally, dissolved Cr(T) and Cr(VI) are analyzed using different analytical methods and hence may yield minor variations in the result quantified. Beginning in 2007, the holding time for pH was reduced to 15 minutes. Because there is no certified lab within 15 minutes of the Topock site, all of these samples are outside of holding time and therefore received a "J" flag.	DOI accepts the comment response.
U.S. Department of the Interior	DOI-74 M	Section 6 Figures	Where possible, the posted color ranges should be correlated with meaningful concentration values (i.e., calculated background and chemical specific ARAR values) rather than the arbitrary values currently used. Decision making will be based on whether concentrations indicate site-related contamination based on comparison to background, exceed ARARs, or exceed risk-based levels. The color range values currently used have no relevance to any of these criteria. In the event that the applicable ARAR values far exceed the highest constituent concentrations, it is acceptable to establish arbitrary color range values to provide insight into relatively higher concentration areas, but this should be explained and not used in lieu of ARAR values. For example; use of arbitrary non-ARAR values to illustrate relatively higher concentrations for constituents like copper is appropriate; but use of 20 ug/L for lead as an arbitrary criterion when the ARAR for lead is 15 ug/L is not appropriate. Add a note regarding the specific ARAR values that apply to each applicable chemical constituent. Revise the Cr(VI) plume outline to reflect plume delineation at the calculated background value of 31.8 ug/L, rather than 50 ug/L.	The changes will be made as requested. Background UTL values were used as a color category boundary in all metals distribution figures. For most of the metals in these figures, ARARs were either much higher than observed concentrations (Cu, Ni, Zn), non-existent (Mo), or used in the figure (As). ARARs for lead and selenium will be incorporated on revised figures. The text will be revised to indicate that 32 µg/L (the site background UTL of 31.8 µg/L for Cr(VI) rounded to the whole unit) will be used to delineate the chromium groundwater plume.	Add a note regarding the specific ARAR values that apply to each applicable chemical constituent.
Department of Toxic Substances Control	DTSC-39	Figure 6-2	The figure titled, Copper Concentrations in Groundwater, 1997-2007, contains a few errors that warrant additional data quality checks for Figures 6-2 through 6-8. On Figure 6-2, the color coding appears incorrect for the following wells: MW-20-70, MW-20-100, and MW-20-130. Additionally, these wells are reported on the figure to have detected copper 100 percent of the time. This is not accurate and should be revised.	The color-coding and data reporting will be checked for all trace metals.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC concurs with PG&E's proposed change and awaits the revised figure(s) so it can be reviewed and approved.

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U.S. Department of the Interior	DOI-75 M	Figure 6-6, Arsenic	Revise the color criteria to correlate with the background value of 24.3 ug/L and the Federal MCL of 10 ug/L. Add notes regarding the background values and CA/Federal MCL values.	These values were used in the color criteria. Notes will be added to the figures to clarify the background and ARAR values.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-40	Figure 6-8	The figure titled, Selenium Concentrations in Groundwater, 1997-2007, was found to contain errors (MW-20 well cluster). A revised figure was provided to DTSC via email on August 29, 2008. This revised figure has two sampling events for TW-02S and TW-02D. An older electronic data base provided to DTSC includes three sampling events (one related to an IM2 sampling event). A revised figure should be included in the Report. The two versus three sampling event issue for wells TW-02S and TW-02D also applies to other figures (e.g., Figure 6-6).	The figures will reflect the correct dataset.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC concurs with PG&E's proposed change and awaits the revised figure so it can be reviewed and approved.
U.S. Department of the Interior	DOI-76 M	Figure 6-8, Selenium	Revise the color criteria to correlate with the background value of 10.3 ug/L and the CA and Federal MCL of 50 ug/L. Add notes regarding the background values and CA/Federal MCL value.	The background UTL was used; the MCL of 50 µg/L will be used. Only well TW-1 exceeds this value. Notes will be added to the figures.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-41	Figures 6-9a, b, and c	As mentioned during the August 19, 2008 TWG meeting, figures delineating the chromium plume should be contoured to background concentrations, not just a 50 ug/L value. This should include a hexavalent chromium contour line of 31.8 ug/L. Due to the limitation of applying the background value to fluvial formation waters, it is also requested that fluvial wells with detectable concentrations of chromium also be identified on these figures as well as in tables and/or text.	The groundwater Cr(VI) results distribution maps will be revised to show the chromium plume delineation using the cited site background UTL for Cr(VI). For practical presentation purposes, the isoconcentration line of 32 µg/L Cr(VI) (calculated UTL rounded to whole unit) will be used on the results maps. See response to DOI-77 comment for additional revision to these figures.	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC concurs with PG&E's proposed change. However, as originally requested, please also identify fluvial wells with detectable concentrations of chromium on some figures (utilize special well symbol, etc.) as well as on tables and/or text.
U.S. Department of the Interior	DOI-77 M	Figure 6-9a, b, and c; Cr(VI)	Add iso-concentration contours to better illustrate the Cr(VI) distribution within the plume. The site-related plume boundary should be based on the calculated background value of 31.8 ug/L, not 50 ug/L. Interior contour lines at 100 ug/L, 1,000 ug/L, and 10,000 ug/L would provide insight into the distribution of Cr(VI) concentrations within the plume.	The groundwater Cr(VI) results distribution maps will be revised to show the chromium plume delineation using the cited site background UTL for Cr(VI). For practical presentation purposes, the isoconcentration line of 32 µg/L Cr(VI) (the Cr(VI) UTL rounded to whole unit) will be used on the results maps. Interior isoconcentration contours of 100 µg/L, 1,000 µg/L, and 10,000 µg/L will be added to the October 2007 Cr(VI) distribution maps, Figures 6-12a,b,c.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-78 M	Figures 6-10 and 6-11	Show the location of the SWMU 1 Former Percolation Bed on the cross sections	The projected location of the Former Percolation Bed in Bat Cave Wash will be shown on the two cross-sections cited.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-42	Figure 6-14	This figure titled, Locations of Additional Groundwater Investigations to Support the RFI/RI, should also include well installations proposed for the Part B soils investigation that will assess potential on-site source areas. This was mentioned to the TWG on August 19, 2008.	The general area(s) for the groundwater drilling and well installation that will be included in the Part B (inside the Compressor Station) soils investigation will be added to Figure 6-17.	Pending DTSC concurrence, DOI accepts the comment response. However, DOI directs PG&E to add the following note to the figure: "The location and number of wells proposed by PG&E to monitor potential on-site source areas during the Part B study have not been approved by agencies." DTSC: DTSC concurs with DOI's recommendation

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					above.
Department of Toxic Substances Control	DTSC-43	Figure 6-20	This figure illustrates the modeled chromium plume from 1960 to 1997. Text within the Report should discuss why the chromium plume persists in the upper reaches of Bat Cave Wash in the well MW-9 area and if the modeling suggests a potential contaminant source in the vadose zone or saturated zone that would continue to feed the plume. The discussion could address an estimated time at which uncontaminated upgradient waters would reduce existing contamination in the MW-9 area to background concentrations.	The plume persists in the upper Bat Cave Wash in this simulation because the original discharge area and its influence were fixed as part of the plume in the simulations. The goal of the simulations was to trace the groundwater flowpaths over time from this original discharge, but not to simulate the evolution of Cr(VI) concentrations. The model uses a simple particle tracking algorithm to simulate groundwater flow. As such, it does not provide information on whether a contaminant source is present in the vadose or saturated zone. Even with the most advanced solute transport and vadose zone transport models, it would not be possible to accurately project the time for concentrations to reach background in MW-9 without substantially more data on the distribution of chromium in the area, the amount of chromium sequestered in dead-end pores and low permeability zones, and the groundwater flow velocities specific to the MW-9 area.	Pending DTSC concurrence, DOI accepts the comment response. DTSC: DTSC concurs with PG&E's proposed change.
Section 7					
U.S. Department of the Interior	DOI-79 M	Sec 7 and Table 7-1	Section 7 and Table 7-1 references 300 mg/L $CaCO_3$ for hardness. It is necessary to know what the hardness is in surface water at/near Topock in order to determine if water concentrations meet or exceed surface water quality concentrations. Please provide a reference for 300 ppm hardness.	The 300 mg/L hardness value is a rough average of the hardness values from surface water analytical samples during the RFI/RI dataset period. Text will be added to Section 7 explaining the source of the 300 mg/L value.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-44	Sec. 7, Page 7-1, Section 7.1.1 - Chemical Parameters and Data Sets for Characterization, Line 4	The July 2007 date is in error and should be corrected.	The date will be corrected in the text.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as indicated.
Department of Toxic Substances Control	DTSC-45	Sec. 7, Page 7-1, Section 7.1.2 - Regulatory Standards for Surface Water	Arizona regulatory surface water standards are not mentioned in this section. The section should include a statement or discussion regarding how Arizona standards/ARARs compare to those already mentioned.	The June 2008 Preliminary Determination of Potential ARARs and TBCs provided by DOI deemed the Arizona surface water standards as not ARARs because "These standards are not more stringent than the equivalent federal standards." These ARARs were not available at the time of the prior 2005 RFI/RI Report, which used different comparison values that included the Arizona surface water standards. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	Pending DTSC concurrence, DOI accepts the comment response. DTSC: Please provide the PG&E Response in the Report as text or footnote as it provides useful clarifying language.
Department of Toxic Substances Control	DTSC-46	Sec. 7, Page 7-1, Section 7.2 - Surface Water Characterization Data, Line 9	It should be noted that unfiltered surface water data are currently being collected and may be used to assess risk to human health.	Text will be added to note that unfiltered surface water data that was collected after the October 2007 cutoff date which may be used to assess risk to human health in the risk assessment is not discussed in this report..	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC concurs with PG&E's proposed change.
Hargis + Associates, Inc. (on behalf of the	H+A-14	Sec 7.2.1.1	Referring to the issue raised in Comment No. 6, would the low-level chromium detections in the shoreline water of the Colorado River upstream	The low levels of Cr(T) detected upstream from the confluence of Bat Cave Wash may be indicative of a natural background concentration, however, they may	DOI understands that PG&E will provide additional discussion of the processes affecting Cr in the river. DOI reserves comment on the adequacy of the

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Fort Mojave Indian Tribe)			from the confluence with Bat Cave Wash indicate background concentration in the River? It seems that if there is a natural background of Cr(VI) in the groundwater of 31.8 micrograms per liter (statistical UTL, see. P. 6-16 for example), and there is groundwater discharging to the river along certain reaches, it is possible to have a natural background concentration of Cr(VI) in the river as well.	also be due to occasional colloidal breakthrough from sample collection. Other than false positives, there have been no detections of Cr(VI) in surface water samples above the analytical reporting limit. No changes to the RFI/RI Volume 2 are proposed in response to this comment. Given the common presence of reducing material in the shallow floodplain and river sediments, a significant portion of the natural Cr(VI) would be expected to be reduced to Cr(III) as it approaches the river and be removed from solution.	response pending receipt of the revised document. DTSC concurs with PG&E's response. DTSC also responded to Hargis + Associates separately in a letter dated December 24, 2008.
U.S. Department of the Interior	DOI-80 M	Section 7.2.1.3, page 7-4, "Manganese"	It appears there is an error in this section. Both average concentrations reported in the paragraph exceed the ARAR criterion of 50 ug/L.	The manganese section will be revised to correct the error. The average manganese concentrations exceed the ARAR criterion 50 ug/L because of elevated reporting limits in one sample each for both locations CON and I-3. The highest manganese concentration above the analytical reporting limit from the CON location was 5.5 ug/L. The highest manganese concentration above the analytical reporting limit from the I-3 location was 10 ug/L. Both of these maximum values are below the ARAR criterion of 50 ug/L.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-81 M	89. Sec 7.2.2.1, Page 7-5, Last sentence	It seems redundant to state that the Cr values were below the ARARs when the previous sentence stated that Cr was not detected above the reporting limits. The discussion of the potential interference is information that should be in the DQA.	The previous sentence regarding Cr(VI) not being detected above the reporting limits was specific to the verification samples. In contrast, the subsequent sentence summarizes the chromium sampling results for all the in-channel samples. The potential interference information was presented in response to the numerous stakeholder comments on the June 2002 false-positive Cr(VI) detections (Section 7.2.1.1) which requested additional information on the analytical quality. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI accepts the comment response.
Metropolitan Water District	MWD-24	7.2.4 Evaluation of Surface Water Characterization Findings, page 7-6	The second paragraph states "…there is no contamination in surface water from the past operations…" It can only be stated unequivocally that there is no surface water contamination during the monitoring period. We do not know for certain what occurred in the river prior to that period. This statement should be reworded to reflect that contamination to the surface water did not occur during the time period in which monitoring occurred.	The statement will be reworded to state "Based on the data in this report, there is no contamination in surface water from the past operations at the Topock Compressor Station during the monitoring period of the RFI/RI."	Rephrase the sentence as follows: "Based on data collected during the monitoring period of this RFI/RI, no site-related contamination of surface water was observed." DTSC: DTSC agrees with DOI's recommendation. The text is revised as requested.
U.S. Department of the Interior	DOI-82 M	Section 7.2.4	Please resolve the apparent manganese error. Either the values are reported in error, or they exceed the ARAR criterion of 50 ug/L.	The manganese section will be revised to correct the error. The average manganese concentrations exceed the ARAR criterion 50 ug/L because of elevated reporting limits in one sample each for both locations CON and I-3. The highest manganese concentration above the analytical reporting limit from the CON location was 5.5 ug/L. The highest manganese concentration above the analytical reporting limit from the I-3 location was 10 ug/L. Both of these maximum values are below the ARAR criterion of 50 ug/L.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Section 8					
Department of Toxic Substances Control	DTSC-47	Sec. 8, Page 8-2, Section 8.2.1 - Pore Water	Figure 4-7 should be referenced instead of Figure 4-6.	The text will be revised to reference Figure 4-7.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

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		Sampling (February 2003), Line 5			DTSC concurs with the response and directs PG&E to make the changes as indicated.
Department of Toxic Substances Control	DTSC-48	Sec. 8, Page 8-3, Section 8.2.2.2 - Sampling Results for General Chemistry Parameters, Specific Conductance and pH	The Report references that a site COPC (specific conductance) is greater in downstream locations as compared to locations located upstream of the site. Further discussion as to why the downstream locations exhibit the elevated specific conductance values as well as certain general chemistry parameters (e.g., sodium, chloride) should be included in the Report similar to the organic carbon discussion in section 8.2.2.4.	Text will be added to explain that the specific conductance at downstream locations are slightly higher than the upstream locations given that the confluence of the Topock Marsh, Park Moabi Slough, and Bat Cave Wash add to the dissolved content of the Colorado River. None of the average specific conductance values exceed the chemical-specific ARAR criteria of 1,600 µS/cm.	Unless this is definitively demonstrated through data collection, DOI directs PG&E to make clear the speculative nature of this statement. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-83 M	Sec. 8.2.2.2	There is no discussion of the analytical results for the other metals included in the analytical suite (Cu, Ni, Zn, and Pb). The fact that these metals were not included in the analytical suite should be discussed because they have been detected at varying concentrations in all other water samples associated with the site. What could be the reason for the large variation in the specific conductance results? Could this impact the other metal results?	The June 2003 pore water samples were analyzed for copper, nickel, and zinc. The January 2006 pore water samples were not analyzed for these metals. The variation in specific conductance is similar to the variation in specific conductance in the surface water samples. It is unlikely that the specific conductance range could significantly impact the other metal concentrations. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response to comments DTSC-48
Metropolitan Water District	MWD-25	8.2.2.4 Geochemistry of Site Pore Water, page 8-4	The last paragraph uses the word "any" preceding Cr(VI) in two places. This implies that the reducing zone has an infinite capacity and will remove all amounts of chromium that it comes in contact with. We do not know the chromium load or duration of contact that would exceed the capacity to reduce chromium in this zone. Extremely high concentrations and total mass, albeit unlikely, could breakthrough this zone and enter the river. We suggest the deletion of the words "any".	The word "any" will be removed from the 2 sentence in the last paragraph.	See DOI and DTSC response to MWD-3 above.
U.S. Department of the Interior	DOI-84 M	Section 8.2.2.4, page 8-4	The reported fluvial soil, river sediment, and pore water data support PG&E's interpretation that wide-spread reducing conditions exist that limit the potential for migration of Cr(VI) contaminated groundwater into the Colorado River, particularly north of the I-40 bridge. However, uncertainties remain in the distribution and extent of reducing zones, particularly south of the bridge where fluvial unconsolidated materials appear to thin and may be absent in some areas. Concerns also exist with respect to bridge piers that may have disrupted natural reducing zones. Moreover, the extent to which current reducing conditions provide a permanent barrier to Cr(VI) contaminant migration is uncertain. Legitimate questions remain about the total capacity of the sediments to reduce Cr(VI) to Cr(III), and the permanence of the immobilizing processes. DOI considers the presence of reducing zones in sediments between the existing Cr(VI) plume and	As described in the *Phase II Anaerobic Core Testing Summary Report* for the PG&E Topock Compressor Station, dated June 2008, anaerobic core testing on recently-collected samples near the river provide additional data on the range and magnitude of anaerobic reducing capacity in this area. However, the extent and average capacity of this area to reduce Cr(VI) will remain an estimate, as it is not possible to quantify these properties at all locations. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	See DOI and DTSC response to MWD-3 above.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
			river as a beneficial limiting factor for contaminant migration under current conditions. Existing data support the conclusion that Cr(VI) is not currently adversely affecting the Colorado River. However, existing data are not sufficient to conclude that reducing conditions will continue indefinitely to preclude migration of Cr(VI) to the river in the future. Additional study of the permanence of the reducing conditions and their potential to limit Cr(VI) migration in the future is warranted.		
Section 9					
U.S. Department of the Interior	DOI-85 E	Section 9	The reference for MacDonald et al. (2000) in Chapter 9 is incorrect. MacDonald et al (2000) should be Arch Environ Contam Toxicol 39:20 (not 38. 20 p).	The reference will be replaced with the correct one.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
U.S. Department of the Interior	DOI-86 M	Sec 9.2.1.2	Specify if the sediment samples were collected from a depth that would correlate with the sediments present during the period of time when there was active discharge of Cr contaminated water from the facility. Are these results considered representative of the potential Cr concentrations during the active discharge period or the current status of the sediments?	The rates of sedimentation or erosion at the mouth of Bat Cave Wash have not been measured so there is no way to know the depositional history of the sediment samples. The text will be revised to state that there is subsequent planned sampling after the RFI/RI Volume 2 cutoff date of the stratification of the sediments at the mouth of BCW to determine if there are contaminants at depths deeper than initially sampled.	Revise the text to state that during subsequent planned sampling the stratification of the sediments at the mouth of BCW will be evaluated to determine if there are contaminants at depths deeper than initially sampled.
Metropolitan Water District	MWD-26	9.2.2 Pore Water Study (2005–2006), page 9-2 to 9-3	The last paragraph states that the shallow sediments below the Colorado River favor reduction. The data for the sediments collected in 2005 were taken at 2 feet below river and there is no data presented for Redox-sensitive species (e.g., nitrate, ammonia, manganese and iron). The pore water samples were taken 6 feet below. There was limited data associated with the sediment samples collected in 2005. Therefore, the conclusions about reducing conditions cannot be definitively made. We recommend rewording this section to acknowledge the limited amount of data available from the 2005 sediment sampling and the inability to draw conclusions.	The text will be reworded to acknowledge the limited data from the sediment sampling and the conclusions drawn.	DOI does not accept PG&E's response. The limited data discussed in the section do not support the final sentence that conditions favor Cr(VI) reduction. Either cite the specific evidence or remove the conclusion. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
Department of Toxic Substances Control	DTSC-49	Table 9-2	A footnote should be included explaining what "B" stands for in the Manganese column.	A footnote will be added explaining the "B" in the manganese column.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as indicated.
Section 10					
U.S. Department of the Interior	DOI-87 M	Sec 10 General	There should be a statement about the data quality and a reference to any DQA or DQI that was conducted.	The data quality assessment summary for the RFI/RI Volume 2 dataset is provided in Appendix H1, and a reference in the text to this appendix will be added as well as additional discussion in Section 4.2.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. A summary of the data quality should also be added to the main document.
Department of Toxic Substances Control	DTSC-50	Sec. 10, Page 10-1, Section 10.1.1 -	The Report only cites the East Ravine area for additional groundwater characterization. The Report must also mention well installation proposed for the	In response to this comment, a second paragraph is proposed to be added to Section 10.1.1 stating: "Additional characterization of potential additional	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
		Completeness of the RFI/RI, Paragraph 3, Last Sentence	Part B soils investigation that will assess potential on-site source areas.	sources of impacts to groundwater at the Topock Compressor Station is ongoing. The results of the additional investigation will be reported in an addendum to RFI/RI Volume 2, RFI/RI Volume 3 or data summary reports, as appropriate, given the nature of the data and the affect on RFI/RI conclusions. Table 4-6 shows the anticipated reporting of additional groundwater data at the Topock Compressor Station following cutoff date for RFI/IR Volume 2.	DTSC concurs with the response and directs PG&E to make the changes as indicated.
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-15	Sec 10.1.1	Perhaps a table or a matrix would be a helpful inclusion or at least a way of tracking whether the report includes the necessary statements with regard to the disposition of outstanding reports and studies. The table below, for example provides a cross-listing of the outstanding reports and the various issues identified in the Tribe's reading of the Document. There may be more, however, this type of table clarifies PG&E's intent insofar as completing and reporting on these studies related to hydrogeological characterization.	In response to this comment, Section 4.3 (Related Site Investigation and Studies) will include a new matrix Table 4-6 that summarizes the outstanding and planned groundwater studies and investigation that have bearing on the groundwater RFI/RI. The anticipated schedule for the completion and reporting of the outstanding groundwater studies will be included in the summary table.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the submission of the table so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-88 M	Section 10.1.2.1, page 10-2, 2nd bullet, 2nd sentence	Bedrock data are not sufficient to conclude that the elevated chromium results at MW-23 are isolated. Revise the sentence to read "The chromium results observed at bedrock well MW-23 warrant additional characterization."	In response to this comment, the third sentence in the second bullet in Section 10.1.2.1 will be revised to state: "The chromium results observed at bedrock well MW-23 warrant additional assessment to better define this area along the southeastern site boundary."	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.
Department of Toxic Substances Control	DTSC-51	Sec. 10, Page 10-2, Section 10.1.2.1 - Groundwater Characterization, Third Bullet	The conclusion to not carry specific conductance forward as a COPC may need to be changed to address comments contained within this memorandum on Section 6.2.3.2.	Please refer to response to DTSC comment #25.	DOI understands that DTSC and PG&E have discussed specific conductance as a COPC further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report DTSC: DTSC awaits the actual revised language responding to DTSC Comment 25 to determine if this section will need revision.
U.S. Department of the Interior	DOI-89 M	Sec. 10.1.2.1, Page 10-2, 5th bullet	Specify the number of the wells that show exceedances of the ARARs that are within the Cr plume. Unless these metals can conclusively be shown not to be associated with the releases from the facility, it should be clear that these constituents will be carried forward to the risk assessment.	As described in the *Human Health and Ecological Risk Assessment Work plan, Topock Compressor Station, Needles, California,* prepared by ARCADIS for PG&E dated August 2008, all constituents showing detections in groundwater data contained in the RFI/RI Volume 2 and the forthcoming Volume 2 Addendum will be included in the risk assessment. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	Per discussions at the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to clearly explain the rationale for concluding that these metals are not associated with releases from SWMU 1 / AOC 1 or SWMU 2.
Department of Toxic Substances Control	DTSC-52	Page 10-3, Section 10.1.2.1 - Groundwater Characterization , First Bullet	The conclusion to not consider other trace metals (e.g., arsenic, molybdenum, and selenium) as COPCs needs to be modified based on comments contained within this memorandum on Sections 6.2.2.1 and 6.2.3.5.	Please refer to response to DTSC comment #23.	DOI understands that DTSC and PG&E have discussed the distribution of arsenic, molybdenum and selenium further and have agreed to retain molybdenum and selenium as RFI/RI identified COPCs. DTSC: DTSC awaits the actual revised language for this section so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-90	Sec. 10.1.2.1, Page 10-3, 1st	Do not agree that the trace metals identified in this and other sections throughout the document are	As discussed above in response to comment DOI-49, for purposes of the RFI/RI, constituents of potential	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
	S	bullet	"non-COPC metals." By definition if an analyte is identified for inclusion in the analytical suite, it should be considered a COPC. If the data from the investigations support the conclusion that these metals are below appropriate ARARS and have no inherent risk, then they can be eliminated from further consideration.	concern (COPCs) are those that were identified for each solid waste management unit (SWMU) and area of concern (AOC) at the PG&E Topock Compressor Station through a thorough review of site background, regulatory, and historic information about facility operations, chemical use, and waste management practices and documented in the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 - Site Background and History,* dated August 2007. The COPCs for SWMU 1/AOC 1 and SWMU 2 are repeated in Sections 2.1.3 and 2.2.2. The sampling and analytical program for groundwater characterization at SWMU 1/AOC 1 and SWMU 2 considered both COPCs (constituents likely to have been associated with wastewater discharge from the Topock Compressor Station based on historical research) as well as non-COPCs (no historic evidence of association with the wastewater discharge) in order to complete a thorough characterization of groundwater and to understand natural geochemical conditions. Those COPCs and non-COPCs that are found during the RFI/RI and risk assessment to warrant development of remedial action objectives will be carried forward into the CMS/FS as constituents of concern (COCs). Note that the Risk Assessment will address all constituents regardless of the determination in the RFI/RI of whether they are COPCs or not. PG&E is agreeable to work with the agencies to use language that is most meaningful.	consider all analyzed constituents as COPCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes PG&E: As agreed with DTSC and DOI in subsequent discussions, all constituents that were not sampled for general chemistry or fate and transport assessment purposes would be considered COPCs at the beginning of Volume 2. Based on the conclusions of Volume 2, constituents that merit further consideration would be considered COPCs in groundwater for SWMU 1/AOC 1. Text has been revised in Section 2.1.3 and throughout the document.
Department of Toxic Substances Control	DTSC-53	Sec. 10, Page 10-3, Section 10.1.2.1 - Groundwater Characterization, Second Bullet	The bullet states, "The historical discharge of high specific conductance wastewater at SWMU 1 does not correlate to the groundwater Cr(VI) plume and is not readily discernable from the naturally-occurring areas of high specific conductance groundwater at the site." This conclusion will need to be replaced with language that is in line with Section 6.5.1 which concludes that historic discharges may have contributed a lingering higher TDS to the plume area compared to non-plume portions of the aquifer. See also comments contained within this memorandum on Sections 6.2.3.2.	Additional information will be provided in Sections 5 and 6 regarding TDS distribution in groundwater. Please refer to response to DTSC comment #25. This text will be revised to be consistent.	DOI understands that DTSC and PG&E have discussed TDS as a COPC further and have reached resolution on this comment. DOI reserves judgment on this response pending review of DTSC's response and any proposed revisions to the report DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-91 M	Section 10.1.2.3, page 10-3, 1st paragraph	The reported pore water data support PG&E's interpretation that wide-spread reducing conditions exist that limit the potential for migration of Cr(VI) contaminated groundwater into the Colorado River, particularly north of the I-40 bridge. However, uncertainties remain in the distribution and extent of reducing zones, particularly south of the bridge where fluvial unconsolidated materials appear to thin and may be absent in some areas. Concerns also exist with respect to bridge piers that may have disrupted natural reducing zones.	As described in the *Phase II Anaerobic Core Testing Summary Report* for the PG&E Topock Compressor Station, dated June 2008, anaerobic core testing on recently-collected samples near the river provide additional data on the range and magnitude of anaerobic reducing capacity in this area. However, the extent and average capacity of this area to reduce Cr(VI) will remain an estimate, as it is not possible to quantify these properties at all locations. No changes to the RFI/RI Volume 2 are proposed in response to this comment.	See DOI and DTSC response to MWD-3 above.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
			Moreover, the extent to which current reducing conditions provide a permanent barrier to Cr(VI) contaminant migration is uncertain. Legitimate questions remain about the total capacity of the sediments to reduce Cr(VI) to Cr(III), and the permanence of the immobilizing processes. DOI considers the presence of reducing zones in sediments between the existing Cr(VI) plume and river as a beneficial limiting factor for contaminant migration under current conditions. Existing data support the conclusion that Cr(VI) is not currently adversely affecting the Colorado River. However, existing data are not sufficient to conclude that reducing conditions will continue indefinitely to preclude migration of Cr(VI) to the river in the future. Additional investigation into the permanence of the reducing conditions and their potential to limit Cr(VI) migration in the future is warranted.		
Hargis + Associates, Inc. (on behalf of the Fort Mojave Indian Tribe)	H+A-16	Sec 10.1.2.3	A statement is made in this section that: "… multiple lines of evidence for the presence of a naturally-occurring geochemical barrier that would prevent any Cr(VI) in groundwater from entering the river." This is a powerful and important conclusion of these extensive studies and of this Document. The Tribe believes that the multiple lines of evidence extend well beyond the pore water investigation. For example, anaerobic core data, ORP, Cr(VI) distribution, other geochemical properties of both groundwater and aquifer matrix materials, lithofacies, absence of Cr(VI) in River water, theoretical calculations of chemical thermodynamics, plume dynamics, chemical time series, etc. all provide ample evidence of the presence of the potential dilution effects of the Colorado River flow on Cr(VI) seepages into the River, assuming hypothetically that the "geochemical barrier" were ineffective. These questions have been posed by the Tribe over at least the past three years, yet there does not appear to be any focused study underway to address them. As pointed out, there is ample information available to evaluate these questions that are relevant to hydrogeologic characterization, risk assessment, and remedy decisions. Either such an assessment should be made within this Document or PG&E should commit to its inclusion in a future document.	The multiple lines of evidence supporting the ability of the anaerobic zone to reduce Cr(VI) will be made in Section 5.	The comment goes beyond requesting a discussion of the multiple lines of evidence for anaerobic conditions to reduce Cr(VI). The commenter also requests that PG&E address other processes, such as dilution effects, that would limit Cr(VI) concentrations in the river if the hypothetical "geochemical barrier" were ineffective. DOI considers the presence of reducing zones in sediments between the existing Cr(VI) plume and river as a beneficial limiting factor for contaminant migration under current conditions. The reported fluvial soil, river sediment, and pore water data support PG&E's interpretation that wide-spread reducing conditions exist that limit the potential for migration of Cr(VI) contaminated groundwater into the Colorado River. However, uncertainties remain in the distribution and extent of reducing zones. Moreover, the extent to which current reducing conditions provide a permanent barrier to Cr(VI) contaminant migration is uncertain. Existing data support the conclusion that Cr(VI) is not currently adversely affecting the Colorado River. However, existing data are not sufficient to conclude that reducing conditions will continue indefinitely to preclude migration of Cr(VI) to the river in the future. DOI agrees that other processes, such as dilution, would limit concentrations of Cr(VI) in river water if Cr(VI) were to reach the river. DOI defers acceptance of the comment response pending receipt and review of the revised language in a track changes revision to the document. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
Metropolitan Water District	MWD-27	10.1.2.3 Pore Water Characterization, page 10-3	The last sentence uses the word "any" preceding Cr(VI), which implies an endless capacity. As mentioned above, the word "any" should be deleted.	The last sentence of the first paragraph of Section 10.1.2.3 will be removed and clarifying language will be added.	DOI directs PG&E to remove the last sentence of the first paragraph of Section 10.1.2.3 as being too broad in its conclusions. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved
Department of Toxic Substances Control	DTSC-54	Sec. 10, Page 10-4, Section 10.1.2.4 - River Sediment Characterization, Paragraph 3	The paragraph indicates that no additional characterization work is required. This should be amended to indicate that soil and sediment sampling are being conducted around the mouth of Bat Cave Wash as part of Part A soil sampling.	In response to this comment, text will be added to the first sentence in the second paragraph in Section 10.1.2.4: "Soil and unsaturated sediment samples are being collected around the mouth of Bat Cave Wash as a part of the soil sampling program for SWMU 1/AOC 1. The soil and sediment data collected from the mouth of Bat Cave Wash will be reported in RFI/RI Volume 3."	Pending DTSC concurrence, DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC concurs with PG&E's proposed change provided it is included as text and not a footnote. Additionally, the first sentence of the cited paragraph must also be changed as it states that no additional characterization work is required. New, unreported, sediment data have not been provided to agencies for evaluation. These new data might warrant additional characterization activities.
Metropolitan Water District	MWD-28	10.1.2.4 River Sediment Characterization, page 10-4	The last sentence in the first paragraph states that the geochemical indicators in the sediment (sampled in 2005) show reducing conditions. The data in Table 9-3 shows TOC to be non detect, which is probably due to the high reporting level. There is no data presented on Redox-sensitive species (e.g., nitrate, ammonia, manganese, and iron). The river sediment sampling in 2003 (Table 9-2) has more data available than the sampling in 2005 (Table 9-3). Conclusions from the 2005 sampling are difficult to draw. We recommend rewording this section to strengthen the discussion and conclusions from the 2003 sampling and acknowledge the limitation of the data and conclusions from the 2003 sediment sampling.	The section will be reworded to acknowledge the limitations of the dataset and strengthen the discussion of the 2003 sediment sampling.	The limited data do not support the final sentence that conditions favor Cr(VI) reduction. Either cite the specific evidence or remove the conclusion. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-92 S	Sec 10.1.2.5, Page 10-4	The data show that the groundwater in the vicinity of the Topock site contains site related contaminants at concentrations that exceed the ARAR. The data are not sufficient to conclude that the other media were not affected in the past; only that contamination does not currently exist in those media at concentrations that exceed the ARAR.	PG&E agrees that the data collected provide information on the characteristics of the sampled media at the time that the samples were collected. The third sentence will be revised to say "Based on the data and conclusions presented in this report, the only medium that appears to be affected currently by the Topock Compressor Station is groundwater".	DOI directs PG&E to revise the third sentence as follows: "Based on the data and conclusions presented in this report, the only medium that appears to be affected currently by the Topock Compressor Station is groundwater."
Department of Toxic Substances Control	DTSC-55	Sec. 10, Page 10-4, Section 10.1.3 - Identification of COPCs in Affected Media	Conclusions regarding COPCs contained in this paragraph will need to be revised to address additional COPCs discussed in this memorandum. The paragraph should be further amended to indicate that, contrary to what is stated, elevated groundwater constituents (e.g., molybdenum, selenium, TDS) do coincide, in general, with the historical discharges to Bat Cave Wash.	Please refer to responses to DTSC comments #s 23 and 25.	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to consider all analyzed constituents as COPCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes. DOI understands that DTSC and PG&E have discussed the distribution of TDS, molybdenum and selenium further and have agreed to retain molybdenum and selenium as RFI/RI identified COPCs.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
					DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved.
U.S. Department of the Interior	DOI-93 M	Sec 10.1.3, Page 10-4, last sentence	The COPCs are identified in the initial planning activities and carried through the RFI/RI. When a list of COPCs that exceed various screening criteria and ARARs are identified, these COPCs are moved through the risk assessment process. The risk assessment is used to identify the COCs that present an unacceptable risk to human health and the environment that will need to be evaluated in the CMS/FS.	As discussed above in response to comment DOI-49, for purposes of the RFI/RI, constituents of potential concern (COPCs) are those that were identified for each solid waste management unit (SWMU) and area of concern (AOC) at the PG&E Topock Compressor Station through a thorough review of site background, regulatory, and historic information about facility operations, chemical use, and waste management practices and documented in the *Revised Final RCRA Facility Investigation and Remedial Investigation Report, Volume 1 - Site Background and History,* dated August 2007. The COPCs for SWMU 1/AOC 1 and SWMU 2 are repeated in Sections 2.1.3 and 2.2.2. The sampling and analytical program for groundwater characterization at SWMU 1/AOC 1 and SWMU 2 considered both COPCs (constituents likely to have been associated with wastewater discharge from the Topock Compressor Station based on historical research) as well as non-COPCs (no historic evidence of association with the wastewater discharge) in order to complete a thorough characterization of groundwater and to understand natural geochemical conditions. Those COPCs and non-COPCs that are found during the RFI/RI and risk assessment to warrant development of remedial action objectives will be carried forward into the CMS/FS as constituents of concern (COCs). PG&E is agreeable to work with the agencies to use language that is most meaningful	Per discussions during the December 3, 2008 RCRA/CERCLA meeting, DOI directs PG&E to consider all analyzed constituents as COPCs except for those general chemistry parameters analyzed strictly for assessment of natural groundwater quality or fate and transport assessment purposes. PG&E: As agreed with DTSC and DOI in subsequent discussions, all constituents that were not sampled for general chemistry or fate and transport assessment purposes would be considered COPCs at the beginning of Volume 2. Based on the conclusions of Volume 2, constituents that merit further consideration would be considered COPCs in groundwater for SWMU 1/AOC 1. Text has been revised in Section 2.1.3 and throughout the document.
Department of Toxic Substances Control	DTSC-56	Sec. 10, Page 10-4, Section 10.2.1 – SWMU 1/AOC 1	Conclusions regarding additional COPCs should be amended in this section (see above comment).	Please refer to responses to DTSC comments #s 23 and 25.	DOI understands that DTSC and PG&E have agreed to retain molybdenum and selenium as RFI/RI identified COPCs. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved. Other related sections in the Report would also need to be revised (e.g., Section 10.1.3).
Metropolitan Water District	MWD-29	10.2.2 SWMU 2, page 10-5 to 10-6	The first bullet on page 10-6 states “reducing conditions within PGE-8”. The reducing conditions in the bedrock are not discussed thoroughly in this report. A brief discussion of these conditions should be included in the appropriate section of this report.	Presentation of redox parameters for PGE-8 and other bedrock wells will be made in Section 5.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved
U.S. Department of the Interior	DOI-94 M	Sec 10.2.2, Page 10-6, last bullet	Revise the last bullet to read: “Existing data are sufficient to conclude that there is no evidence that PGE-8 adversely affected bedrock groundwater. The chromium results observed at bedrock well MW-23, however, warrant additional characterization.”	In response to this comment, the second sentence in the last bullet in Section 10.2.2 will be revised as follows: “The consistent lack of Cr(VI) above reporting limits in groundwater samples from bedrock wells in the vicinity of the compressor station and SWMU-2 area indicate that no negative effects to bedrock groundwater have	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response.

Agency	Comment Number	Section	Comment	Response	DOI/DTSC Response to RTC
				resulted from the PGE-8 past operations.”	
Appendices					
Metropolitan Water District	MWD-30	Appendix H, Attachment 1. Appendix B	Where is this document referenced in the RFI report? What time period does this document cover? How is this different than Appendix H1? We recommend a brief discussion and reference to Attachment 1 in Section 4.2. This should discuss why it is included in this report and how it differs or complements the plans listed in Table 4-1.	Attachment 1 is referenced in Appendix H1 (page H-3) and covers the time period from 1997 to 2004 (date of a prior version of the RFI/RI Report). Appendix H1 cover the data time period of 2002-2007. A brief discussion regarding Attachment 1 will be provided in Section 4.2.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC: DTSC awaits the actual revised language so that it can be reviewed and approved
Metropolitan Water District	MWD-31	Appendix I	There is a page with a plot of MW-40 well results. The bottom plot is incorrectly labeled MW-41S. Should it be MW-40S?	The bottom plot will be corrected to show MW-40S.	DOI accepts the comment response and directs PG&E to make the changes to the document as indicated in its response. DTSC concurs with the response and directs PG&E to make the changes as proposed.

Appendix B
Drilling and Well Construction Information

B1 Summary Information for Drilling and Groundwater Wells in Study Area

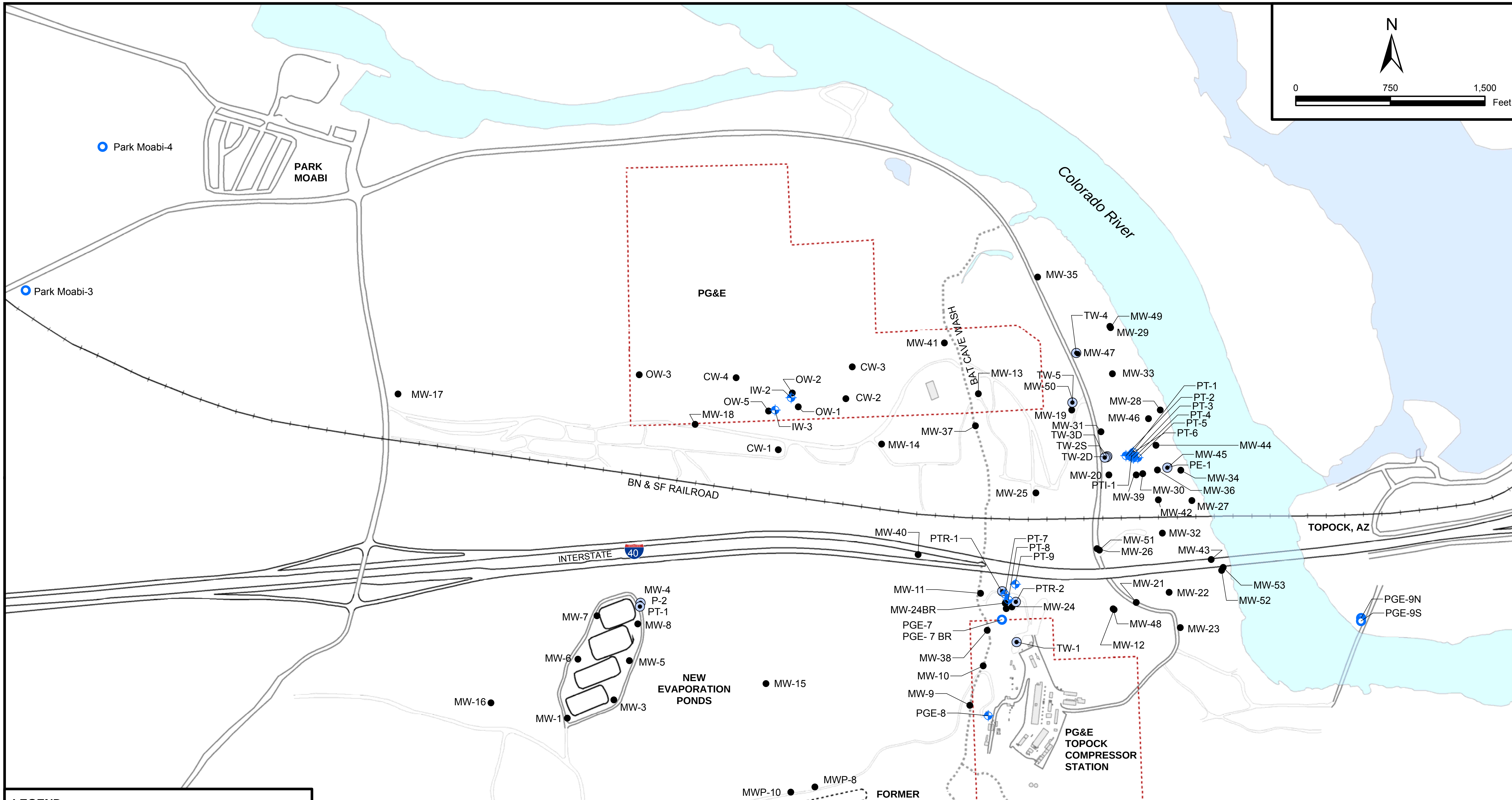


FIGURE B-1
LOCATIONS OF WELLS AND BORINGS USED FOR HYDROGEOLOGIC CHARACTERIZATION, EXISTING WELLS OCTOBER 2007
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2007\RFI\FIGUREB-1.MXD FIGUREB-1.MXD 1/18/2008 16:24:16

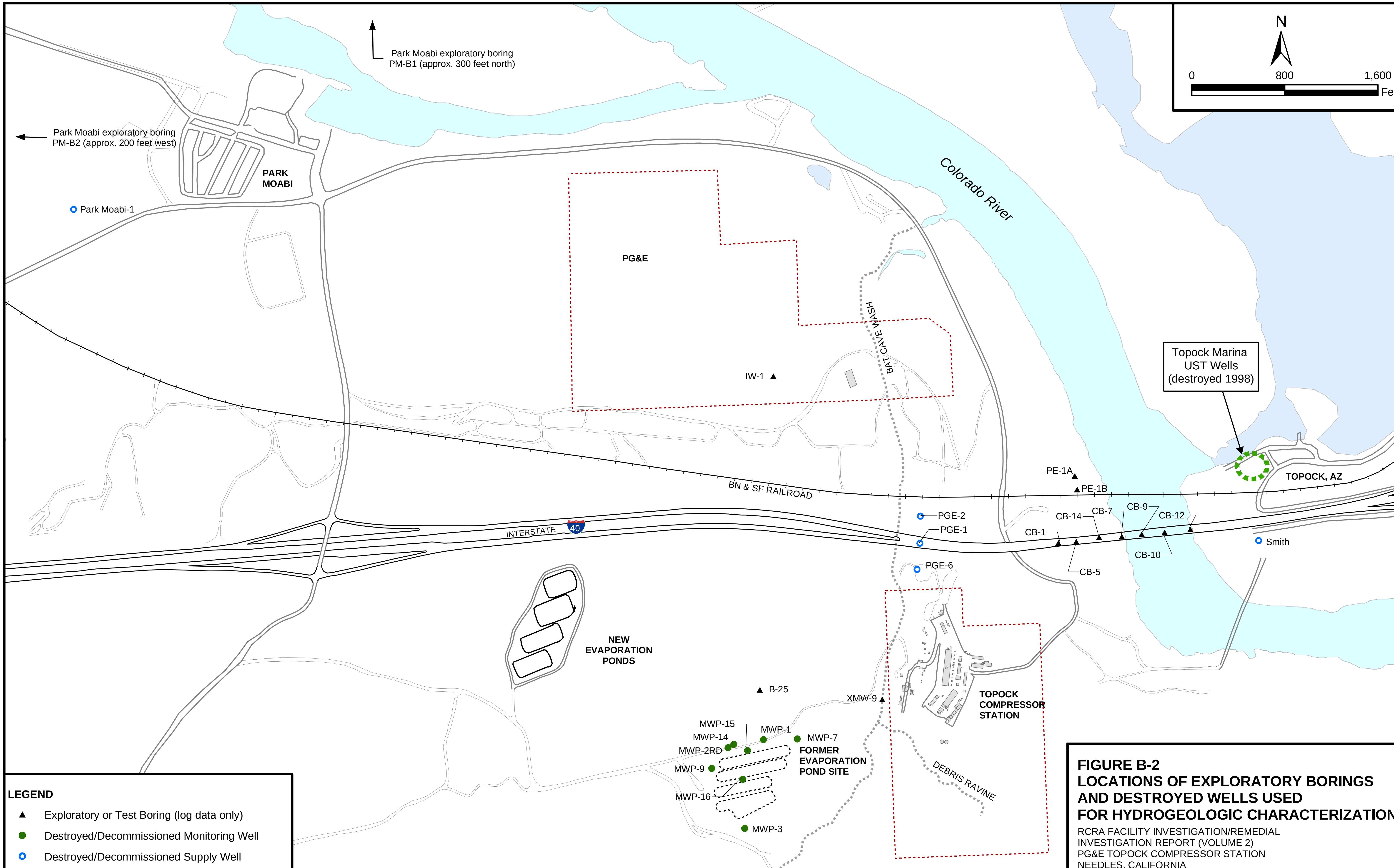
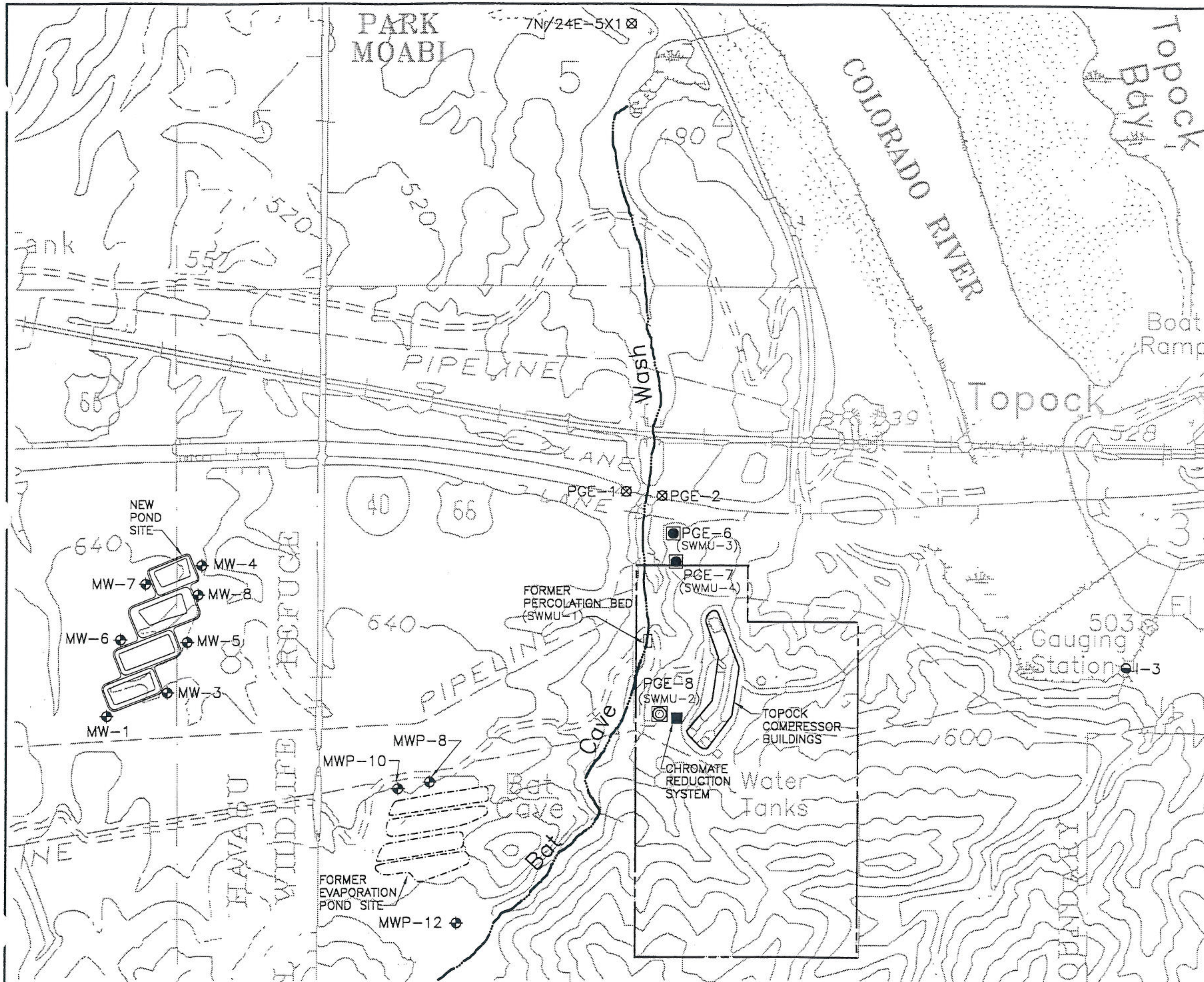


FIGURE B-2
LOCATIONS OF EXPLORATORY BORINGS AND DESTROYED WELLS USED FOR HYDROGEOLOGIC CHARACTERIZATION

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2007\RFI\FIGUREB-2.MXD FIGUREB-2.MXD CARCHER 1/29/2009 14:08:01



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0 600 1200

SCALE IN FEET

LEGEND

- GROUNDWATER MONITORING WELL
- INACTIVE INJECTION WELL
- FORMER WATER SUPPLY WELL
- DESTROYED WELL
- GAUGING STATION
- (SWMU) SOLID WASTE MANAGEMENT UNIT
- PG&E PROPERTY LINE

Pre-RFI Site Wells, May 1996

from RFI Work Plan (1997)

FIGURE 2

SITE FEATURE MAP

BAT CAVE WASH PROJECT
PACIFIC GAS AND ELECTRIC COMPANY
TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

PROJECT NO. 10-320

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Elevation[5]		Boring Total Depth (ft bgs)	Top of Screen[6]		Base of Screen[6]		Well Depth[7] (ft bgs)	Approx Depth to Water[8] (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
					Ground (ft MSL)	Measure Point (ft MSL)		Depth (ft bgs)	Elevation (ft MSL)	Depth (ft bgs)	Elevation (ft MSL)							
Groundwater Monitoring Wells																		
MW-1	P-1	New Ponds - Monitoring	Active	SA - alluvial	660	662	212	201	461	211	451	211	205	10	4" PVC	---	Aug-86	Air Percuss
MW-3	P-3	New Ponds - Monitoring	Active	SA - alluvial	649	651	207	193	458	203	448	204	195	10	4" PVC	---	Aug-86	Air Percuss
MW-4	P-4	New Ponds - Monitoring	Active	SA - alluvial	624	626	180	165	461	175	451	175	109	10	4" PVC	---	Aug-86	Air Percuss
MW-5	MW-5	New Ponds - Monitoring	Active	SA - alluvial	635	636	188	176	460	185	451	185	178	9	4" PVC	---	Jun-89	Air Rotary
MW-6	MW-6	New Ponds - Monitoring	Active	SA - alluvial	642	643	194	185	458	194	449	194	186	9	4" PVC	---	Jun-89	Air Rotary
MW-7	MW-7	New Ponds - Monitoring	Active	SA - alluvial	630	632	188	173	459	183	449	183	176	10	4" PVC	---	Jun-89	Air Rotary
MW-8	MW-8	New Ponds - Monitoring	Active	SA - alluvial	627	628	179	169	459	178	450	178	170	9	4" PVC	---	Jun-89	Air Rotary
MW-9	MW-9	RFI - Monitoring	Active	SA - alluvial	534	537	89	77	460	87	450	87	80	10	4" PVC	---	Jul-97	Rotosonic
MW-10	MW-10	RFI - Monitoring	Active	SA - alluvial	529	531	99	74	457	94	437	95	75	20	4" PVC	---	Jun-97	Rotosonic
MW-11	MW-11	RFI - Monitoring	Active	SA - alluvial	521	523	87	63	460	83	440	84	66	20	4" PVC	---	Jun-97	Rotosonic
MW-12	MW-12	RFI - Monitoring	Active	SA - alluvial	483	484	50	28	457	48	437	49	28	20	4" PVC	---	Jul-97	Rotosonic
MW-13	MW-13	RFI - Monitoring	Active	SA - alluvial	487	489	50	29	460	49	440	50	32	20	4" PVC	---	Jul-97	Rotosonic
MW-14	MW-14	RFI - Monitoring	Active	SA - alluvial	570	571	135	111	460	131	440	131	115	20	4" PVC	---	Jul-97	Rotosonic
MW-15	MW-15	RFI - Monitoring	Active	SA - alluvial	640	642	204	181	461	201	441	202	186	20	4" PVC	---	Jul-97	Rotosonic
MW-16	MW-16	RFI - Monitoring	Active	SA - alluvial	655	657	218	198	459	218	439	218	184	20	4" PVC	---	Apr-98	Air Rotary
MW-17	MW-17	RFI - Monitoring	Active	SA - alluvial	588	590	151	130	460	150	440	150	132	20	4" PVC	---	May-98	Rotosonic
MW-18	MW-18	RFI - Monitoring	Active	SA - alluvial	544	545	110	85	460	105	440	105	89	20	4" PVC	---	Apr-98	Air Rotary
MW-19	MW-19	RFI - Monitoring	Active	SA - alluvial	499	500	66	46	454	66	434	66	46	20	4" PVC	---	Mar-98	Air Rotary
MW-20-70	MW-20-70	RFI - Monitoring	Active	SA - alluvial	499	500	70	50	450	70	430	70	46	20	4" PVC	---	Mar-98	Air Rotary
MW-20-100	MW-20-100	RFI - Monitoring	Active	MA - alluvial	499	501	100	90	411	100	401	100	47	10	4" PVC	---	Apr-99	Rotosonic
MW-20-130	MW-20-130	RFI - Monitoring	Active	DA - alluvial	499	501	132	121	380	131	370	131	48	10	4" PVC	---	Apr-99	Rotosonic
MW-21	MW-21	RFI - Monitoring	Active	SA - alluvial	506	506	62	39	467	59	447	59	55	20	4" PVC	---	May-98	Rotosonic
MW-22	MW-22	RFI - Monitoring	Active	SA - fluvial	458	461	12	6	455	11	450	11	6	5	2" PVC	---	Apr-98	Hand Auger
MW-23	MW-23	RFI - Monitoring	Active	BR-Tmc	505	507	80	60	447	80	427	80	55	20	4" PVC	---	Apr-98	Air Rotary
MW-24A	MW-24A	RFI - Monitoring	Active	SA - alluvial	565	567	125	104	463	124	443	125	110	20	4" PVC	---	May-98	Rotosonic
MW-24B	MW-24B	RFI - Monitoring	Active	DA - alluvial	563	565	218	193	372	213	352	213	110	20	4" PVC	---	May-98	Rotosonic
MW-24BR	MW-24BR	RFI - Monitoring	Active	BR-pTbr	563	564	442	378	186	437	127	437	108	59	4" PVC	---	Apr-98	Air Rotary
MW-25	MW-25	RFI - Monitoring	Active	SA - alluvial	541	543	107	85	458	105	438	105	87	20	4" PVC	---	Apr-99	Rotosonic
MW-26	MW-26	RFI - Monitoring	Active	SA - alluvial	503	502	74	52	451	72	431	72	46	20	2" PVC	---	Apr-99	Rotosonic
MW-27-20	MW-27	RFI - Monitoring	Active	SA - alluvial	459	461	17	7	454	17	444	17	6	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-27-60	MW-27-060	IM - Monitoring	Active	MA - alluvial	458	461	60	47	414	57	404	58	8	10	2" PVC	---	Feb-05	Rotosonic
MW-27-85	MW-27	IM - Monitoring	Active	DA - alluvial	458	461	107	78	383	88	373	98	5	10	2" PVC	10' sump	Feb-05	Rotosonic
MW-28-25	MW-28	RFI - Monitoring	Active	SA - fluvial	465	467	23	13	454	23	444	23	12	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-28-90	MW-28	IM - Monitoring	Active	DA - fluvial	465	468	148	70	398	90	378	95	13	20	2" PVC	5' sump	Apr-04	Rotosonic
MW-29	---	RFI - Monitoring	Active	SA - fluvial	483	485	40	30	456	40	446	40	30	10	2" PVC	---	Apr-99	Hollow Stem Auger
MW-30-30	MW-30-30	RFI - Monitoring	Active	SA - fluvial	466	468	32	12	456	32	436	32	14	20	2" PVC	---	Apr-99	Hollow Stem Auger
MW-30-50	MW-30-50	RFI - Monitoring	Active	MA - fluvial	466	469	63	40	429	50	419	50	14	10	4" PVC	---	Mar-03	Rotosonic
MW-31-60	MW-31	RFI - Monitoring	Active	SA - alluvial	495	497	65	42	455	62	435	62	42	20	4" PVC	---	Apr-99	Rotosonic
MW-31-135	MW-31	IM - Monitoring	Active	DA - alluvial	495	498	168	113	385	133	365	133	44	20	2" PVC	---	Mar-04	Rotosonic
MW-32-20	MW-32-20	RFI - Monitoring	Active	SA - fluvial	459	462	20	10	452	20	442	20	7	10	2" PVC	---	Mar-03	Rotosonic
MW-32-35	MW-32-35	RFI - Monitoring	Active	SA - fluvial	459	462	37	28	434	35	427	35	5	8	4" PVC	---	Mar-03	Rotosonic

Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Elevation[5] Ground (ft MSL)	Elevation[5] Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Top of Screen[6] Depth (ft bgs)	Top of Screen[6] Elevation (ft MSL)	Base of Screen[6] Depth (ft bgs)	Base of Screen[6] Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth to Water[8] (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Groundwater Monitoring Wells																		
MW-33-40	MW-33-40	RFI - Monitoring	Active	SA - fluvial	485	487	40	29	458	39	448	39	31	10	4" PVC	---	Mar-03	Rotosonic
MW-33-90	MW-33-90	RFI - Monitoring	Active	MA - fluvial	485	488	130	69	419	89	399	89	32	20	4" PVC	---	Mar-03	Rotosonic
MW-33-150	MW-33	IM - Monitoring	Active	DA - alluvial	485	488	158	132	356	152	336	152	31	20	2" PVC	---	Feb-05	Rotosonic
MW-33-210	MW-33	IM - Monitoring	Active	DA - alluvial	485	487	237	190	297	210	277	220	32	20	2" PVC	10' sump	Feb-05	Rotosonic
MW-34-55	MW-34-55	RFI - Monitoring	Active	MA - fluvial	459	461	57	45	416	55	406	55	6	10	4" PVC	---	Jun-03	Rotosonic
MW-34-80	MW-34-80	RFI - Monitoring	Active	DA - fluvial	459	461	93	73	388	83	378	83	5	10	4" PVC	---	Jun-03	Rotosonic
MW-34-100	MW-34	IM - Monitoring	Active	DA - fluvial	459	461	116	90	371	100	361	115	5	10	2" PVC	15' sump	Jan-05	Rotosonic
MW-35-60	MW-35	IM - Monitoring	Active	SA - alluvial	481	484	61	41	443	61	423	61	29	20	2" PVC	---	Mar-04	Rotosonic
MW-35-135	MW-35	IM - Monitoring	Active	DA - alluvial	481	484	168	116	368	136	348	156	30	20	2" PVC	20' sump	Mar-04	Rotosonic
MW-36-20	MW-36	IM - Monitoring	Active	SA - fluvial	467	469	20	10	459	20	449	20	16	10	1" PVC	---	May-04	Rotosonic
MW-36-40	MW-36	IM - Monitoring	Active	SA - fluvial	467	470	40	30	440	40	430	40	16	10	1" PVC	---	May-04	Rotosonic
MW-36-50	MW-36	IM - Monitoring	Active	MA - fluvial	467	470	108	46	424	51	419	51	15	5	1" PVC	---	May-04	Rotosonic
MW-36-70	MW-36	IM - Monitoring	Active	MA - fluvial	467	469	70	60	409	70	399	70	15	10	1" PVC	---	May-04	Rotosonic
MW-36-90	MW-36	IM - Monitoring	Active	DA - fluvial	467	470	90	80	390	90	380	90	16	10	1" PVC	---	May-04	Rotosonic
MW-36-100	MW-36	IM - Monitoring	Active	DA - fluvial	467	470	108	88	382	98	372	108	16	10	2" PVC	10' sump	May-04	Rotosonic
MW-37S	MW-37	IM - Monitoring	Active	MA - alluvial	484	486	85	64	422	84	402	84	31	20	2" PVC	---	Apr-04	Rotosonic
MW-37D	MW-37	IM - Monitoring	Active	DA - alluvial	484	486	228	180	306	200	286	225	31	20	2" PVC	25' sump	Apr-04	Rotosonic
MW-38S	MW-38S	IM - Monitoring	Active	SA - alluvial	523	526	130	75	451	95	431	95	70	20	2" PVC	---	Apr-04	Rotosonic
MW-38D	MW-38	IM - Monitoring	Active	DA - alluvial	523	525	195	163	362	183	342	188	70	20	2" PVC	5' sump	Apr-04	Rotosonic
MW-39-40	MW-39	IM - Monitoring	Active	SA - fluvial	465	468	70	30	438	40	428	42	14	10	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-50	MW-39	IM - Monitoring	Active	MA - fluvial	465	468	80	47	421	52	416	54	14	5	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-60	MW-39	IM - Monitoring	Active	MA - fluvial	465	468	118	49	419	59	409	64	14	10	1" PVC	5' sump	Apr-04	Rotosonic
MW-39-70	MW-39	IM - Monitoring	Active	MA - alluvial	465	468	70	60	408	70	398	72	14	10	1" PVC	2' sump	Apr-04	Rotosonic
MW-39-80	MW-39	IM - Monitoring	Active	DA - alluvial	465	468	80	70	398	80	388	80	14	10	1" PVC	---	Apr-04	Rotosonic
MW-39-100	MW-39	IM - Monitoring	Active	DA - alluvial	465	468	118	80	388	100	368	115	14	20	2" PVC	15' sump	Apr-04	Rotosonic
MW-40S	MW-40	IM - Monitoring	Active	SA - alluvial	566	566	135	115	451	135	431	135	111	20	2" PVC	---	May-04	Rotosonic
MW-40D	MW-40	IM - Monitoring	Active	DA - alluvial	567	566	268	240	326	260	306	265	111	20	2" PVC	5' sump	May-04	Rotosonic
MW-41S	MW-41	IM - Monitoring	Active	SA - alluvial	477	480	60	40	440	60	420	60	24	20	2" PVC	---	Nov-04	Rotosonic
MW-41M	MW-41	IM - Monitoring	Active	DA - alluvial	477	480	190	170	310	190	290	190	26	20	2" PVC	---	Nov-04	Rotosonic
MW-41D	MW-41	IM - Monitoring	Active	DA - alluvial	477	479	320	271	208	291	188	311	24	20	2" PVC	20' sump	Nov-04	Rotosonic
MW-42-30	MW-42	IM - Monitoring	Active	SA - fluvial	461	464	30	10	454	30	434	30	12	20	2" PVC	---	Feb-05	Rotosonic
MW-42-55	MW-42	IM - Monitoring	Active	MA - fluvial	461	464	53	43	421	53	411	53	8	10	2" PVC	---	Feb-05	Rotosonic
MW-42-65	MW-42	IM - Monitoring	Active	MA - fluvial	461	463	81	56	407	66	397	81	7	10	2" PVC	15' sump	Feb-05	Rotosonic
MW-43-25	MW-43	IM - Monitoring	Active	SA - fluvial	463	463	25	15	448	25	438	25	7	10	2" PVC	---	Feb-05	Rotosonic
MW-43-75	MW-43	IM - Monitoring	Active	DA - fluvial	463	463	75	65	398	75	388	75	10	10	2" PVC	---	Feb-05	Rotosonic
MW-43-90	MW-43	IM - Monitoring	Active	DA - fluvial	460	463	97	80	383	90	373	90	11	10	2" PVC	---	Feb-05	Rotosonic
MW-44-70	MW-44	IM - Monitoring	Active	MA - fluvial	471	472	134	61	411	71	401	71	17	10	2" PVC	---	Mar-06	Rotosonic
MW-44-115	MW-44	IM - Monitoring	Active	DA - alluvial	470	472	117	103	369	113	359	113	17	10	2" PVC	---	Mar-06	Rotosonic
MW-44-125	MW-44	IM - Monitoring	Active	DA - alluvial	471	472	134	116	356	125	347	134	16	9	2" PVC	10' sump	Mar-06	Rotosonic
MW-45-095a	MW-45	IM - Monitoring	Active	DA - fluvial	467	470	97	83	387	93	377	94	15	10	2" PVC	---	Feb-06	Rotosonic
MW-45-095b	MW-45	IM - Monitoring	Active	DA - fluvial	467	470	97	83	387	93	377	94	18	10	1" PVC	---	Feb-06	Rotosonic

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Groundwater Monitoring Wells																		
MW-46-175	MW-46	IM - Monitoring	Active	DA - alluvial	481	482	217	165	317	175	307	217	28	10	2" PVC	---	Feb-06	Rotosonic
MW-46-205	MW-46	IM - Monitoring	Active	DA - alluvial	481	482	217	197	286	207	276	217	28	10	2" PVC	---	Feb-06	Rotosonic
MW-47-55	MW-47	IM - Monitoring	Active	SA - alluvial	483	484	117	45	439	55	429	100	28	10	2" PVC	---	Mar-06	Rotosonic
MW-47-115	MW-47	IM - Monitoring	Active	DA - alluvial	483	484	117	105	379	115	369	117	28	10	2" PVC	---	Mar-06	Rotosonic
MW-48	MW-48	IM - Monitoring	Active	BR-Tmc	484	486	155	124	362	134	352	138	112	10	2" PVC	---	May-06	Rotosonic
MW-49-135	MW-49	IM - Monitoring	Active	DA - alluvial	483	484	135	125	359	135	349	135	29	10	1.5" PVC	---	Mar-06	Rotosonic
MW-49-275	MW-49	IM - Monitoring	Active	DA - alluvial	483	484	275	255	229	275	209	275	30	20	2" PVC	---	Mar-06	Rotosonic
MW-49-365	MW-49	IM - Monitoring	Active	DA - alluvial	483	484	384	345	139	365	119	370	32	20	2" PVC	---	Mar-06	Rotosonic
MW-50-095	MW-50	IM - Monitoring	Active	MA - alluvial	495	496	249	85	411	95	401	---	40	10	2" PVC	---	Apr-06	Rotosonic
MW-50-200	MW-50	IM - Monitoring	Active	DA - alluvial	495	496	248	190	306	200	296	---	41	10	2" PVC	---	Apr-06	Rotosonic
MW-51	MW-51	IM - Monitoring	Active	MA - alluvial	502	502	114	97	405	112	390	---	47	15	4" PVC	---	Apr-06	Rotosonic
MW-52S	MW-52	IM - Monitoring	Active	MA - fluvial	460	462	---	47	415	49	413	49	10	2	0.75" PVC	---	Mar-07	Rotosonic
MW-52M	MW-52	IM - Monitoring	Active	DA - fluvial	460	462	---	66	396	68	394	68	11	2	0.75"	---	Mar-07	Rotosonic
MW-52D	MW-52	IM - Monitoring	Active	DA - fluvial	460	462	102	85	377	87	375	87	11	2	0.75"	---	Mar-07	Rotosonic
MW-53S	MW-53	IM - Monitoring	Inactive	SA - fluvial	460	---	---	29	---	30	---	30	---	2	0.75"	---	Mar-07	Rotosonic
MW-53M	MW-53	IM - Monitoring	Active	DA - fluvial	460	---	---	99	---	100	---	100	14	2	0.75"	---	Mar-07	Rotosonic
MW-53D	MW-53	IM - Monitoring	Inactive	DA - fluvial	460	---	133	124	---	125	---	125	14	2	0.75"	---	Mar-07	Rotosonic
MWP-1	---	Old Ponds - Monitoring	decomm	SA - alluvial	675	---	127	75	---	115	---	125	---	40	3"	---	Jul-85	---
MWP-2	---	Old Ponds - Monitoring	decomm	SA - alluvial	675	---	---	200	---	260	---	270	---	60	3"	---	Jul-85	---
MWP-2RD	---	Old Ponds - Monitoring	decomm	BR-pTbr	674	---	279	265	---	275	---	275	---	10	5"	---	Jul-85	---
MWP-3	---	Old Ponds - Monitoring	decomm	SA - alluvial	661	---	222	108	---	208	---	218	---	100	3"	10' sump	Jul-85	---
MWP-7	---	Old Ponds - Monitoring	decomm	SA - alluvial	675	---	110	70	---	110	---	110	---	40	3"	---	Oct-85	---
MWP-8	---	Old Ponds - Monitoring	Standby	SA - alluvial	677	677	211	181	496	211	466	211	190	30	3" PVC	---	Oct-85	---
MWP-9	---	Old Ponds - Monitoring	decomm	SA - alluvial	680	---	220	179	---	219	---	220	---	40	3" PVC	---	Oct-85	Air Percuss
MWP-10	---	Old Ponds - Monitoring	Standby	SA - alluvial	675	676	235	194	482	234	442	235	209	40	3" PVC	---	Jan-86	---
MWP-12	---	Old Ponds - Monitoring	Standby	SA - alluvial	662	663	217	96	567	136	527	217	108	40	3" PVC	81' sump	Jan-86	---
MWP-14	---	Old Ponds - Monitoring	decomm	SA - alluvial	674	---	221	206	---	216	---	216	---	10	5" PVC	---	Jun-92	Air Rotary
MWP-15	---	Old Ponds - Monitoring	decomm	SA - alluvial	676	---	290	198	---	208	---	208	---	10	5" PVC	---	Jun-92	Air Rotary
MWP-16	---	Old Ponds - Monitoring	decomm	SA - alluvial	690	---	261	210	---	220	---	222	---	10	5" PVC	---	Jun-92	Air Rotary
OW-1S	OW-1	CMP - Monitoring	Active	SA - alluvial	548	550	115	84	467	114	437	114	93	30	2" PVC	---	Nov-04	Rotosonic
OW-1M	OW-1	CMP - Monitoring	Active	MA - alluvial	548	550	291	165	385	185	365	186	93	20	2" PVC	---	Sep-04	Rotosonic
OW-1D	OW-1	CMP - Monitoring	Active	DA - alluvial	548	550	291	257	293	277	273	277	93	20	2" PVC	---	Sep-04	Rotosonic
OW-2S	OW-2	CMP - Monitoring	Active	SA - alluvial	546	549	104	71	478	101	448	101	92	30	2" PVC	---	Dec-04	Rotosonic
OW-2M	OW-2	CMP - Monitoring	Active	MA - alluvial	546	549	210	190	359	210	339	210	91	20	2" PVC	---	Dec-04	Rotosonic
OW-2D	OW-2	CMP - Monitoring	Active	DA - alluvial	547	549	347	310	239	330	219	340	91	20	2" PVC	10' sump	Dec-04	Rotosonic
OW-3S	OW-3	IM - Monitoring	Active	SA - alluvial	556	559	118	86	473	116	443	116	103	30	2" PVC	---	Oct-04	Rotosonic
OW-3M	OW-3	IM - Monitoring	Active	MA - alluvial	556	559	202	180	379	200	359	200	103	20	2" PVC	---	Oct-04	Rotosonic
OW-3D	OW-3	IM - Monitoring	Active	DA - alluvial	556	559	275	242	317	262	297	273	103	20	2" PVC	10' sump	Oct-04	Rotosonic
OW-5S	OW-5	CMP - Monitoring	Active	SA - alluvial	549	552	112	70	482	110	442	110	95	40	2" PVC	---	Nov-04	Rotosonic
OW-5M	OW-5	CMP - Monitoring	Active	DA - alluvial	549	552	252	210	342	250	302	250	94	40	2" PVC	---	Nov-04	Rotosonic
OW-5D	OW-5	CMP - Monitoring	Active	DA - alluvial	550	552	350	300	252	320	232	350	95	20	2" PVC	30' sump	Nov-04	Rotosonic

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Groundwater Monitoring Wells																		
P-1	---	Old Ponds - Monitoring	decomm	SA - alluvial	694	---	217	171	---	211	---	217	---	40	3" PVC	6' sump	Feb-86	Air Percuss
P-2	---	New Ponds - Monitoring	Inactive	DA - alluvial	536	538	249	239	299	249	289	249	170	10	4" PVC	---	Aug-86	---
PGE-7BR	---	IM - Monitoring	Active	BR-pTbr	563	---	292	249	---	300	---	292	111	51	7"	---	Oct-07	---
CW-1M	CW-1	CMP - Monitoring	Active	MA - alluvial	563	566	191	140	426	190	376	190	109	50	2" PVC	---	Jan-05	Rotosonic
CW-1D	CW-1	CMP - Monitoring	Active	DA - alluvial	564	567	360	250	317	300	267	320	110	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-2M	CW-2	CMP - Monitoring	Active	MA - alluvial	547	549	203	152	397	202	347	206	92	50	2" PVC	---	Feb-05	Rotosonic
CW-2D	CW-2	CMP - Monitoring	Active	DA - alluvial	547	550	385	285	265	335	215	355	92	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-3M	CW-3	CMP - Monitoring	Active	MA - alluvial	532	534	223	172	362	222	312	222	77	50	2" PVC	---	Feb-05	Rotosonic
CW-3D	CW-3	CMP - Monitoring	Active	DA - alluvial	532	534	360	270	264	320	214	340	77	50	2" PVC	20' sump	Jan-05	Rotosonic
CW-4M	CW-4	CMP - Monitoring	Active	MA - alluvial	516	519	170	120	399	170	349	170	61	50	2" PVC	---	Jan-05	Rotosonic
CW-4D	CW-4	CMP - Monitoring	Active	DA - alluvial	516	519	337	233	286	283	236	303	61	50	2" PVC	20' sump	Jan-05	Rotosonic
Extraction, Test & Injection Wells																		
IW-2	IW-2	IM - Injection	Active	MA-DA - alluvial	547	550	412	170	380	330	220	340	96	160	6" Steel	10' sump	Dec-04	Mud Rotary
IW-3	IW-3	IM - Injection	Active	MA-DA - alluvial	551	554	411	160	394	320	234	330	100	160	6" Steel	10' sump	Dec-04	Mud Rotary
PE-1	PE-01	IM - Extraction	Active	DA - fluvial	458	458	97	79	379	89	369	99	16	10	6" Steel	10' sump	Mar-05	Rotosonic
PGE-8	---	TCS - Injection	Inactive	BR-pTbr	595	596	562	405	191	554	42	562	139	149	6.75" Steel	---	Jun-69	---
PGE-PT-1	---	New Ponds - Test	Inactive	MA-DA - alluvial	625	623	280	220	403	260	363	280	168	40	4" Steel	20' sump	Nov-86	Rotosonic
TW-1	TW-1	IM - Test	Active	SA-MA-DA - alluvial	621	621	312	169	452	269	352	269	164	100	5" PVC	---	Nov-03	Mud Rotary
TW-2S	TW-2	IM - Extraction	Standby	SA-MA - alluvial	497	499	98	43	457	93	407	98	34	50	6" PVC	5' sump	Apr-04	Mud Rotary
TW-2D	TW-2	IM - Extraction	Standby	DA - alluvial	497	493	180	113	380	148	345	153	69	35	6" PVC	5' sump	Apr-04	Mud Rotary
TW-3D	TW-3D	IM - Extraction	Active	DA - alluvial	497	498	158	111	387	156	342	156	46	45	8" PVC	---	Oct-05	Rotosonic
TW-4	MW-47	IM - Test	Active	DA - alluvial	483	484	288	210	274	250	234	---	29	40	4" PVC	4' sump	Mar-06	Rotosonic
TW-5	MW-50	IM - Test	Active	DA - alluvial	495	496	150	110	386	150	346	---	43	40	4" PVC	---	Apr-06	Rotosonic
Pilot Study Wells																		
PT-1S	PT-1	ISPT - Monitoring	Active	SA - fluvial	472	475	---	35	440	45	430	45	---	10	2" PVC	---	Jan-06	Rotosonic
PT-1M	PT-1	ISPT - Monitoring	Active	MA - fluvial	472	474	---	60	414	70	404	70	---	10	2" PVC	---	Jan-06	Rotosonic
PT-1D	PT-1	ISPT - Monitoring	Active	DA - fluvial	472	474	125	95	379	105	369	105	---	10	2" PVC	---	Jan-06	Rotosonic
PT-2S	PT-2	ISPT - Monitoring	Active	SA - fluvial	471	473	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-2M	PT-2	ISPT - Monitoring	Active	MA - fluvial	471	473	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-2D	PT-2	ISPT - Monitoring	Active	DA - fluvial	471	473	127	95	378	105	368	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3S	PT-3	ISPT - Monitoring	Active	SA - alluvial	472	473	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3M	PT-3	ISPT - Monitoring	Active	MA - alluvial	472	473	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-3D	PT-3	ISPT - Monitoring	Active	DA - alluvial	472	473	129	95	378	105	368	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4S	PT-4	ISPT - Monitoring	Active	SA - fluvial	472	474	---	35	439	45	429	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4M	PT-4	ISPT - Monitoring	Active	MA - fluvial	472	474	---	60	414	70	404	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-4D	PT-4	ISPT - Monitoring	Active	DA - fluvial	472	474	127	95	379	105	369	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5S	PT-5	ISPT - Monitoring	Active	SA - fluvial	471	473	---	35	438	45	428	45	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5M	PT-5	ISPT - Monitoring	Active	MA - fluvial	471	473	---	60	413	70	403	70	---	10	2" PVC	---	Feb-06	Rotosonic
PT-5D	PT-5	ISPT - Monitoring	Active	DA - fluvial	471	474	127	95	379	105	369	105	---	10	2" PVC	---	Feb-06	Rotosonic
PT-6S	PT-6	ISPT - Monitoring	Active	SA - fluvial	474	476	---	35	441	45	431	45	---	10	2" PVC	---	Jan-06	Rotosonic
PT-6M	PT-6	ISPT - Monitoring	Active	MA - fluvial	474	476	---	60	416	70	406	70	---	10	2" PVC	---	Jan-06	Rotosonic

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Elevation[5] Ground (ft MSL)	Elevation[5] Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Top of Screen[6] Depth (ft bgs)	Top of Screen[6] Elevation (ft MSL)	Base of Screen[6] Depth (ft bgs)	Base of Screen[6] Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth to Water[8] (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Pilot Study Wells																		
PT-6D	PT-6	ISPT - Monitoring	Active	DA - fluvial	474	476	137	95	381	105	371	105	---	10	2" PVC	---	Jan-06	Rotosonic
PT-7S	PT-7S/D	ISPT - Monitoring	Active	SA - alluvial	561	561	---	130	431	155	406	155	---	25	2" PVC	---	May-07	Rotosonic
PT-7M	PT-7M	ISPT - Monitoring	Active	MA - alluvial	561	561	188	165	396	185	376	185	---	20	2" PVC	---	May-07	Rotosonic
PT-7D	PT-7D	ISPT - Monitoring	Active	DA - alluvial	560	560	230	177	383	217	343	220	---	40	2" PVC	---	May-07	Rotosonic
PT-8S	PT-8S/D	ISPT - Monitoring	Active	SA - alluvial	562	562	---	147	415	152	410	152	---	5	2" PVC	---	May-07	Rotosonic
PT-8M	PT-8M	ISPT - Monitoring	Active	MA - alluvial	562	562	---	162	400	183	379	182	---	21	2" PVC	---	May-07	Rotosonic
PT-8D	PT-8S/D	ISPT - Monitoring	Active	DA - alluvial	562	562	---	190	372	210	352	213	---	20	2" PVC	---	May-07	Rotosonic
PT-9S	PT-9S/D	ISPT - Monitoring	Active	SA - alluvial	562	559	---	128	431	148	411	153	---	20	2" PVC	---	Jun-07	Rotosonic
PT-9M	PT-9M	ISPT - Monitoring	Active	MA - alluvial	560	559	---	163	396	183	376	182	---	20	2" PVC	---	Jun-07	Rotosonic
PT-9D	PT-9S/D	ISPT - Monitoring	Active	DA - alluvial	560	559	225	190	369	210	349	213	---	20	2" PVC	---	Jun-07	Rotosonic
PTI-1S	PTI-1S	ISPT - Injection	Active	SA - alluvial	473	475	47	35	440	45	430	45	---	10	4" PVC	---	Jan-06	Rotosonic
PTI-1M	PTI-1M	ISPT - Injection	Active	MA - fluvial	473	475	77	60	415	70	405	70	---	10	4" PVC	---	Jan-06	Rotosonic
PTI-1D	PTI-1D	ISPT - Injection	Active	DA - fluvial	473	475	137	95	380	105	370	105	---	10	4" PVC	---	Jan-06	Rotosonic
PTR-1	PTR-1	ISPT - recirculation	Active	MA-DA - alluvial	558	---	225	125	---	220	---	220	---	95	6" LCS	---	May-07	Rotosonic
PTR-2	PTR-2	ISPT - recirculation	Active	MA-DA - alluvial	565	---	223	118	---	218	---	218	---	100	6" LCS	---	Jun-07	Rotosonic
Water Supply Wells																		
PGE-1	PGE-1	TCS - original supply	decomm	MA - alluvial	555	---	176	99	---	177	---	177	---	78	14"	---	Sep-51	---
PGE-2	PGE-2	TCS - original supply	decomm	MA - alluvial	552	---	152	98	---	152	---	152	---	54	14"	---	Jul-51	---
PGE-6	PGE-6	TCS - replacement supply	decomm	SA-MA - alluvial	562	563	180	110	453	180	383	180	107	70	14" Steel	---	Jun-64	---
PGE-7	PGE-7	TCS - replacement supply	Inactive	DA-BR-pTbr	563	564	330	195	369	330	234	330	107	135	14" Steel	---	Sep-64	---
PGE-9N	PGE-9N	TCS - replacement supply	Inactive	MA-DA - fluvial	460	462	95	25	437	95	367	95	---	70	12" Steel	---	Apr-97	---
PGE-9S	PGE-9S	TCS - replacement supply	Inactive	MA-DA - fluvial	459	462	100	30	432	100	362	100	---	70	12" Steel	---	Apr-97	---
Park Moabi-1	PM-01	SBC original supply	decomm	---	470	---	190	28	---	180	---	190	---	152	10" Steel	---	Mar-61	Cable Tool
Park Moabi-3	Well No.3	SBC supply	Active	MA - alluvial	517	519	250	80	439	200	319	210	61	120	8" Steel	10' sump	Aug-86	---
Park Moabi-4	---	SBC supply	Standby	MA - alluvial	485	---	145	93	---	140	---	145	---	47	---	---	Oct-06	Mud Rotary
Selected Wells in Arizona																		
Sanders	Sanders	private supply	Active	SA	464	464	230	48	416	68	396	---	---	20	3"	---	Jun-05	---
Smith	Smith	private supply	decomm	SA	505	---	80	48	---	68	---	80	---	20	5" PVC	12' sump	Feb-98	---
TMW-6	TMW-6	TM - Monitoring	decomm	SA - fluvial	469	468	35	12	456	32	436	32	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-8	TMW-8	TM - Monitoring	decomm	SA - fluvial	465	464	31	5	459	25	439	25	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-9	TMW-9	TM - Monitoring	decomm	SA - fluvial	461	460	31	6	454	31	429	31	---	25	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-10	TMW-10	TM - Monitoring	decomm	SA - fluvial	470	470	35	10	460	30	440	30	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
TMW-11	TMW-11	TM - Monitoring	decomm	SA - fluvial	468	468	35	10	458	30	438	30	---	20	4" PVC	4' sump	Jan-91	Direct Mud Rotary
Topock-1	Topock-1	ATSF original supply	decomm	SA - fluvial	505*	---	50	---	---	---	---	50	---	---	16"	---	---	---
Topock-2	Topock-2	City of Needles supply	Active	SA - alluvial	509	509	150	100	409	140	369	140	53	40	12" Steel	---	Sep-80	---
Topock-3	Topock-3	City of Needles supply	Active	SA - alluvial	511	511	250	85	426	130	381	150	51	45	12" Steel	20' sump	May-74	---
Exploratory & Test Borings																		
B-25	B-25	RFI - Boring	Closed	---	672	---	210	---	---	---	---	---	---	---	---	---	Apr-98	Air Rotary
CB-1	CB-1	Caltrans - Boring I-40	Closed	---	471	---	54	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-2	CB-2	Caltrans - Boring I-40	Closed	---	499	---	34	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-3	CB-3	Caltrans - Boring I-40	Closed	---	504	---	37	---	---	---	---	---	---	---	---	---	Mar-62	---

TABLE B-1
Drilling and Well Construction Summary for RFI/RI Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID[1]	Boring ID	Investigation Program[2] & Well Type	Status[3]	Monitoring Zone[4]	Elevation[5] Ground (ft MSL)	Elevation[5] Measure Point (ft MSL)	Boring Total Depth (ft bgs)	Top of Screen[6] Depth (ft bgs)	Top of Screen[6] Elevation (ft MSL)	Base of Screen[6] Depth (ft bgs)	Base of Screen[6] Elevation (ft MSL)	Well Depth[7] (ft bgs)	Approx Depth to Water[8] (ft TOC)	Screen Length (ft)	Well Casing	Sump Length	Date Installed	Drilling Method
Exploratory & Test Borings																		
CB-4	CB-4	Caltrans - Boring I-40	Closed	---	504	---	37	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-5	CB-5	Caltrans - Boring I-40	Closed	---	460	---	50	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-6	CB-6	Caltrans - Boring I-40	Closed	---	460	---	20	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-7	CB-7	Caltrans - Boring I-40	Closed	---	459	---	102	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-8	CB-8	Caltrans - Boring I-40	Closed	---	460	---	40	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-9	CB-9	Caltrans - Boring I-40	Closed	---	461	---	105	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-10	CB-10	Caltrans - Boring I-40	Closed	---	459	---	117	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-11	CB-11	Caltrans - Boring I-40	Closed	---	459	---	57	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-12	CB-12	Caltrans - Boring I-40	Closed	---	458	---	125	---	---	---	---	---	---	---	---	---	May-62	---
CB-13	CB-13	Caltrans - Boring I-40	Closed	---	458	---	81	---	---	---	---	---	---	---	---	---	Mar-62	---
CB-14	CB-14	Caltrans - Boring I-40	Closed	---	458	---	110	---	---	---	---	---	---	---	---	---	Mar-62	---
IW-1	IW-1	IM - Boring	Closed	---	545	---	411	---	---	---	---	---	---	---	---	---	Nov-04	Mud Rotary
PE-1A	PE-01	IM - Boring	Closed	---	461	---	90	---	---	---	---	---	---	---	---	---	Feb-05	---
PE-1B	PE-01	IM - Boring	Closed	---	459	---	87	---	---	---	---	---	---	---	---	---	Feb-05	---
PM-B1	---	SBC Park Maobi - Boring	Closed	---	475*	---	250	---	---	---	---	---	---	---	---	5' sump	Mar-86	Mud Rotary
PM-B2	---	SBC Park Maobi - Boring	Closed	---	495*	---	80	---	---	---	---	---	---	---	---	---	Mar-86	Mud Rotary
XMW-9	XMW-9	RFI - Boring	Closed	---	536	538	78	---	538	---	538	---	---	---	---	---	Jun-97	Rotosonic

Notes:

1 The location IDs listed are the assigned, abbreviated "posting Ids" for wells and borings used on maps, tables, logs and other displays in the RFI/RI report. The project sampling database utilizes additional formated location Ids)see Table B-2)

2 Investigation Programs:

CMP	Compliance Monitoring Program, for IM No. 3 injection well field
IM	Interim Measures, includes IM No. 3 investigations and well installation
ISPT	In-situ Pilot Test, includes Floodplain and Upland test areas
New Ponds	TCS evaporation ponds, current operated site with active monitoring WDR
Old Ponds	TCS former, closed evaporation pond site
RFI	RCRA Facility Investigation / Remedial Investigation
SBC	San Bernardino County, Park Moabi water supply
TCS	PGE's Topock Compressor Station, operations facilities
TM	Topock Marina underground storage tank (UST) investigation

3 Location status (as of October 2007):

Active	Well used in current PGE monitoring, testing, or compliance project
Standby	Existing well (servicable condition) not used in current monitoring
Inactive	Existing well (closed condition)
Decomm	Destroyed, permanently abandoned well
Closed	Exploratory or test boring, closed and sealed after logging
Unknown	Well status unknown

4 Monitoring zone:

SA	Shallow zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
MA	Mid-depth zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
DA	Deep zone of the Alluvial Aquifer completed in alluvial fan deposits (alluvial) or Colorado River deposits (fluvial)
BR-Tmc	Bedrock well; completed in Miocene Conglomerate
BR-pTbr	Bedrock well; completed in pre-Tertiary metamorphic and igneous bedrock.

5 Elevations noted with asterisk * are estimated from togpgraphic map.

6 Screen depths rounded-ff to whole foot for presentation.

7 Well depths indicate the location of the bottom of the well casing in feet below the ground surface.

8 Depth of water in feet welow top of well casing (TOC). Water depths rounded-off to whole foot for presentation.

Additional Abbreviations:

ATSF	Atchison, Topeka and Santa Fe Railway
MSL	Feet above mean sea level
bgs	Feet below ground surface
PVC	Ployvinyl chloride
---	data not available or not applicable

TABLE B-2
Survey Location and Elevation Data for RFI/RI Wells and Borings
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID	Date Installed	Elevation: Ground (ft MSL)	Elevation: Measure Point (ft MSL)	Coordinates[1]: Northing (ft)	Coordinates[1]: Easting (ft)	Survey[2] Date	Notes[3]
Groundwater Monitoring Wells							
MW-1	Aug-86	660.3	661.76	2100337.16	7611791.84	02/18/2004	
MW-3	Aug-86	649.1	650.51	2100482.98	7612142.45	02/18/2004	
MW-4	Aug-86	624.3	625.73	2101229.58	7612325.13	02/18/2004	
MW-5	Jun-89	634.8	635.69	2100778.73	7612254.37	02/18/2004	
MW-6	Jun-89	642.4	642.84	2100779.85	7611864.83	02/18/2004	
MW-7	Jun-89	630.2	631.91	2101110.78	7611998.87	02/18/2004	
MW-8	Jun-89	626.7	627.54	2101056.39	7612304.04	02/18/2004	
MW-9	Jul-97	534.1	536.56	2100673.29	7614780.27	02/18/2004	
MW-10	Jun-97	529.3	530.65	2100984.2	7614886.6	02/18/2004	
MW-11	Jun-97	520.8	522.61	2101557.09	7614865.33	02/18/2004	
MW-12	Jul-97	483.1	484.01	2101429.49	7615923.61	02/18/2004	
MW-13	Jul-97	486.8	488.64	2103135.17	7614848.07	02/18/2004	
MW-14	Jul-97	570.2	570.99	2102738.09	7614081.09	02/18/2004	
MW-15	Jul-97	639.7	641.52	2100844.08	7613164.94	02/18/2004	
MW-16	Apr-98	655.4	657.31	2100697.20	7610980.32	02/18/2004	
MW-17	May-98	587.9	589.96	2103135.57	7610243.29	02/18/2004	
MW-18	Apr-98	543.5	545.32	2102894.59	7612598.60	02/18/2004	
MW-19	Mar-98	499.3	499.92	2103007.47	7615587.82	02/18/2004	
MW-20-70	Mar-98	499.1	500.15	2102493.39	7615893.48	02/18/2004	
MW-20-100	Apr-99	499	500.58	2102506.33	7615881.03	02/18/2004	
MW-20-130	Apr-99	499.1	500.66	2102493.68	7615881.52	02/18/2004	
MW-21	May-98	506.1	505.55	2101486.75	7616099.26	02/18/2004	
MW-22	Apr-98	458.2	460.72	2101566.69	7616359.75	02/18/2004	
MW-23	Apr-98	504.6	507.33	2101286.15	7616448.53	02/18/2004	
MW-24A	May-98	564.9	567.16	2101451	7615114.47	02/18/2004	
MW-24B	May-98	562.8	564.76	2101436.41	7615069.38	02/18/2004	
MW-24BR	Apr-98	562.6	563.95	2101480.79	7615060.85	02/18/2004	
MW-25	Apr-99	541	542.9	2102351.22	7615303.59	02/18/2004	
MW-26	Apr-99	502.9	502.22	2101911.86	7615787.7	02/18/2004	
MW-27-20	Apr-99	458.8	460.56	2102294.92	7616557.52	07/17/2007	
MW-27-60	Feb-05	458.37	461.375	2102288.57	7616534.61	07/17/2007	
MW-27-85	Feb-05	458.437	460.993	2102290.53	7616540.22	07/17/2007	
MW-28-25	Apr-99	464.9	466.765	2103003.91	7616280.73	04/16/2007	
MW-28-90	Apr-04	464.9	467.534	2103005.68	7616289.73	04/16/2007	
MW-29	Apr-99	483	485.21	2103657.86	7615895.43	02/18/2004	
MW-30-30	Apr-99	466.2	468.12	2102499.58	7616141.26	02/18/2004	
MW-30-50	Mar-03	466.4	468.81	2102503.83	7616150.98	02/18/2004	
MW-31-60	Apr-99	495.1	496.81	2102876.3	7615812.43	02/18/2004	
MW-31-135	Mar-04	495.1	498.11	2102835.29	7615819.13	05/11/2004	
MW-32-20	Mar-03	459.1	461.51	2102044.81	7616304.82	02/18/2004	
MW-32-35	Mar-03	459.2	461.63	2102034.68	7616306.61	02/18/2004	
MW-33-40	Mar-03	485	487.378	2103280.78	7615916.42	03/08/2005	

TABLE B-2
Survey Location and Elevation Data for RFI/RI Wells and Borings
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station, Needles, California

Location ID	Date Installed	Elevation		Coordinates[1]		Survey[2] Date	Notes[3]
		Ground (ft MSL)	Measure Point (ft MSL)	Northing (ft)	Easting (ft)		
Groundwater Monitoring Wells							
MW-33-90	Mar-03	485	487.55	2103287.43	7615914.59	03/08/2005	
MW-33-150	Feb-05	485	487.77	2103302.58	7615906.05	03/08/2005	
MW-33-210	Feb-05	485	487.25	2103295.13	7615909.72	03/08/2005	
MW-34-55	Jun-03	458.9	460.945	2102542.45	7616444.49	03/08/2005	
MW-34-80	Jun-03	459.1	461.197	2102535.25	7616444.98	03/08/2005	
MW-34-100	Jan-05	458.932	460.965	2102530.6	7616452.41	03/08/2005	
MW-35-60	Mar-04	481.1	484.326	2104058.8	7615317.5	04/16/2007	
MW-35-135	Mar-04	481.2	484.242	2104045.82	7615329.76	04/16/2007	
MW-36-20	May-04	466.5	469.328	2102542.57	7616267.1	04/16/2007	
MW-36-40	May-04	466.7	469.591	2102537.2	7616267.58	04/16/2007	
MW-36-50	May-04	466.8	469.617	2102532.17	7616267.47	04/16/2007	
MW-36-70	May-04	466.5	469.265	2102542.67	7616267.18	04/16/2007	
MW-36-90	May-04	466.7	469.642	2102537.34	7616267.63	04/16/2007	
MW-36-100	May-04	466.8	469.65	2102532.37	7616267.51	04/16/2007	
MW-37S	Apr-04	483.5	485.97	2102869.45	7614827.87	05/11/2004	
MW-37D	Apr-04	483.7	486.19	2102882.18	7614825.33	05/11/2004	
MW-38S	Apr-04	522.8	525.51	2101279.65	7614918.75	05/11/2004	
MW-38D	Apr-04	523	525.31	2101264.32	7614918.79	05/11/2004	
MW-39-40	Apr-04	465.2	468.02	2102506.22	7616091.44	05/11/2004	
MW-39-50	Apr-04	465.1	467.93	2102498.75	7616095.96	05/11/2004	
MW-39-60	Apr-04	465.3	468	2102495.05	7616099.45	05/11/2004	
MW-39-70	Apr-04	465.2	468.02	2102506.3	7616091.38	05/11/2004	
MW-39-80	Apr-04	465.1	467.92	2102498.83	7616095.86	05/11/2004	
MW-39-100	Apr-04	465.3	468.12	2102494.95	7616099.3	05/11/2004	
MW-40S	May-04	566.3	566.04	2101861.86	7614386.85	05/11/2004	
MW-40D	May-04	566.5	566.08	2101864.35	7614370.53	05/11/2004	
MW-41S	Nov-04	477.406	480.071	2103518.07	7614588.78	02/15/2005	
MW-41M	Nov-04	477.061	479.835	2103527.41	7614583.19	02/15/2005	
MW-41D	Nov-04	476.877	479.416	2103536.66	7614578.85	02/15/2005	
MW-42-30	Feb-05	461.404	463.736	2102309.31	7616282.1	04/16/2007	
MW-42-55	Feb-05	461.229	463.853	2102303.38	7616278.63	04/16/2007	
MW-42-65	Feb-05	460.969	463.371	2102296.96	7616274.98	04/16/2007	
MW-43-25	Feb-05	462.54	462.54	2101817.50	7616702.79	03/08/2005	
MW-43-75	Feb-05	462.71	462.71	2101821.29	7616698.13	03/08/2005	
MW-43-90	Feb-05	459.94	462.76	2101824.65	7616693.23	03/08/2005	
MW-44-70	Mar-06	470.68	471.9	2102728.39	7616255.61	04/17/2006	
MW-44-115	Mar-06	470.32	472.01	2102723.93	7616261.92	08/22/2006	
MW-44-125	Mar-06	470.68	472.04	2102728.51	7616255.58	08/22/2006	
MW-45-095a	Feb-06	466.63	470.03	2102559.75	7616358.13	03/02/2006	
MW-45-095b	Feb-06	466.63	469.51	2102559.75	7616358.13	03/02/2006	
MW-46-175	Feb-06	480.82	482.16	2102940.02	7616196.86	05/16/2006	
MW-46-205	Feb-06	480.82	482.23	2102940.16	7616196.96	05/16/2006	

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Location ID	Date Installed	Elevation		Coordinates[1]		Survey[2] Date	Notes[3]
		Ground (ft MSL)	Measure Point (ft MSL)	Northing (ft)	Easting (ft)		
Groundwater Monitoring Wells							
MW-47-55	Mar-06	482.59	484.04	2103450.05	7615629.49	04/17/2006	
MW-47-115	Mar-06	482.59	484.17	2103450.09	7615629.74	04/17/2006	
MW-48	May-06	484.41	486.22	2101435.28	7615915.9	05/16/2006	
MW-49-135	Mar-06	482.57	484.02	2103667.53	7615889.63	05/16/2006	
MW-49-275	Mar-06	482.57	483.95	2103667.52	7615889.88	05/16/2006	
MW-49-365	Mar-06	482.57	484.01	2103667.25	7615889.83	05/16/2006	
MW-50-095	Apr-06	495.05	496.486	2103069.34	7615599.82	04/16/2007	
MW-50-200	Apr-06	495.05	496.349	2103069.62	7615599.82	04/16/2007	
MW-51	Apr-06	501.99	501.559	2101900.11	7615807.51	04/16/2007	
MW-52S	Mar-07	459.524	462.224	2101741.95	7616832.94	05/24/2007	
MW-52M	Mar-07	459.524	462.036	2101743.15	7616855.89	05/24/2007	
MW-52D	Mar-07	459.524	---	2101744.35	7616878.84	05/24/2007	
MW-53S	Mar-07	459.822	---	2101761.47	7616839.05	05/24/2007	
MW-53M	Mar-07	459.822	---	2101761.47	7616960.3	05/24/2007	
MW-53D	Mar-07	459.822	---	2101761.47	7617003.6	05/24/2007	
MWP-1	Jul-85	675	---	2100063	7613730	---	
MWP-2	Jul-85	674.71	---	---	---	---	
MWP-2RD	Jul-85	674	---	2099993	7613427	---	
MWP-3	Jul-85	660.7	---	2099298	7613570	---	
MWP-7	Oct-85	675.1	---	2100068	7614021	---	
MWP-8	Oct-85	676.8	677.48	2100026.29	7613553.1	02/18/2004	
MWP-9	Oct-85	680.2	---	2099815	7613287	---	
MWP-10	1986	675.3	675.81	2099985.14	7613361.94	02/18/2004	
MWP-12	1986	662	663.49	2099175.79	7613717.69	02/18/2004	
MWP-14	Jun-92	674.1	---	2100021	7613476	---	
MWP-15	Jun-92	676.4	---	2099968	7613594	---	
MWP-16	Jun-92	689.5	---	2099721	7613552	---	
OW-1S	Nov-04	547.589	550.205	2103040.48	7613419.2	02/15/2005	
OW-1M	Sep-04	547.746	550.45	2103038.38	7613428.89	02/15/2005	
OW-1D	Sep-04	547.766	550.485	2103030.9	7613420.85	02/15/2005	
OW-2S	Dec-04	546.167	548.876	2103153.89	7613373.77	02/15/2005	
OW-2M	Dec-04	545.871	548.589	2103160.57	7613382.67	02/15/2005	
OW-2D	Dec-04	546.675	549.152	2103142.09	7613374.28	02/15/2005	
OW-3S	Oct-04	555.833	558.577	2103267.64	7612152.99	02/15/2005	
OW-3M	Oct-04	556.202	558.895	2103276.78	7612157.98	02/15/2005	
OW-3D	Oct-04	555.914	558.625	2103286.35	7612161.22	02/15/2005	
OW-5S	Nov-04	549.124	551.826	2103017.60	7613186.81	02/15/2005	
OW-5M	Nov-04	549.005	551.806	2103008.06	7613185.86	02/15/2005	
OW-5D	Nov-04	549.52	552.33	2102998.32	7613185.55	02/15/2005	
P-1	Feb-86	694	---	---	---	---	
P-2	Aug-86	535.6	537.6	2101228.89	7612324.79	---	
PGE-7BR	Oct-07	562.6	---	2101350.19	7615034.78	---	

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Location ID	Date Installed	Elevation: Ground (ft MSL)	Elevation: Measure Point (ft MSL)	Coordinates[1]: Northing (ft)	Coordinates[1]: Easting (ft)	Survey Date[2]	Notes[3]
Groundwater Monitoring Wells							
CW-1M	Jan-05	563.363	566.157	2102703.17	7613263.12	02/15/2005	
CW-1D	Jan-05	563.774	566.573	2102692.93	7613263.17	02/15/2005	
CW-2M	Feb-05	546.637	549.37	2103106.51	7613795.76	02/15/2005	
CW-2D	Jan-05	546.722	549.64	2103097.47	7613798.05	02/15/2005	
CW-3M	Feb-05	531.547	534.208	2103351.93	7613858.79	02/15/2005	
CW-3D	Jan-05	531.531	534.265	2103348.44	7613849.33	02/15/2005	
CW-4M	Jan-05	515.803	518.656	2103268.73	7612925.43	02/15/2005	
CW-4D	Jan-05	515.905	518.682	2103263.03	7612928.74	02/15/2005	
Extraction, Test & Injection Wells							
IW-2	Dec-04	546.542	550.105	2103104.94	7613363.87	02/15/2005	
IW-3	Dec-04	551.433	554.441	2103007.18	7613237.80	02/15/2005	
PE-1	Mar-05	457.524	457.524	2102550.25	7616345.31	03/08/2005	
PGE-8	Jun-69	595.3	596.01	2100589.66	7614925.89	02/18/2004	
PGE-PT-1	Nov-86	624.5	623.29	2101453	7612166	---	
TW-1	Nov-03	621	620.55	2101173.17	7615150.78	02/18/2004	
TW-2S	Apr-04	496.7	499.05	2102641.02	7615869.56	03/02/2006	
TW-2D	Apr-04	497	493.29	2102633.34	7615861.57	03/02/2006	
TW-3D	Oct-05	497.28	498.094	2102630.41	7615849.61	03/02/2006	
TW-4	Mar-06	482.62	484.11	2103457.17	7615623.69	04/17/2006	
TW-5	Apr-06	494.97	496.3	2103066.15	7615592.99	05/16/2006	
Pilot Study Wells							
PT-1S	Jan-06	472.1	474.51	2102643.69	7616043.57	03/02/2006	
PT-1M	Jan-06	472.1	474.48	2102643.42	7616043.6	03/02/2006	
PT-1D	Jan-06	472.1	474.49	2102643.59	7616043.5	03/02/2006	
PT-2S	Feb-06	471.49	473.35	2102645.89	7616017.9	03/02/2006	
PT-2M	Feb-06	471.49	473.45	2102646.18	7616018.09	03/02/2006	
PT-2D	Feb-06	471.49	473.48	2102646.23	7616017.74	03/02/2006	
PT-3S	Feb-06	471.56	473.45	2102637.31	7616060.88	03/02/2006	
PT-3M	Feb-06	471.56	473.38	2102637.43	7616060.86	03/02/2006	
PT-3D	Feb-06	471.56	473.39	2102637.02	7616061.09	03/02/2006	
PT-4S	Feb-06	471.65	474.29	2102626.76	7616077.37	03/02/2006	
PT-4M	Feb-06	471.65	474.19	2102626.65	7616077.53	03/02/2006	
PT-4D	Feb-06	471.65	474.19	2102626.68	7616077.38	03/02/2006	
PT-5S	Feb-06	471.12	473.47	2102629.73	7616112.06	03/02/2006	
PT-5M	Feb-06	471.12	473.49	2102629.70	7616112.29	03/02/2006	
PT-5D	Feb-06	471.12	473.65	2102629.47	7616112.09	03/02/2006	
PT-6S	Jan-06	474.3	475.84	2102673.02	7616074.76	03/02/2006	
PT-6M	Jan-06	474.3	475.89	2102672.69	7616074.74	03/02/2006	
PT-6D	Jan-06	474.3	476.08	2102672.77	7616074.62	03/02/2006	
PT-7S	May-07	560.54	560.54	2101552	7615058.94	07/17/2007	
PT-7M	May-07	560.66	560.66	2101547.4	7615058.02	07/17/2007	
PT-7D	May-07	560.42	560.42	2101551.61	7615058.69	07/17/2007	

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Pilot Study Wells							
PT-8S	May-07	562.22	562.22	2101507.41	7615085.75	07/17/2007	
PT-8M	May-07	562.1	562.1	2101511.31	7615089.23	07/17/2007	
PT-8D	May-07	562.03	562.03	2101507.28	7615085.88	07/17/2007	
PT-9S	Jun-07	562	559.27	2101630.33	7615141.91	07/17/2007	
PT-9M	Jun-07	559.5	559.14	2101631.88	7615136.65	07/17/2007	
PT-9D	Jun-07	559.56	559.11	2101630.53	7615141.87	07/17/2007	
PTI-1S	Jan-06	472.54	474.9	2102648.8	7616067.35	08/22/2006	
PTI-1M	Jan-06	472.73	474.99	2102652.29	7616064.56	08/22/2006	
PTI-1D	Jan-06	472.54	474.61	2102649.26	7616062.3	08/22/2006	
PTR-1	May-07	558	---	2101561	7615044	07/17/2007	
PTR-2	Jun-07	565	---	2101451	7615127	07/17/2007	
Water Supply Wells							
PGE-1	Sep-51	555	---	2101814.18	7614816.75	02/08/2008	Elevation and coordinates are estimated
PGE-2	Jul-51	552	---	2101799.46	7614943.31	02/08/2008	Elevation and coordinates are estimated
PGE-6	Jun-64	562.3	563.32	2101525.08	7615050.86	02/18/2004	
PGE-7	Sep-64	562.6	563.89	2101350.19	7615034.78	02/18/2004	
PGE-9N	Apr-97	459.7	462.21	2101364.3	7617882.1	02/18/2004	
PGE-9S	Apr-97	459.4	461.99	2101340.52	7617879.85	02/18/2004	
Park Moabi-1	Mar-61	470	---	2104866.07	7608076.97	---	Elevation and coordinates are estimated
Park Moabi-3	Aug-86	517.2	518.55	2103953.94	7607298.24	02/18/2004	
Park Moabi-4	Oct-06	485	---	2105089	7607908	---	Elevation and coordinates are estimated
Selected Wells in Arizona							
Sanders	Jun-05	464	464.17	2101893.74	7619011.01	---	
Smith	Feb-98	505	---	2101771.58	7617985.72	---	
TMW-6	Jan-91	469	468.465	---	---	---	Located in Marina parking area
TMW-8	Jan-91	465	464.232	---	---	---	Located in Marina parking area
TMW-9	Jan-91	461	460.27	---	---	---	Located in Marina parking area
TMW-10	Jan-91	470	470	---	---	---	Located in Marina parking area
TMW-11	Jan-91	468	468.137	---	---	---	Located in Marina parking area
Topock-1		505	---	2102798.55	7619175.44	---	
Topock-2	Sep-80	509.07	509.07	2103733.81	7620366.28	---	
Topock-3	May-74	510.8	510.8	2103732.31	7620357.73	---	
Exploratory & Test Borings							
B-25	Apr-98	672	---	2100483	7613703	---	
CB-1	Mar-62	471	---	2101752	7616264	---	State of California Public Works Bore Log
CB-2	Mar-62	499	---	2101866	7617554	---	State of California Public Works Bore Log
CB-3	Mar-62	504	---	2101885	7617575	---	State of California Public Works Bore Log
CB-4	Mar-62	504	---	2101876	7617565	---	State of California Public Works Bore Log
CB-5	Mar-62	460	---	2101763	7616418	---	State of California Public Works Bore Log
CB-6	Mar-62	460	---	2101765	7616433	---	State of California Public Works Bore Log
CB-7	Mar-62	459	---	2101805	7616809	---	State of California Public Works Bore Log
CB-8	Mar-62	460	---	2101745	7616520	---	State of California Public Works Bore Log

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Location ID	Date Installed	Elevation		Coordinates[1]		Survey[2] Date	Notes[3]
		Ground (ft MSL)	Measure Point (ft MSL)	Northing (ft)	Easting (ft)		
Exploratory & Test Borings							
CB-9	Mar-62	461	---	2101825	7616980	---	State of California Public Works Bore Log
CB-10	Mar-62	459	---	2101843	7617176	---	State of California Public Works Bore Log
CB-11	Mar-62	459	---	2101854	7617385	---	State of California Public Works Bore Log
CB-12	May-62	458	---	2101868	7617399	---	State of California Public Works Bore Log
CB-13	Mar-62	458	---	2101784	7616605	---	State of California Public Works Bore Log
CB-14	Mar-62	458	---	2101799	7616616	---	State of California Public Works Bore Log
IW-1	Nov-04	545	---	2103026.39	7613368.09	11/19/2004	
PE-1A	Feb-05	461.233	---	2102326.16	7616405.15	02/28/2005	
PE-1B	Feb-05	458.639	---	2102210.36	7616424.89	02/27/2005	
PM-B1	Mar-86	475	---	2107040	7609614	---	
PM-B2	Mar-86	495	---	2104788	7606964	---	
XMW-9	Jun-97	535.6	537.6	2100454.1	7614759.4	---	

Notes:

Boring and well constuction logs included in Appendex B

1 California State Plane, NAD 83, Zone 5, US Feet

2 All dates represent most recent survey date unless otherwise noted.

3 Estimated elevations were derived from USGS topographic data. Estimated coordinates were determined using photobased georeferencing methods.

Additional Abbreviations:

ATSF	Atchison, Topeka and Santa Fe Railway
bgs	Feet below ground surface
MSL	Feet above mean sea level
USGS	United States Geological Survey
---	data not available or not applicable

B2 Boring Logs and Well Construction Data for RFI/RI Wells

ON 09/08/03 for MW-1
Ground surface = 656.3'
PVC = 661.31'

BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

Topock Compressor Station (NEW POND SITE)

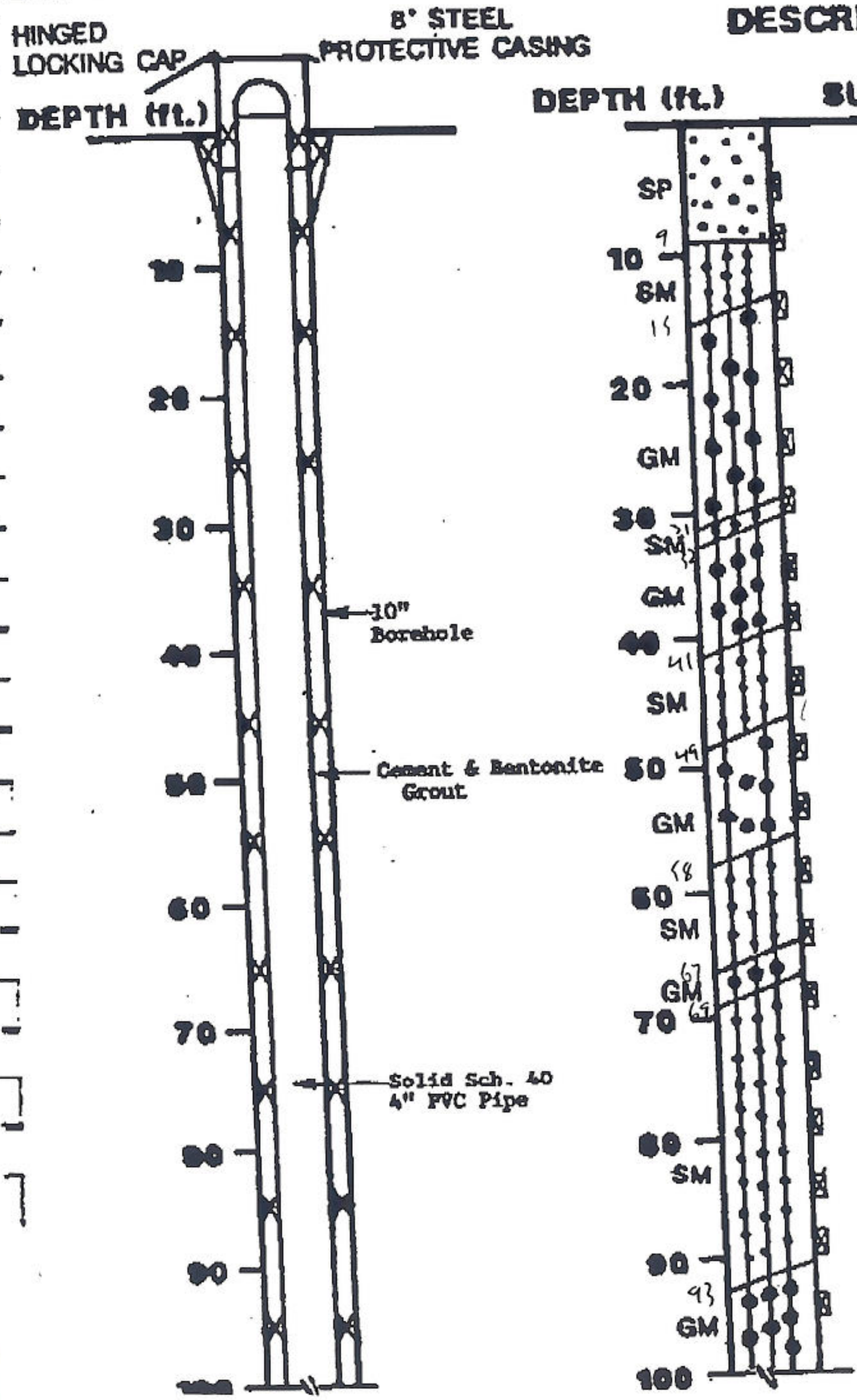
WELL AS BUILT **BORE HOLE** P-1 MW-1

ELEV. TOP OF PVC PIPE: 660.41' **DATE STARTED:** 8/24/86

DESCRIPTION OF MATERIALS

DATUM: MEAN SEA LEVEL

SURFACE ELEV. 659.17'



SAND - Pinkish Brn, VF-F gr, dry, subang to subrdd; sparse gravels to ½".

SILTY SAND w/gravel-Brn, dry, calc., metadiorite, gneiss & qtz gravels to 2½". Sand Matrix

SILTY GRAVEL w/sand-Brn, dry, calc., metadiorite, gneiss & qtz gravels to 2½". Sand Matrix

SILTY SAND - As before (Lens)

SILTY GRAVEL w/sand - As before

SILTY SAND w/gravel - Brn, VF-C gr, dry, subang., calc. w/subang gravels to 2"

SILTY GRAVEL w/sand - Brn, ang to subang, dry, calc., to 2½"

SILTY SAND w/gravel - Brn, VF-C gr, dry, subang w/gravels to 2"

- Increasing Gravels -

SILTY SAND w/gravel - as before

- Increasing Gravels -

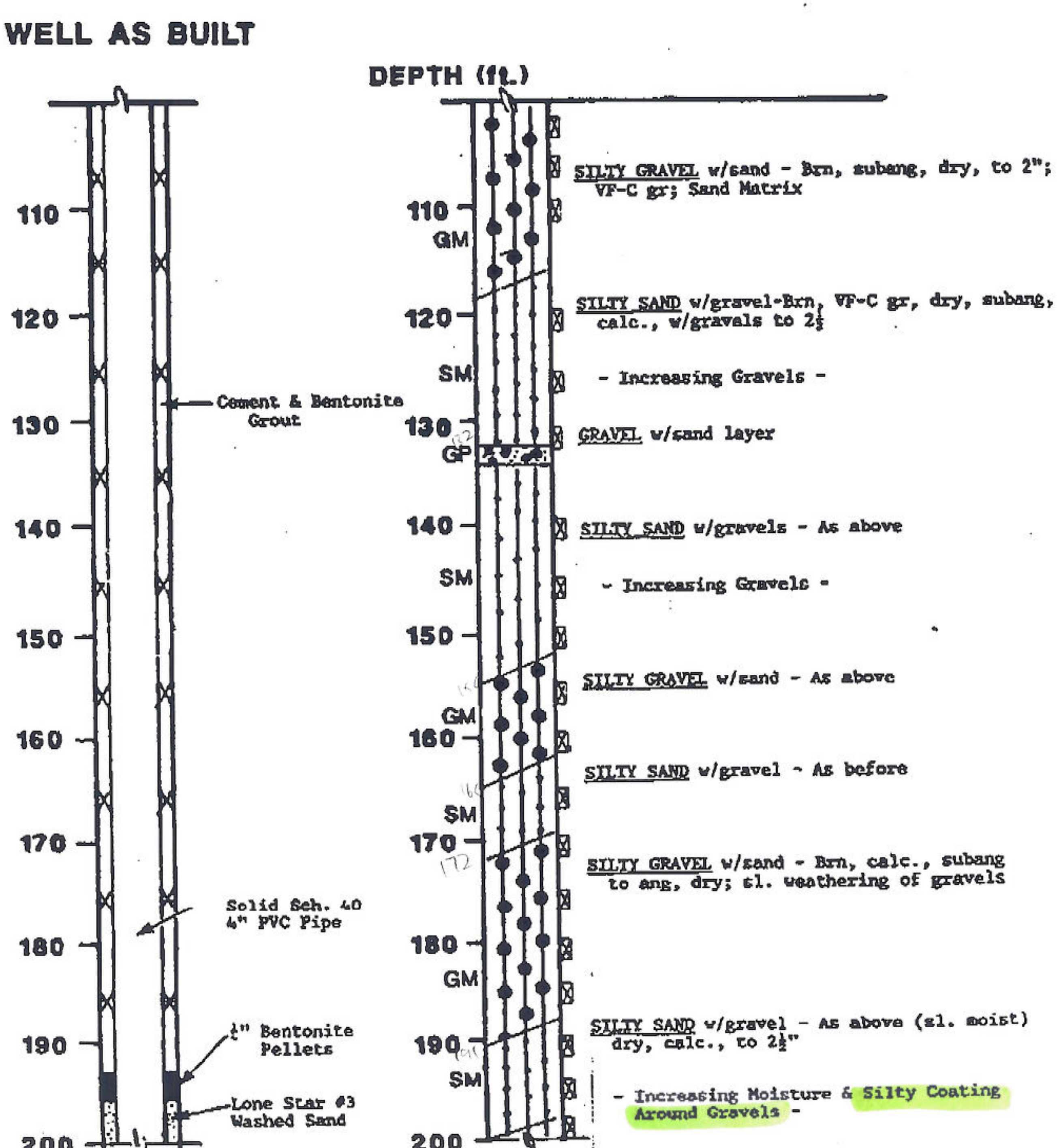
SILTY GRAVEL w/sand - Brn, subang, dry, to 3"

- Calc. Cemented Congl Frags - ?

BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

Topock Compressor Station (NEW POND SITE)

BORE HOLE P-1 Continued



BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

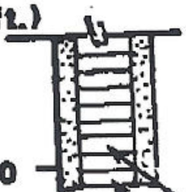
Topock Compressor Station (NEW POND SITE)

BORE HOLE P-1 Continued

DESCRIPTION OF MATERIALS

WELL AS BUILT

DEPTH (ft.)

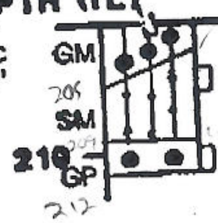


4" Sch. 40 PVC Pipe W/4 0.02" horiz. slots per inch of length

Screened Interval 200.5' - 210.5'

4" Sch. 40 Screw Cap

DEPTH (ft.)



SILTY GRAVEL w/sand

SILTY SAND w/gravel - wet

GRAVEL w/sand - Brn, subang to ang, wet to 2½"

Depth to 1st water 204' (8/27/86)

Hole Terminated at 212'

Notes:
1. Hole advanced by Layne-Western's 10" air percussion hammer rig.
2. Borehole logged by L.A. Flora.

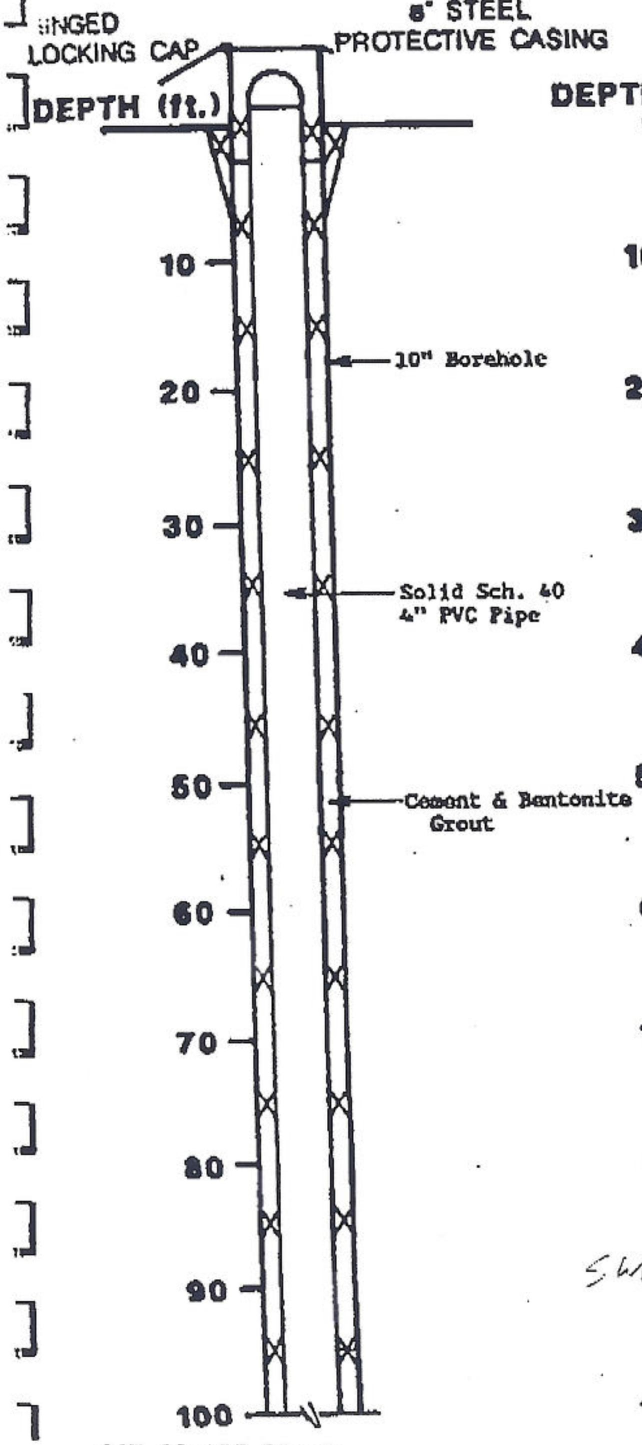
ON 07/08/03 for MW-3
GS = 645.30'
PVC = 650.08'

BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

Topock Compressor Station (NEW POND SITE)

WELL AS BUILT **BORE HOLE** P-3 (MW-3) MW-3

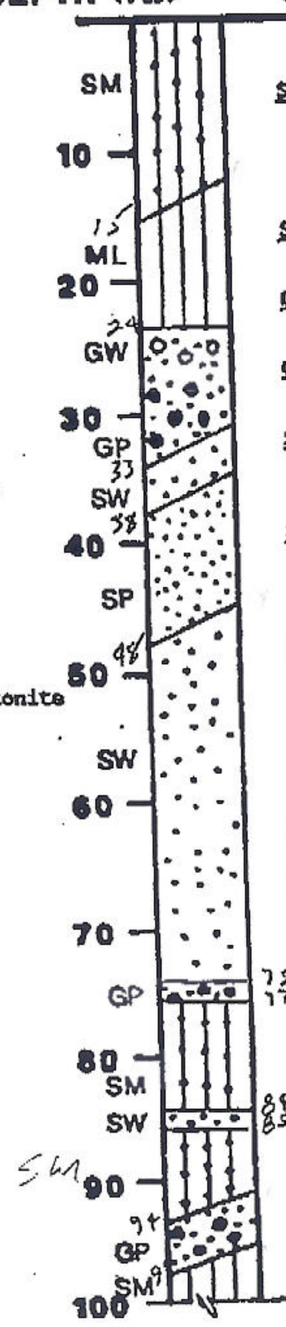
ELEV. TOP OF PVC PIPE: 648.56' **DATE STARTED:** 8/19/86



DESCRIPTION OF MATERIALS

DATUM: MEAN SEA LEVEL

SURFACE ELEV. 647.83'



SILTY SAND - Pinkish Brn., VF gr, calc, dry subang w/sparse gravels to ½".
- increasing gravels -
- blebs of Red silty clay -

SILT w/sand - Pinkish Brn, dry
- decreasing clay blebs -

GRAVEL w/sand & silt - Brn, dry, subang to ang, to 4", fresh

GRAVEL w/sand & silt - As above to 1½"

SAND w/gravel - Brn, VF-C gr, dry; gravels to 1½"

SAND w/gravel - As above, VF-M gr

SAND w/gravel - Brn to Reddish Brn, VF-C gr, dry, calc., subang w/metadiorite & gneissic gravels to 2"; trace silt

GRAVEL w/sand Layer

SILT SAND w/gravel - Grn, VF-C gr, dry, subang to subrdd, w/subang gravels to 2½"

- sparse calc. cemented congl frags -

SAND - Rd Brn, VF-C gv, sl. moist

SILTY SAND - As above

GRAVEL w/sand - some calc. cemented congl frags

SILTY SAND w/gravel - Rd Brn, VF-C gr, dry calc. w/gravels to 3"

GRAVEL w/sand

BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

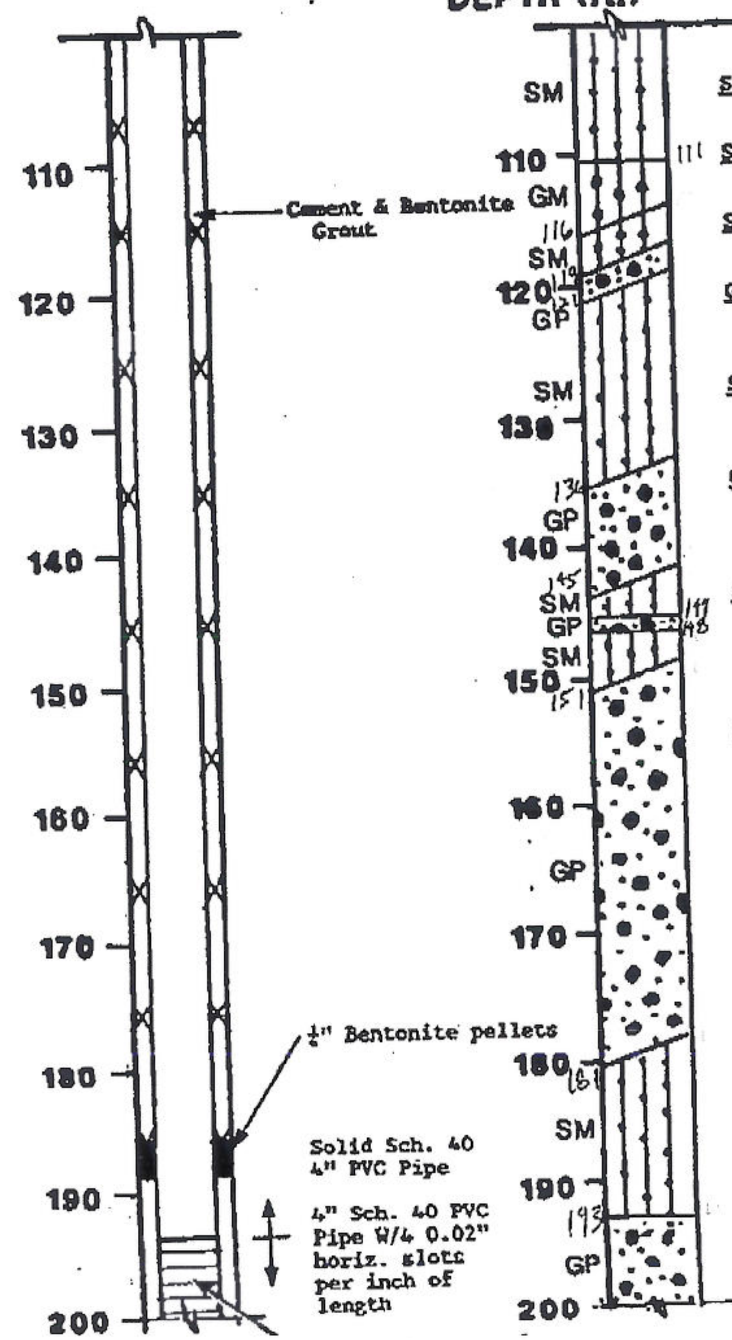
Topock Compressor Station (NEW POND SITE)

BORE HOLE P-3 Continued

647.83

WELL AS BUILT

DEPTH (ft.)



SILTY SAND w/gravel - Rd Brn, VF-C gr, dry subang; w/meta gravels & calc cemented congl frags to 4"

SILTY GRAVEL w/sand - As above, more gravel

SILTY SAND w/gravel

GRAVEL w/sand - Dk Gray, fresh to sl. weathered; dry, to 2"

SILTY SAND w/gravel - As above

GRAVEL w/sand & silt - Gray, subang to ang, dry, to 3" w/Sandy - Silty Matrix

SILTY SAND w/gravel - Brn, VF-Cgr, dry, subang. calc., w/gravels to 1½"

GRAVEL w/Sand - Gray, subang, fresh to sl. weathered clasts, to 2½"

- some w/calc. cement coating -

- increased gravels between 171' - 172' -

- Dry -

SILTY SAND w/gravels - Brn, sl. moist, VF-Cgr, subang w/moist coating on gravels

- increasing moisture -

Depth of 1st water
▽ 189' (8/20/86) - wet -

GRAVEL w/sand & silt - Brn, wet, to 3", common silt/sand coatings

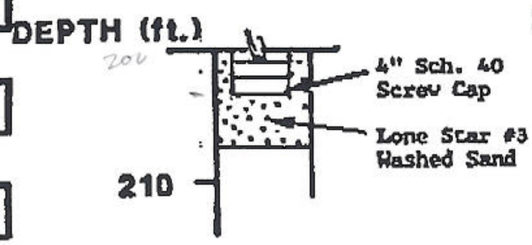
BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

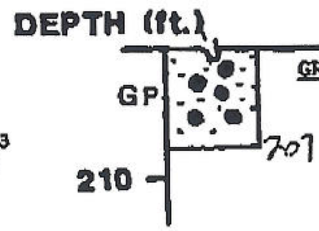
Topock Compressor Station (NEW POND SITE)

BORE HOLE P-3 Continued

WELL AS BUILT

DESCRIPTION OF MATERIALS





GRAVEL w/sand & silt - As before

Hole Terminated at 207'

Notes:
1. Hole advanced by Layne-Western's 10" air percussion hammer rig.
2. Borehole logged by L.A. Flora.

BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

Topock Compressor Station (NEW POND SITE)

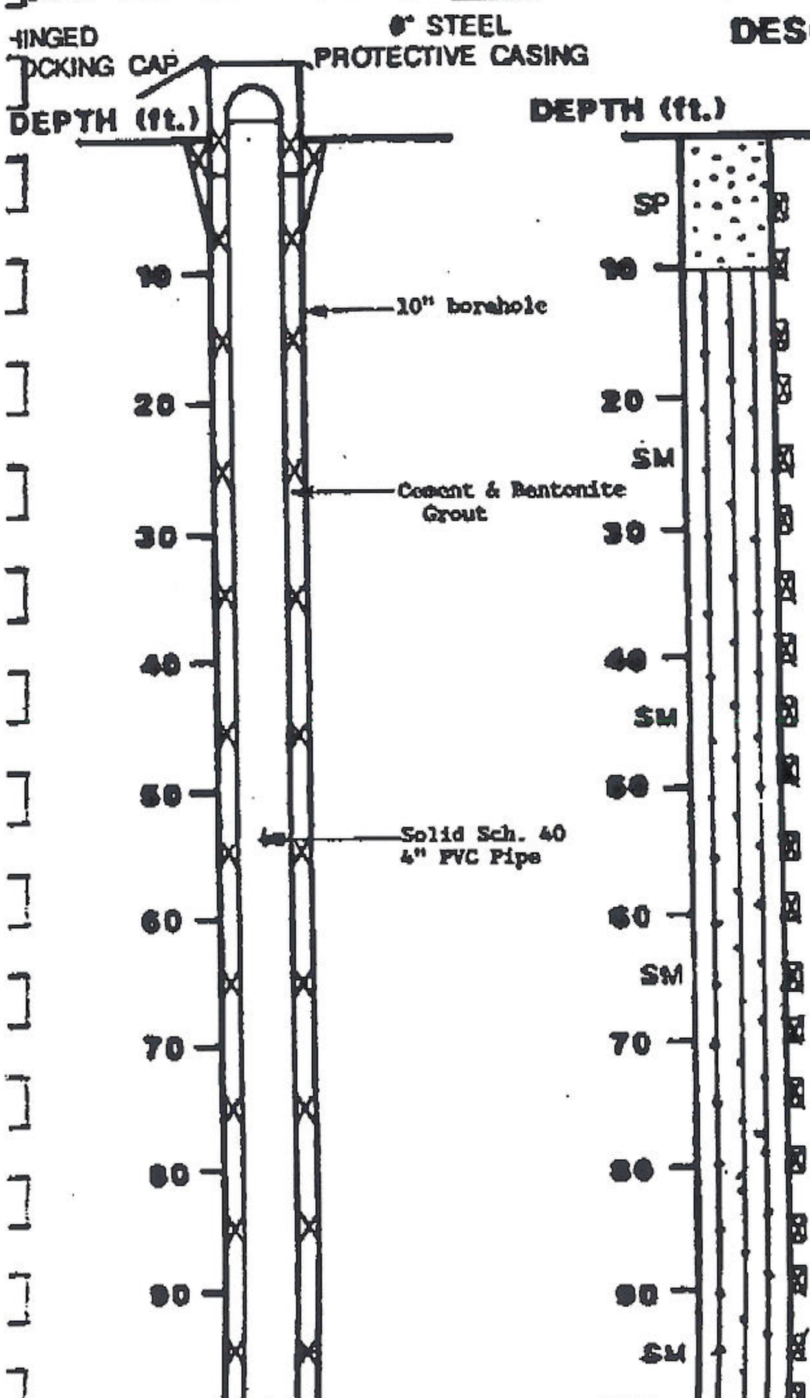
WELL AS BUILT **BORE HOLE** P-4 mw-4 mw-4

ELEV. TOP OF PVC PIPE: 624.34' **DATE STARTED:** 8/21/86

DESCRIPTION OF MATERIALS

DATUM: MEAN SEA LEVEL

SURFACE ELEV. 622.95'



SAND - Pinkish Brn, VF-F gr, dry, subang to ang, uniform; sparse fine gravels

- increasing gravels to 1" -

SILTY SAND w/gravel - Brn, VF-C gr, dry, subang to subrdd, poorly sorted, w/ang metadiorite gravels to 2½"

SILTY SAND w/gravel - As above

- decreasing gravels -

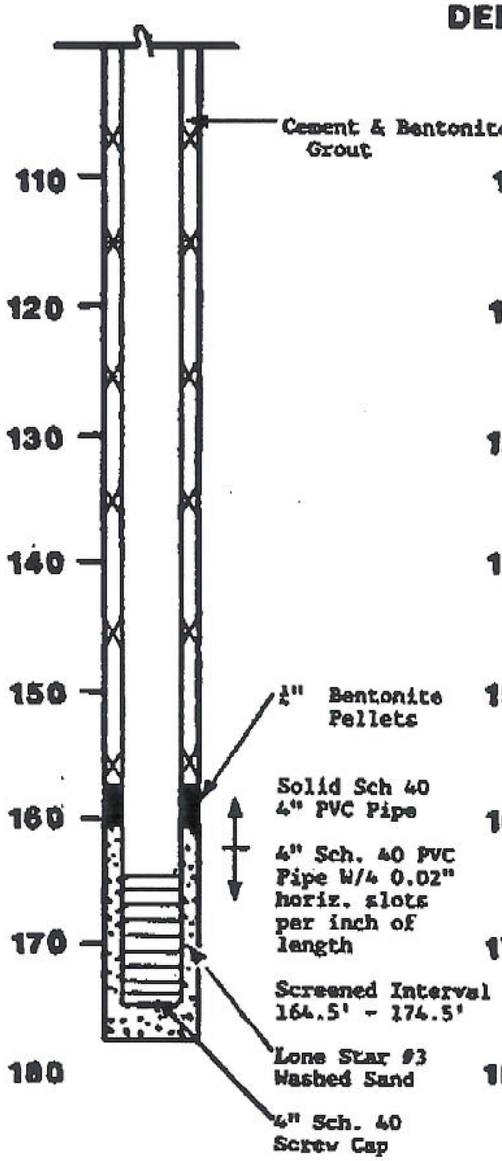
SILTY SAND w/gravel - As above w/calc. cemented congl. frags

BOREHOLE LOGS AND WELL CONSTRUCTION RECORD

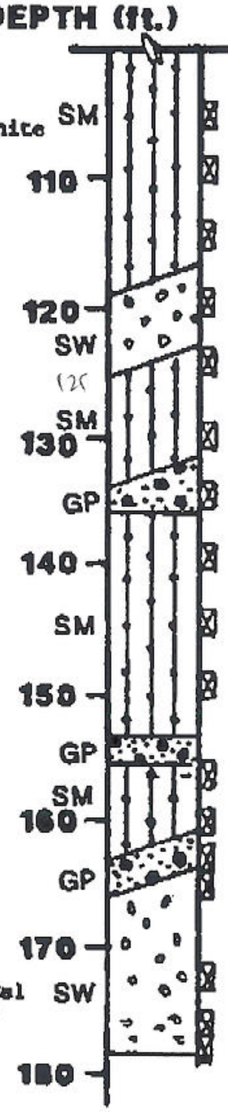
Topock Compressor Station (NEW POND SITE)

BORE HOLE P-4 Continued

WELL AS BUILT



DEPTH (ft.)



SILTY SAND - Brn, VF-C gv, dry, subang; sparse sl. moist, silt coated gravels to 2"

SAND w/gravel -Brn, VF-C gr, subang, dry to sl. Moist silty coating on some gravels; calc. cemented congl. frags common.

SILTY SAND w/gravel - As before

GRAVEL w/sand - Pinkish Brn, subang to subrdd, to 1½"; Reddish silt-sand sl. moist coatings on some gravels; Sandy Matrix, dry.

SILTY SAND w/gravel - Pinkish Brn, VF-C gr, dry, subang to subrdd; Meta gravels to 2½", sl. moist silty coating on gravels

GRAVEL w/sand - As above

SILTY SAND w/gravel - As before

GRAVEL w/sand - As above ▽ Depth to 1st water 164' (8/21/86)

SAND w/gravel - Brn, moist, VF -C gr, subang, moist to wet gravels to 1"

- increasing moisture -

Wet

Hole Terminated at 180'

Notes:
1. Hole advanced by Layne-Western's 10" air percussion hammer rig.
2. Borehole logged by L.A. Flora.

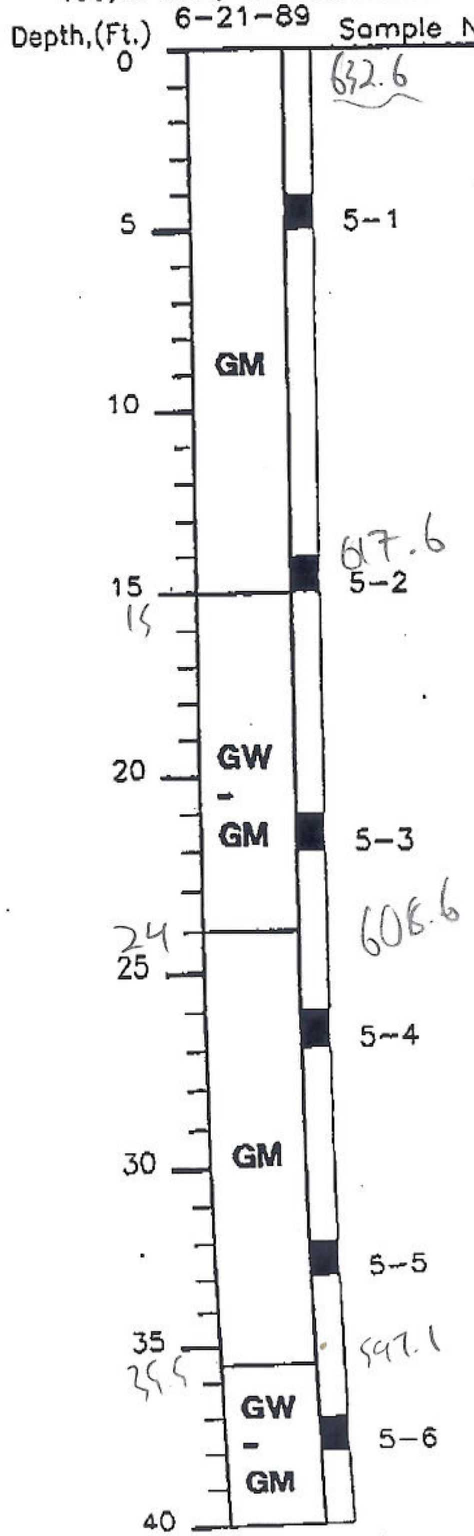
TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-5

Soil Boring Log - Monitoring Well MW-5

El.=632.6
460,601.2N, 3,050,677.8E
6-21-89



Description

SILTY GRAVEL WITH SAND

5-1: Gray-brown, dry, slightly silty gravel. Subangular to 3" size. Predominantly metadiorite, quartz diorite, and gneiss. Older alluvial fan materials.

Slightly humid.

5-2

WELL GRADED GRAVEL WITH SILT AND SAND

5-3: Gray-brown, slightly silty gravel.

SILTY GRAVEL WITH SAND

5-4: Tan, humid, moderately silty gravel.

5-5: Gray-brown, humid, silty gravel.

WELL GRADED GRAVEL WITH SILT AND SAND

5-6: Grey brown, humid, slightly less silty gravel.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-5

Soil Boring Log - Monitoring Well MW-5

Depth,(Ft.)		Sample No.	Description
40–45.5	GM - GW	5-7	WELL GRADED GRAVEL WITH SILT AND SAND Tan-brown, moist\humid, silty gravel.
45.5 (587.1) – 50	SM	5-8	SILTY SAND WITH GRAVEL Slightly reddish brown, humid, medium fine silty sand with gravel.
50 (582.6) – 56	GM	5-9	SILTY GRAVEL WITH SAND Tan-brown, humid, silty gravel.
56 (576.6) – 69.5	SM	5-10, 5-11, 5-12	SILTY SAND WITH GRAVEL Brown, humid, fairly gravelly silty sand. Brown, humid, medium coarse silty sand with occassional coarse gravel to 3" and abundant smaller, subangular gravel.
69.5 (563.1) – 72	GM		SILTY GRAVEL WITH SAND Brown, humid slightly silty medium-fine gravel.
72 (560.6) – 74.5	SM	5-13	SILTY SAND WITH GRAVEL Brown, silty sand with small gravel.
74.5 (558.1) – 80	GM		SILTY GRAVEL WITH SAND Brown, humid, silty gravel with sand.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-5

Soil Boring Log - Monitoring Well MW-5

Sheet 3 of 5

Depth,(Ft.)		Sample No.	Description
80	GM		SILTY GRAVEL WITH SAND Brown, humid, slightly silty small gravel with sand.
85		5-14	
		5-15	
90 90		542.6	
	GM - GW	5-16	WELL GRADED GRAVEL WITH SILT AND SAND Brown, humid, silty gravel with sand.
95		5-17	
			Brown, humid, silty to sandy gravel.
100			
105 105		527.6	
	SM	5-18	SILTY SAND WITH GRAVEL Brown, humid, silty sand with gravel.
106.5		526.1	
	GM - GW		WELL GRADED GRAVEL WITH SILT AND SAND Brown, humid, silty gravel with sand. Gravels to 3" - most 3/4 to 1-1/2".
110			
		5-19	
115			
			117' - large cobbles.
120			

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-5

Soil Boring Log - Monitoring Well MW-5

Sheet 4 of 5

Depth (Ft.)	USCS	Sample No.	Description
120	GM - GW	5-20	WELL GRADED GRAVEL WITH SILT AND SAND
125			
129		503.6	
130	SM	5-21	SILTY SAND WITH GRAVEL Brown, humid, medium coarse slightly silty sand with gravel.
133.5		499.1	
135	GM - GW	5-22	WELL GRADED GRAVEL WITH SILT AND SAND Brown, humid, slightly silty gravel with sand.
140		5-23	
145		487.1	
145.5	SM	5-24	SILTY SAND WITH GRAVEL Gray-brown, humid, medium coarse sand with gravel.
150			
155		5-25	Tan, humid, silty sand with sparse gravel. Firm.
160			

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-5

Soil Boring Log - Monitoring Well MW-5

Sheet 5 of 5

Depth,(Ft.)		Sample No.	Description
160	SM		
161		471.6	
	GM	5-26	SILTY GRAVEL WITH SAND Gray-tan, slightly moist sitly gravel with sand. Gravels coated with silt.
165			
		5-27	Sandy gravel coated with reddish-brown silt. Somewhat moist. Firm.
170			
		5-28	Gray-brown, slightly moist fairly silty gravel with sand. Firm. Gravel silt-coated.
175			
		5-29	Gray-brown, moist, silty gravel with sand.
		▽ 177.9' 6-22-89 7:05am	
180			
		5-30	Gray-brown, moist, silty gravel with sand. Firm.
185		447.1	
186.5	SM	5-31	SILTY SAND WITH GRAVEL Gray-brown to brown, moist, slightly silty coarse sand with gravel.
188	188.0' BOH	444.6	

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-6

Soil Boring Log - Monitoring Well MW-6

El.=640.1'
460,614.7N, 3,050,269.5E
6-27-89

Depth,(Ft.)	Soil	Sample No.	Description
0–4.5	GM	6-1	SILTY GRAVEL WITH SAND Gray-tan, silty gravel with sand. Fill, medium dense, dry.
4.5–6 (635.6)	SP	6-2	POORLY GRADED SAND WITH GRAVEL. Tan, dry, slightly silty, poorly graded fine sand with gravel. Loose, young alluvial fan deposit.
6–14 (634.1)	GM	6-3, 6-4	SILTY GRAVEL WITH SAND Gray, dry silty gravel. Older alluvial fan material. Gravels subangular diorite and metadiorite rock types. Firm, to 4" some larger.
14–26 (626.1)	GW-GM	6-5, 6-6, 6-7	WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid, less silty gravel with sand.
26–40 (614.1)	GM	6-8, 6-9, 6-10	SILTY GRAVEL WITH SAND Gray-tan, humid, silty gravel with sand. Gravels to 4" Slight silt coating on gravels.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-6

Soil Boring Log - Monitoring Well MW-6

Sheet 2 of 5

Depth,(Ft.)		Sample No.	Description
40	GM		SILTY GRAVEL WITH SAND
		6-11	
US 45		595.1	
	GW - GM	6-12	WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid, silty gravel with appreciable sand. Dense.
50			
55		6-13	Gray-brown, humid, silty gravel with appreciable sand. Gravel silt-coated. Dense.
60			
65		6-14	
70		6-15	
73.5		566.6	
75	GM	6-16	SILTY GRAVEL WITH SAND Grayish-brown to brown, humid, silty gravel with sand. Gravel silt coated. Dense.
79.5		560.6	
80			

TOPOCK COMPRESSOR STATION

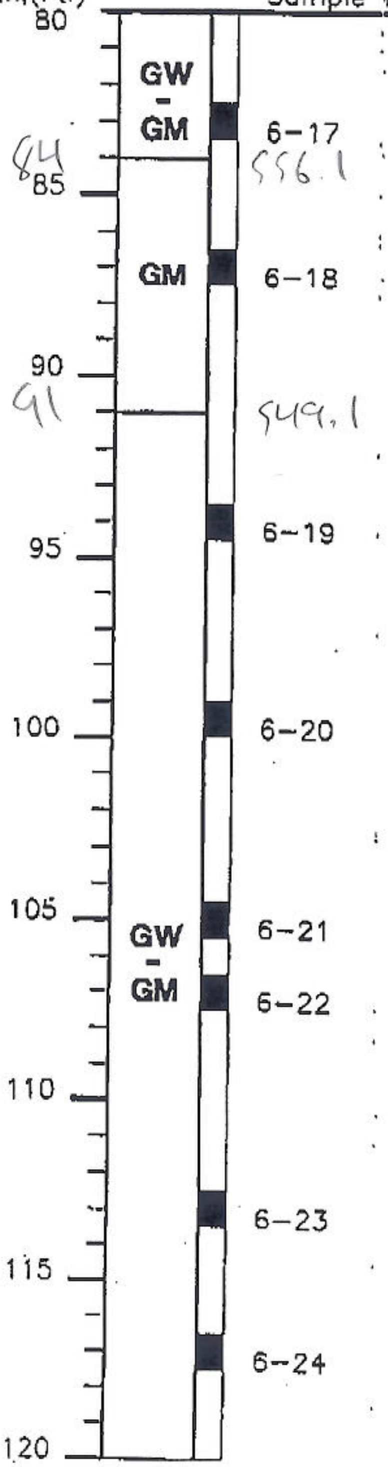
NEW SURFACE IMPOUNDMENTS

MW-6

Soil Boring Log - Monitoring Well MW-6

Sheet 3 of 5

Depth,(Ft.) Sample No. Description



WELL GRADED GRAVEL WITH SILT AND SAND
Gray-brown, humid, fairly silty, well-graded gravel with sand

SILTY GRAVEL WITH SAND
Brown to gray-brown, humid, moderately silty gravel with sand. Dense.

WELL GRADED GRAVEL WITH SILT AND SAND
Gray-brown, humid (increasing moisture), slightly silty gravel with sand. Moderately dense.

Tan-brown, humid, fairly silty, well-graded gravel with sand.

Gray-brown, humid, slightly silty, well-graded gravel with sand.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-6

Soil Boring Log - Monitoring Well MW-6

Depth,(Ft.)	Soil	Sample No.	Description
120	GW-GM		WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid; slightly silty, well-graded gravel with sand. Dense. Gravels coated with silt.
125		6-25	
130		6-26	
135			
139		501.1	
140	GM	6-27	SILTY GRAVEL WITH SAND Gray-brown, humid, silty gravel with sand.
145			
147		493.1	
150	GW-GM	6-28	WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid, slightly silty, well-graded gravel with appreciable sand.
155	GW-GM	6-29	Slight suggestion of increasing moisture content.
160			

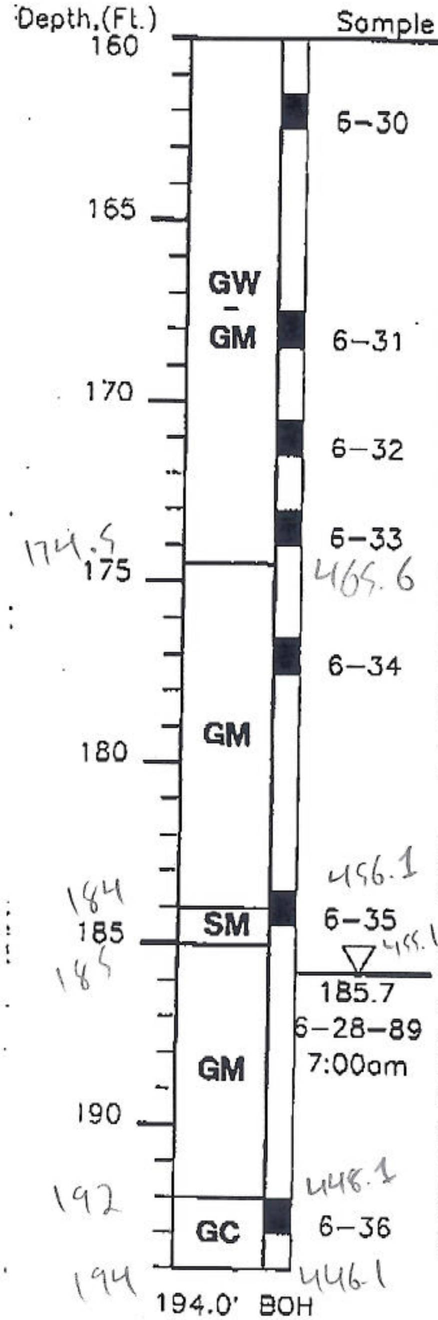
TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-6

Soil Boring Log - Monitoring Well MW-6

Depth,(Ft.) Sample No. Description



WELL GRADED GRAVEL WITH SILT AND SAND

Gray-brown, humid, slightly silty, well graded gravel with sand and abundant cobbles.

172.0' - 174.5' cobbly zone.

SILTY GRAVEL WITH SAND

Tan-brown, slightly damp silty to sandy gravel. Dense.
179.5' -180.5' cobbly zone.
181.5' - 184' cobbly zone.

SILTY SAND WITH GRAVEL Brown, moist silty gravel with appreciable sand.

SILTY GRAVEL WITH SAND

Very rocky 189.5' - 191.0'.
Large cobble 191.0' - 192.2'.

CLAYEY GRAVEL WITH SAND

Brown, wet, fairly silty, clayey gravel.

TOPOCK COMPRESSOR STATION

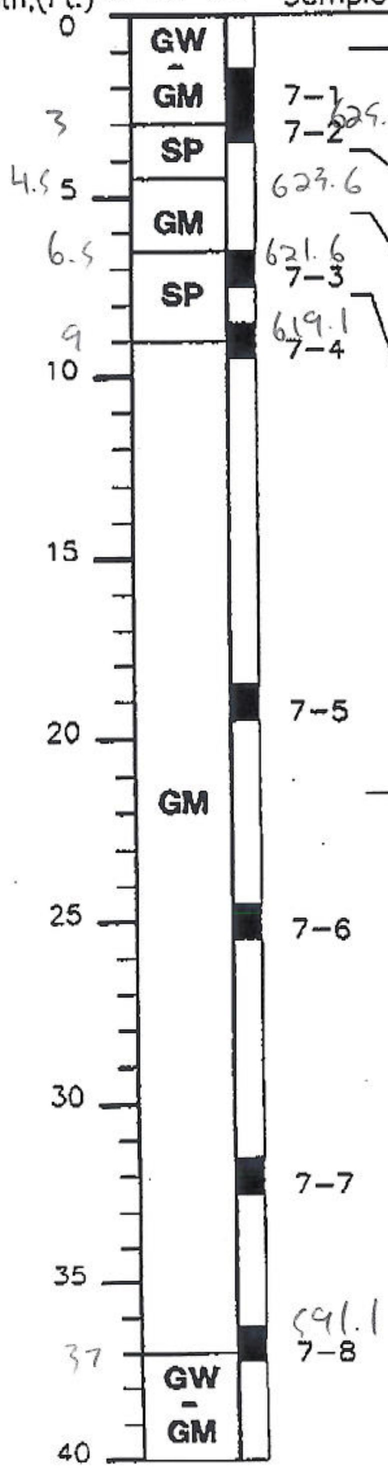
NEW SURFACE IMPOUNDMENTS

MW-7

Soil Boring Log - Monitoring Well MW-7

El.=628.1'
460,957.2N, 3,050,421.6E

Depth,(Ft.) 6-25-89 Sample No. Description



WELL GRADED GRAVEL WITH SILT AND SAND
Gray-brown, humid, silty, sandy gravel. Gravel to subangular 3". Young alluvial fan deposit.

POORLY GRADED SAND WITH SILT.
Brown, dry, medium coarse, slightly silty sand with small subangular gravel.

SILTY GRAVEL WITH SAND
Brown, humid, moderately silty gravel with sand. Gravels subangular to 2".

POORLY GRADED SAND WITH SILT.
Tan, dry, medium coarse sand with gravel to 1". Loose.

SILTY GRAVEL WITH SAND
Gray-brown, silty gravel. Medium dense older alluvial fan deposit. Gravels silt coated. Gravels to 2-4" size.

WELL GRADED GRAVEL WITH SILT AND SAND
Gray-brown, humid, sandy silt with gravel. Gravels to 2-3".

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-7

Soil Boring Log - Monitoring Well MW-7

Sheet 2 of 5

Depth,(Ft.)	Handwritten depth	Soil type	Sample No.	Handwritten	Description
40		GW - GM	7-9		WELL GRADED GRAVEL WITH SILT AND SAND
45	46	GM	7-10	582.1	SILTY GRAVEL WITH SAND Grayish-brown, humid, silty gravel. Moderately dense.
50	49	GW - GM		579.1	WELL GRADED GRAVEL WITH SILT AND SAND Grayish-brown, humid, sandy gravel with silt. Moderately loose.
55	54.5	GM	7-11 7-12	573.6	SILTY GRAVEL WITH SAND Brown, humid to moist, silty gravel with sand, moderately firm.
60, 65, 70, 75, 80	60	GW - GM	7-13 7-14 7-15 7-16	568.1	WELL GRADED GRAVEL WITH SILT AND SAND Grayish-brown to brown, humid, sandy gravel with silt, moderately loose.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-7

Soil Boring Log - Monitoring Well MW-7

Depth,(Ft.)	Soil	Sample No.	Description
80	GW - GM		WELL GRADED GRAVEL WITH SILT AND SAND
84		544.1 7-17	
85	GM		SILTY GRAVEL WITH SAND Grayish-brown, humid, silty gravel with sand. More gravelly and firmer.
		7-18	
			89.5' large boulder.
90			Gray-brown, humid, silty gravel with sand. Medium dense. Gravels silt coated.
		7-19	
95			
			96.0-96.2; 96.4-96.7' rocky zone.
100			
		7-20	
104		524.1	
105	GW	7-21	WELL GRADED GRAVEL WITH SAND Grayish-brown, humid gravel with coarse sand and some silt.
110			
		7-22	
115 (115)		7-23	
	GM	513.1	SILTY GRAVEL WITH SAND Gray-brown to gray, humid, silty gravel with sand.
120			

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-7

Soil Boring Log - Monitoring Well MW-7

Sheet 4 of 5

Depth,(Ft.)		Sample No.	Description
120			
		7-24	SILTY GRAVEL WITH SAND Gray-brown to gray, humid, silty gravel with sand.
			123.5 – 124.3' large cobbles
125			
130		7-25	
			131.0 – 131.6' cobble
	GM		Grayish-brown to brown, humid, sandy gravel with silt.
135			
		7-26	
140			139.5 – 139.9' cobble.
		7-27	Brown, damp, humid, sandy silty gravel.
145			
148		480.1	
150	GW-GM	7-28	WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid, slightly silty sandy gravel.
155 155		473.1	
	GM	7-29	SILTY GRAVEL WITH SAND Gray-brown, humid silty gravel with sand.
160			

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-7

Soil Boring Log - Monitoring Well MW-7

Sheet 5 of 5

Depth,(Ft.)	Soil	Sample No.	Description
160			
161		467.1	
	SM	7-30	SILTY SAND WITH GRAVEL Tan, humid silty sand with gravel..
165 (165)		463.1	
	GW		WELL GRADED GRAVEL WITH SAND 165.5-169.0' Large cobbles. Chips of fine grained boulder, fresh diorite. Chips at 167.8 are gneissic as well. (Two boulders?)
170			
		7-31	Moist silty gravel and cobbles.
175		174.6' 6-26-89 6:30am	Brown moist, silty gravel with sand.
176		452.1	
	GM	7-32	SILTY GRAVEL WITH SAND Nested large cobbles
180			
185		7-33	Brown, moist, silty gravel with sand. Very firm.
188		7-34 440.1	

188.0' BOH

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-8

Soil Boring Log - Monitoring Well MW-8

El.=624.7'
460,892.0N, 3,050,744.3E
Depth,(Ft.) 6-23-89

Depth (Ft.) 0–40	Sample No.	Description
SP	8-1	POORLY GRADED SNAD WITH GRAVEL Light brown, dry, medium sand with gravel to 1". Loose. Young alluvial fan deposit.
SM	8-2	SILTY SAND WITH GRAVEL Gray-brown, dry silty sand with gravel to 3".
GM	8-3	SILTY GRAVEL WITH SAND Gray-brown, dry, silty gravel with sand. Subangular to angular gravels to 3". Metamorphic gneiss and metadiorite. Older alluvial fan material.
SM	8-4	SILTY SAND WITH GRAVEL Gray-brown, dry to humid, very gravelly, medium coarse silty sand.
GM	8-5	SILTY GRAVEL WITH SAND Large cobble - metadiorite at 21.3 - 21.5' Gray-brown, dry to humid, fairly silty sandy gravel.
SW-SM		WELL GRADED SAND WITH SILT AND GRAVEL Gray-tan, humid to dry, gravelly slightly silty medium coarse sand.
GM	8-6	SILTY GRAVEL WITH SAND Gray-brown, humid, slightly silty sandy gravel. Gravels to 3-4" maximum.
SW - SM	8-7	WELL GRADED SAND WITH SILT AND GRAVEL Gray-brown, dry, slightly silty gravelly sand.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-8

Soil Boring Log - Monitoring Well MW-8

Sheet 2 of 5

Depth,(Ft.): 40, 45, 50, 55, 60, 65, 70, 75, 80

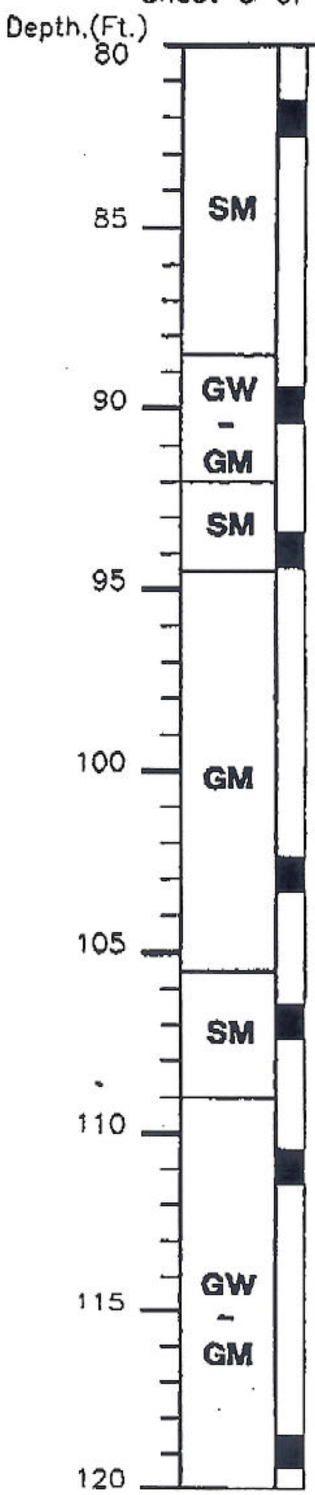
Soil	Sample No.	Description
GM	8-8	SILTY GRAVEL WITH SAND Gray-brown, humid, silty, sandy gravel.
GW-GM	8-9	WELL GRADED GRAVEL WITH SILT AND SAND Brown, humid, slightly silty, quite sandy gravel.
GM		SILTY GRAVEL WITH SAND Brown, humid, silty gravel.
SM	8-10	SILTY SAND WITH GRAVEL Gray-brown, humid, fairly gravelly silty sand.
GM	8-11 8-12	SILTY GRAVEL WITH SAND Gray-brown, humid, sandy slightly silty gravel. Gravel to 3"
SM	8-13	SILTY SAND WITH GRAVEL Light brown, humid, slightly silty medium sand with sparse gravel.
GW	8-14	WELL GRADED GRAVEL WITH SAND Gray-brown, humid, slightly silty gravel. Gravel silt-coated.
SM	8-15	SILTY SAND WITH GRAVEL Brown to gray-brown, humid, silty sand with gravel.

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-8

Soil Boring Log - Monitoring Well MW-8



Sample No.	Description
8-16	SILTY SAND WITH GRAVEL Gray-brown, humid, silty sand with gravel. Gravel silt-coated.
8-17	WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid, slightly silty sandy gravel. Gravels silt-coated.
8-18	SILTY SAND WITH GRAVEL Gray-brown, humid, slightly silty coarse sand with gravel.
	SILTY GRAVEL WITH SAND Gray-brown, humid, silty gravel. Firm.
8-19	
8-20	SILTY SAND WITH GRAVEL Gray-brown, humid, medium coarse silty sand with gravel.
8-21	WELL GRADED GRAVEL WITH SILT AND SAND Gray-brown, humid, quite sandy silty gravel.
8-22	

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-8

Soil Boring Log - Monitoring Well MW-8

Depth,(Ft.)		Sample No.	Description
120			
125	SM	8-23	SILTY SAND WITH GRAVEL Brown, humid, medium coarse silty sand with gravel.
130	GM	8-24	SILTY GRAVEL WITH SAND Brown to gray-brown, humid, silty gravel. Firm.
135	GW - GM		WELL GRADED GRAVEL WITH SILT AND SAND Gray, humid, very slightly silty, sandy gravel. Firm.
140	SW - SM	8-25	WELL GRADED SAND WITH SILT AND GRAVEL. Gray-brown, humid, slightly silty sand with gravel.
145	GW - GM	8-26	WELL GRADED GRAVEL WITH SILT AND SAND Tan ~~to~~ gray, humid, slightly silty sandy gravel.
150		8-27	
155	SM	8-28	SILTY SAND WITH GRAVEL Brown, humid, silty sand with gravel.
160			

TOPOCK COMPRESSOR STATION

NEW SURFACE IMPOUNDMENTS

MW-8

Soil Boring Log - Monitoring Well MW-8

Sheet 5 of 5

Depth,(Ft.)	Soil	Sample No.	Description
160	GM	8-29	SILTY GRAVEL WITH SAND Brown, slightly moist to humid silty gravel with sand. Slightly increasing moisture.
165 (165)	SW - SM	8-30	WELL GRADED SAND WITH SILT AND GRAVEL. Brown, moist to slightly moist, gravelly silty sand.
(168.5) 170	GW - GM	8-31 170.2' 6-24-89 6:30am 8-32 8-33	WELL GRADED GRAVEL WITH SILT AND SAND Brown, moist, silty gravel. Firm. 171.5-177' large cobbles/boulders.
175			
(177)	GP - GM		POORLY GRADED GRAVEL WITH SILT Brown, moist silty gravel.
(179.4)			

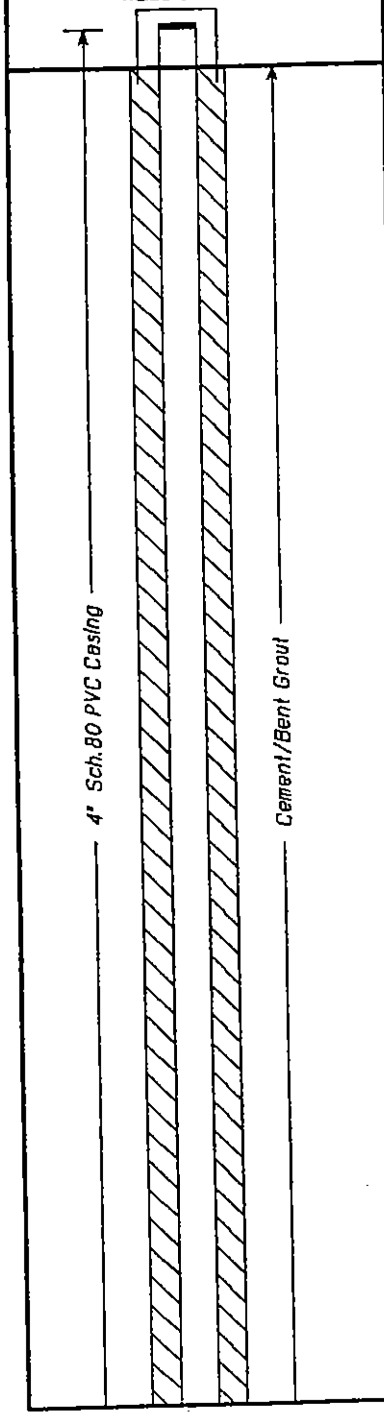
179.4' BOH

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-9	Page 1 of 3

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*

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0	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 ?
5	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. 6.5' 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.
10	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.
15		
20		
		Same: color change to moderate brown, moist.
25		
30		

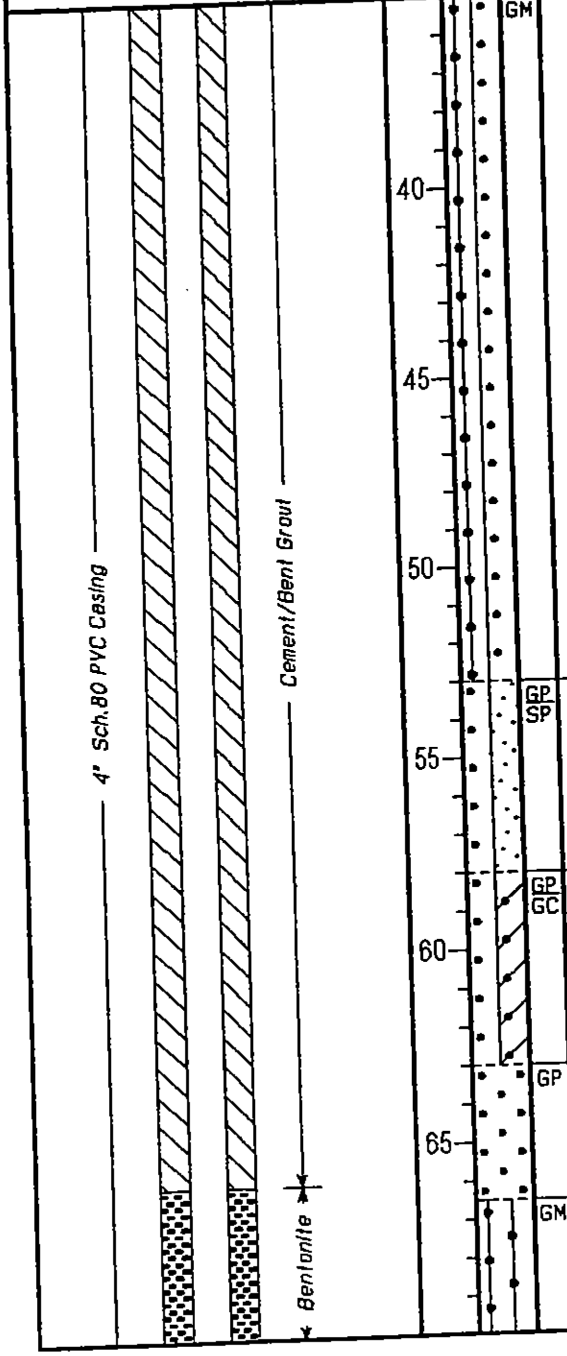
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-9

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: 536.18
LOGGED BY: Dan Salaices	APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			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

ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *07/01/97*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

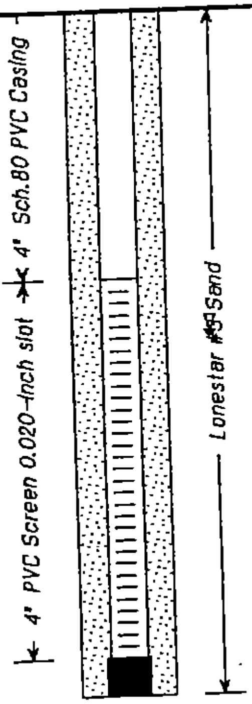
DRILLING METHOD: *Resonant Sonic, Continuous Coring*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *536.18*

LOGGED BY: *Dan Salaices* APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
75	GM	
	GP GM	sandy silty GRAVEL: moderate brown; 70% gravel, 4-30 mm, subangular; 20% sand, fine to coarse grained; 10% fines; very moist.
80	GC	clayey GRAVEL: dark yellowish brown; 80% gravel, 4-30 mm, occasional cobble fragments; 20% sand, fine grained; 20% fines; wet.
85	GM	RED FANGLOMERATE sandy silty GRAVEL: (GM although rock at 88.5) moderate reddish brown, wet to 88.5, dry at 88.5.
		refusal at 89 feet. Total depth of borehole is 89 feet.
90		
95		
100		

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-10

ALISTO PROJECT NO: 10-320-06 DATE DRILLED: 06/27/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

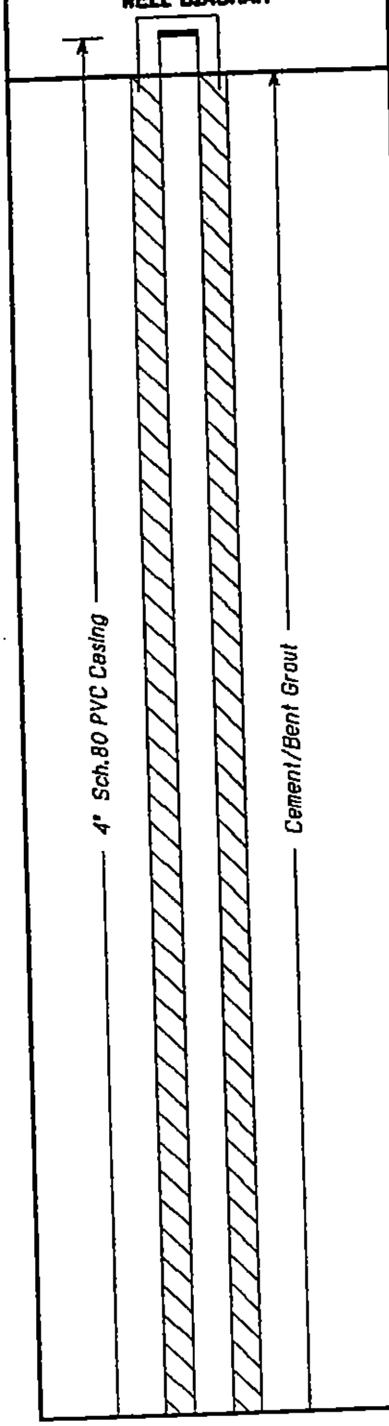
DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear CASING ELEVATION: 530.24

LOGGED BY: Dan Salaices APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM



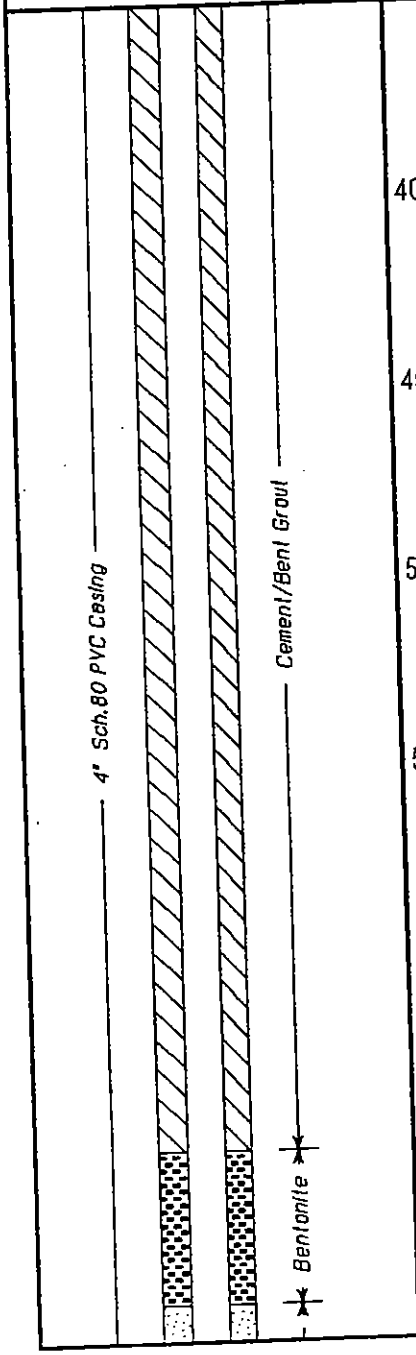
DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0–5.5	GP	sandy GRAVEL: various shades of gray; 70-80% gravel, 4-30 mm, subangular; 20-30% sand, fine to coarse grained; dry.
5.5–9	GP/SP	sandy gravel/gravelly SAND: light olive gray; 50% gravel, 4-50 mm, cobble fragments at 7'; 50% sand, fine to coarse grained; dry.
9–12	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.
12–23	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
23–26	SP	gravelly SAND: dark yellowish brown to light olive gray; 80% sand, fine to coarse grained; 40% gravel, 4-20 mm; moist.
26–34	GP	sandy GRAVEL: dark yellowish brown; 70% gravel, 4-40 mm, 30% sand, fine to coarse grained; moist.
34–	GP/GC	sandy clayey GRAVEL: moderate brown; 70% gravel, 4-50 mm,

Depth scale: 5, 10, 15, 20, 25, 30

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 Salaices*	*APPROVED BY: Dan Salaices*

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP GC	subangular, some fracturing; 20% sand, fine to medium grained; 10% fines; moist. cobble at 38.0 feet, 100 mm.
40, 45	SP	gravelly SAND: dark yellowish brown; 60% sand, fine to coarse grained; 40% gravel, 4-50 mm, some cobble fragments; moist.
50, 55, 60	GP	sandy GRAVEL: dark yellowish brown; 60% 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.
65	GP GM	sandy silty GRAVEL: dark yellowish brown; 60% gravel, 4-40 mm; 30% sand, fine to coarse grained; 10% fines; moist.

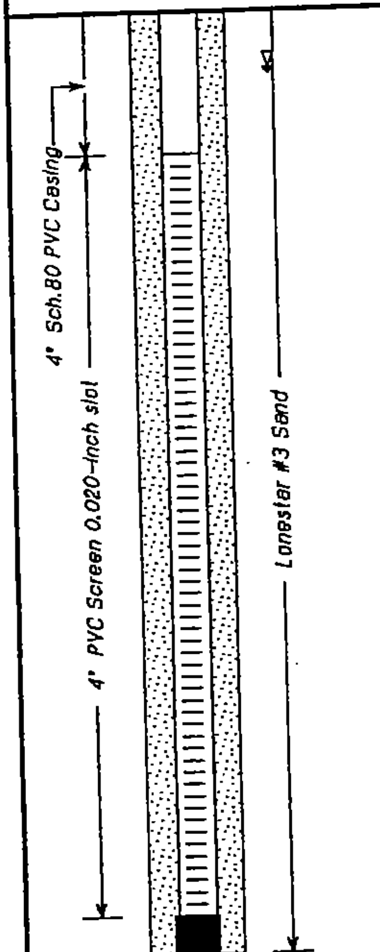
LOG OF WELL MW-10

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

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 Salaices* APPROVED BY: *Dan Salaices*

WELL DIAGRAM



DEPTH feet	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.
75		
	GP	sandy GRAVEL: dark yellowish brown; 60% gravel, 4–30 mm, subangular; 30–40% sand, coarse grained; 0–10% fines, wet.
80		
	GP-GC	sandy clayey GRAVEL: dark yellowish brown; 70% gravel, 4–30 mm; 20% sand, medium to coarse grained; 10% fines; wet.
85		No recovery from 85–88
	GP	sandy GRAVEL: dark yellowish brown; 60% gravel, 4–40 mm, subrounded to subangular; 40% sand, medium to coarse grained; wet.
90		
95		
	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 99 feet.
100		

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-11

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06 DATE DRILLED: 06/29-30/97

CLIENT: Pacific Gas and Electric Co.

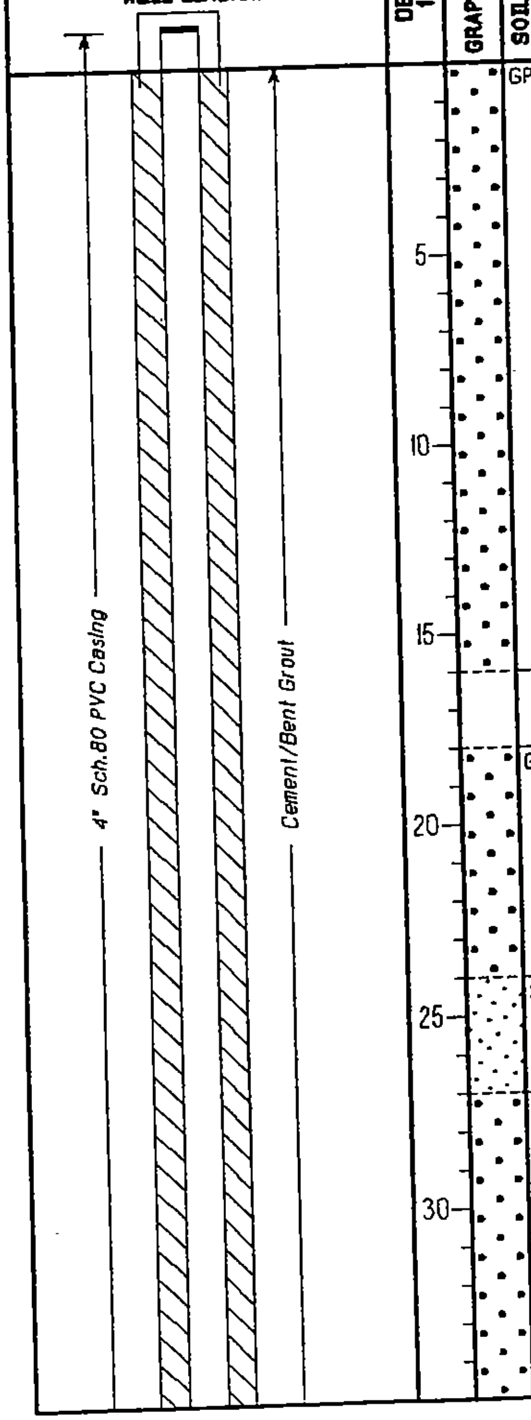
LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear CASING ELEVATION: 522.19

LOGGED BY: Dan Salaices APPROVED BY: Dan Salaices

WELL DIAGRAM



SOIL CLASS	GEOLOGIC DESCRIPTION
GP	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; 60% gravel, 4-50 mm, subangular, occasional cobble fragments; 40% sand, fine to coarse grained; dry.
	No Recovery
GP	sandy GRAVEL: moderate yellowish brown; 60% gravel, 4-50 mm, subangular, occasional cobble fragments; 40% sand, fine to coarse grained; dry. Cobbles at 20 feet
SP	gravelly SAND: moderate yellowish brown; 60% sand, fine and coarse grained; 40% gravel, 4-50 mm, subangular, cobble at 27 feet.
GP	sandy GRAVEL: moderate yellowish brown; 60-70% 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

ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *08/29-30/97*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

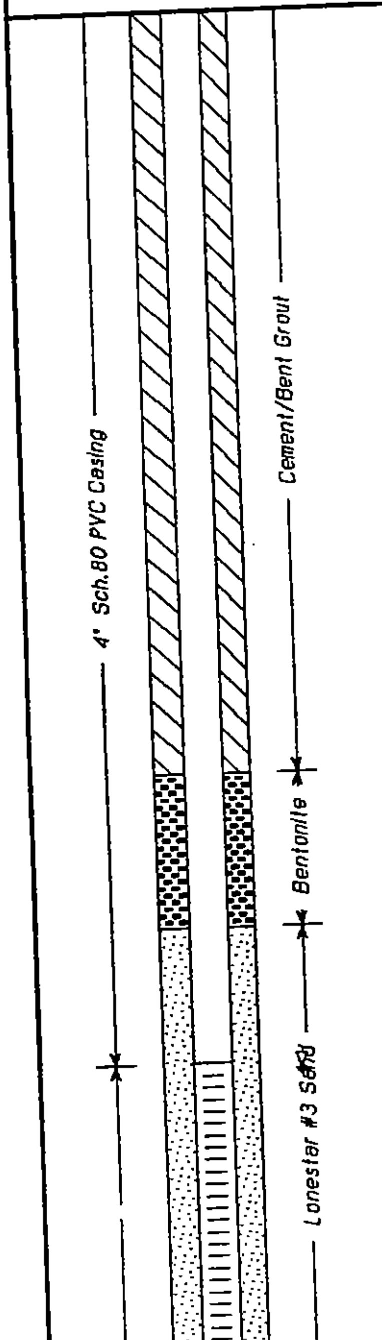
DRILLING METHOD: *Resonant Sonic, Continuous Coring*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *522.19*

LOGGED BY: *Dan Salaices* APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	at 38.5' dark yellowish brown; 60% gravel, 4-40 mm; 40% sand, mostly fine grained.
40	SP	gravelly SAND: dark yellowish brown; 60% sand, fine to coarse grained; 40% gravel, 4-30 mm, subangular, occasional cobble; moist.
45	GP	sandy GRAVEL: dark yellowish brown; 60% gravel, 4-40 mm, subangular, occasional cobbles; 40% sand, fine to coarse grained.
50		
55		
60	SP	gravelly SAND: dark yellowish brown; 60-70% sand, fine to coarse grained; 30-40% gravel, 4-20 mm, subrounded; appears wet at 63 feet.
65	SC	gravelly clayey SAND: dark yellowish brown; 60% sand, fine to coarse grained; 20% gravel, subrounded, 4-20mm; 20% fines, low plasticity; wet.
	GC	See next page

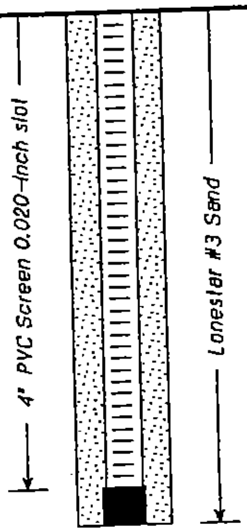
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-11

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

SEE SITE PLAN

WELL DIAGRAM



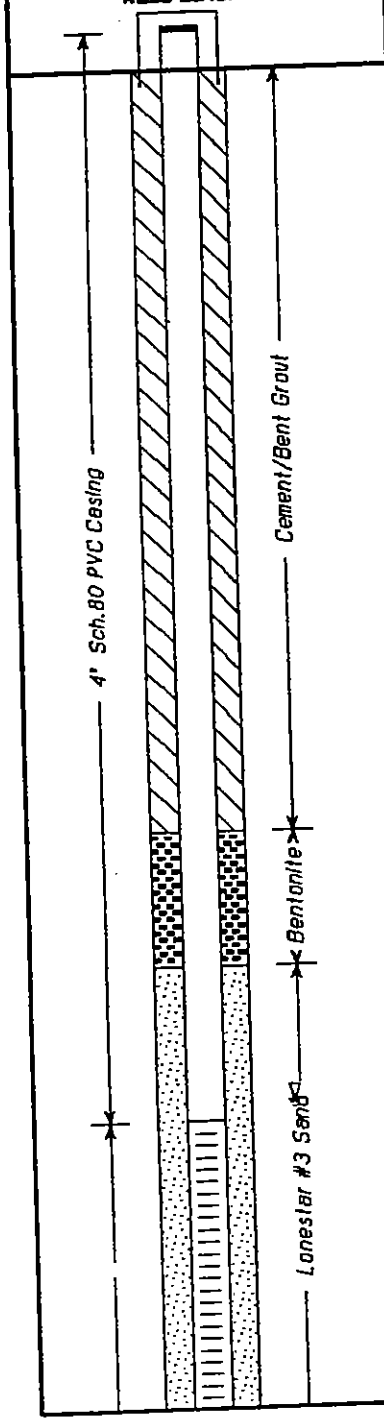
DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GC	sandy clayey GRAVEL: dark yellowish brown; 80% gravel, 4-20 mm, subangular, occasional cobble; 20% sand, fine to coarse grained; 20% fines; wet.
		No Recovery
75	SP	gravelly SAND: dark yellowish brown; 80-70% sand, medium to coarse grained, subrounded; 30-40% gravel, 4-20 mm, subrounded to subangular; wet.
	GC	sandy clayey GRAVEL: dark yellowish brown; 80% gravel, 4-20 mm, subrounded to subangular; 20% sand, fine to coarse grained; 20% fines; wet.
80	SP	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.
85	SC	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
90		
95		
100		

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-12	Page 1 of 2

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 Salaices

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
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.
7	SM	silty SAND: pale yellowish brown; 60% sand, very fine to fine grained; 30% fines; 10% gravel, 4-20 mm, subangular; dry.
10		at 10 feet, angular gravel to 40 mm.
11	SP	gravelly SAND: pale brown; 75% sand, fine to medium grained; 15% gravel, 4-15 mm, subrounded; 10% fines; dry.
15		at 15 feet, color change to moderate brown; 60% sand, fine to coarse grained; 40% gravel, 4-20 mm, subangular, occasional cobble; dry.
20		at 20 feet; 60% sand, fine to medium grained; 40% gravel, 4-25 mm, subangular; dry to very moist.
28		Wet at 28 feet.
28	GP	sandy GRAVEL: pale brown; 55% gravel, 4-20 mm, subangular; 35% sand, fine to medium grained; 10% fines; wet.
33	SP	gravelly SAND: pale brown; 60% sand, fine to medium grained; 40% gravel, 4-20 mm, subangular; wet.

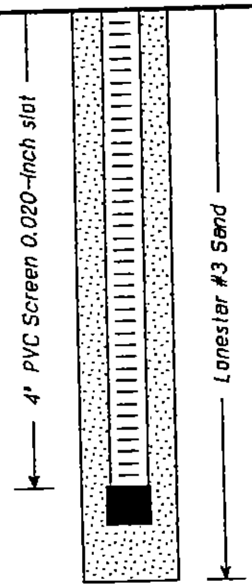
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-12

ALISTO PROJECT NO: 10-320-06	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 Salaices

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	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.
40	SP	gravelly SAND: pale brown; 80% sand, fine to medium grained; 40% gravel, 4–35 mm, subangular, occasional cobble; wet.
45		
	SM	RED FANGLOMERATE AT 47 feet. silty SAND: grayish red; 80% sand, fine to medium grained; 20% fines; wet.
50		Total depth of boring 50 feet.
55		
60		
65		

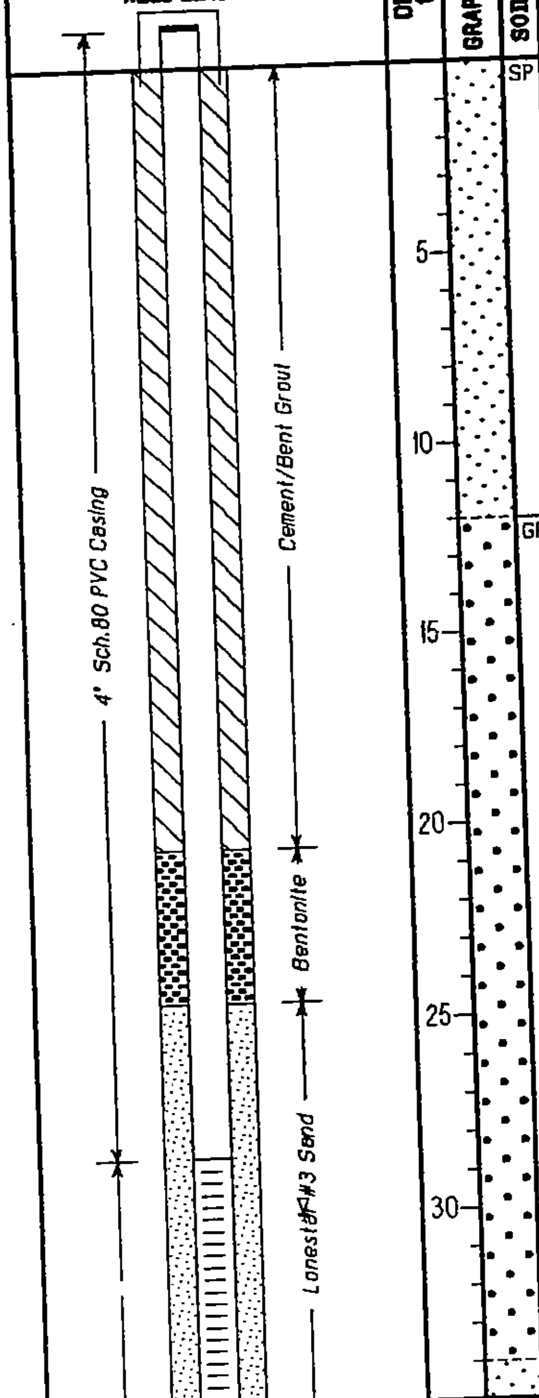
LOG OF WELL MW-13

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

ALISTO PROJECT NO: *10-320-08*	DATE DRILLED: *07/09/97*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *Resonant Sonic, Continuous Coring*	
DRILLING COMPANY: *Boart Longyear*	CASING ELEVATION: *488.19*
LOGGED BY: *Ted Moise/Dan Birch*	APPROVED BY: *Dan Salaices*

SEE SITE PLAN

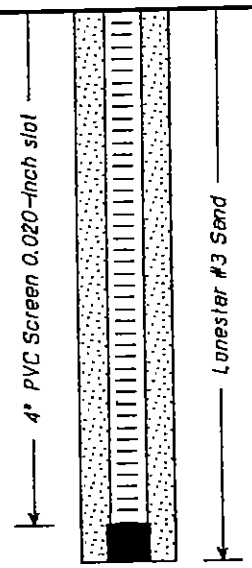
WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0	SP	gravelly SAND: yellowish gray; 50% sand, fine to coarse grained; 45% gravel, 4-50 mm, subangular, occasional cobbles; minor fines; dry.
5		color change to light olive gray
12	GP	sandy GRAVEL: light gray; 60% gravel, 4-75 mm, subangular; 40% sand, fine to medium grained; dry.
18		at 18 feet, 150 mm cobble.
19.5		at 19.5 feet, color change to pale yellowish brown; 70% gravel; 30% sand, fine to medium grained. Possibly older alluvium.
26.5		at 26.5 feet, 60% gravel, 40% sand.
30		Wet at 30 feet.
34	SP	gravelly SAND: pale brown; 60% sand, fine to coarse grained;

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-13	Page 2 of 2

SEE SITE PLAN	
	ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *07/09/97*
	CLIENT: *Pacific Gas and Electric Co.*
	LOCATION: *Topock Compressor Station*
	DRILLING METHOD: *Resonant Sonic, Continuous Coring*
	DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *488.19*
	LOGGED BY: *Ted Moise/Dan Birch* APPROVED BY: *Dan Salaices*



WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			SP	35% gravel, 4-40 mm, subangular; wet.
	40			At 40 feet, color change to pale red; 70% sand, fine to coarse grained; 30% gravel, 4-25 mm, subangular.
				At 43 feet, color change to light brownish gray, cobble to 100 mm.
	45			
	50			Total depth of borehole is 48.5 feet.
	55			
	60			
	65			

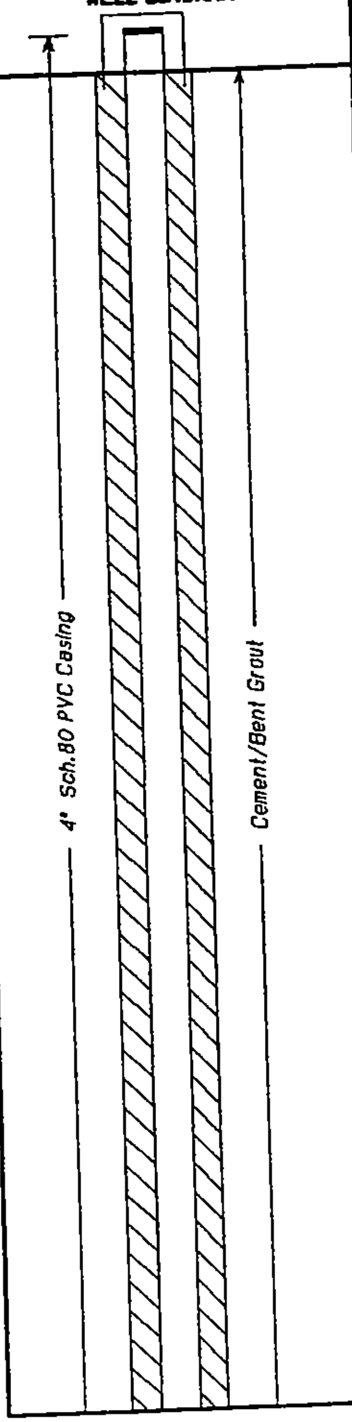
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-14

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *07/14-15/97*
CLIENT: *Pacific Gas and Electric Co.*
LOCATION: *Topock Compressor Station*
DRILLING METHOD: *Resonant Sonic, Continuous Coring*
DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *570.54*
LOGGED BY: *Ted Moise/Ken Simas* APPROVED BY: *Dan Salaices*

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0	GP	sandy GRAVEL: grayish orange pink; 70% gravel, 4-75 mm, rounded to subangular; 30% sand, fine to coarse grained; dry.
3	SP	gravelly SAND: pale yellowish brown; 80% sand, fine to coarse grained; 20% gravel, 4-50 mm, subangular; dry.
8		At 8 feet, 60% sand, fine to coarse grained; 40% gravel, 4-70 mm, subangular.
14	GP	sandy GRAVEL: pale yellowish brown; 60% gravel, 4-35 mm; subangular; 40% sand, fine to coarse grained, dry.
16	SP	gravelly SAND: pale yellowish brown; 90% sand, fine to coarse grained; 10% gravel, 4-20 mm, subangular, dry.
20		At 20 feet, 55% sand, fine to coarse grained; 45% gravel, 4-50 mm.
22		At 22 feet, color change to light gray; 60% sand, fine to coarse grained; 40% gravel, 4-50 mm, angular to subrounded.
25		At 25 feet, color change to light olive gray; 40% gravel, 4-25 mm, subangular.
30		At 30 feet, color change to pale yellowish brown; 75% sand, fine to coarse grained; 25% gravel, 4-80 mm, subangular; dry.

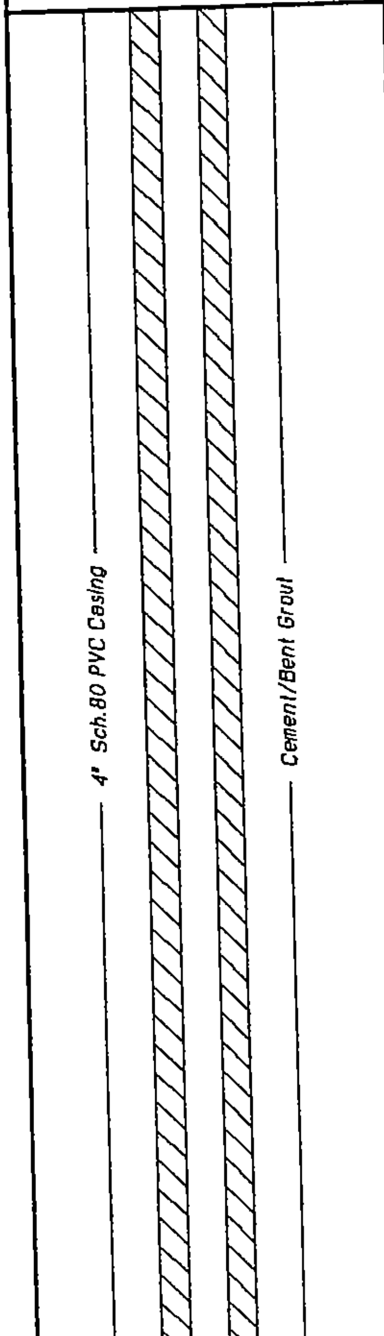
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-14

ALISTO PROJECT NO: *10-320-06*	DATE DRILLED: *07/14-15/97*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *Resonant Sonic, Continuous Coring*	
DRILLING COMPANY: *Boart Longyear*	CASING ELEVATION: *570.54*
LOGGED BY: *Ted Moise/Ken Simas*	APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM



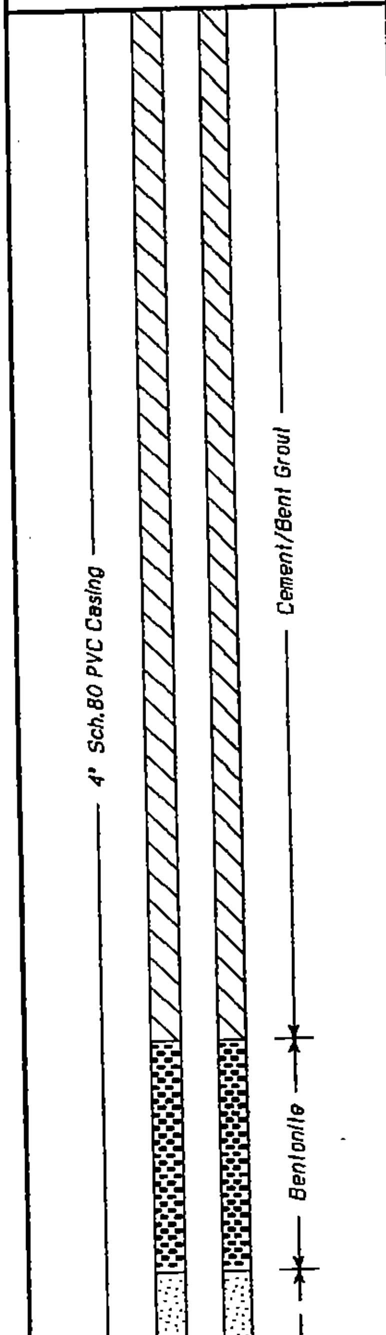
DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	SP	At 36 feet, gravel, 4-40 mm, subangular. At 38 feet, color change to light olive gray; 60% sand, fine to coarse grained; 40% gravel, 4-75 mm, subrounded to subangular; dry.
40	GP/SP	sandy GRAVEL/gravelly SAND: Pale yellowish brown; 50% sand, fine to coarse grained; 50% gravel, 4-75 mm, subangular to subrounded; dry.
45	SP	gravelly SAND: Pale yellowish brown; 70% sand, fine to coarse grained; 30% gravel, 4-75 mm, subangular. At 50 feet, 60% sand, fine to coarse grained; 40% gravel, 4-65 mm, subrounded to subangular; dry. At 54 feet; color change to light gray, 55% sand, fine to coarse grained; 40% gravel, 4-35 mm, subangular to subrounded; 5% fines; dry. At 57 feet, 65% sand, fine to coarse grained; 30% gravel, subangular to subrounded, 4-75 mm; 5% fines.
50, 55, 60		
65	GP	sandy GRAVEL: light gray; 60% gravel, subangular to subrounded, 4-75 mm; 40% sand, fine to coarse grained.

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-14	

ALISTO PROJECT NO: *10-320-06*	DATE DRILLED: *07/14-15/97*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *Resonant Sonic, Continuous Coring*	
DRILLING COMPANY: *Boart Longyear*	CASING ELEVATION: *570.54*
LOGGED BY: *Ted Moise/Ken Simas*	APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	Same
75	SP	gravelly SAND: pale yellowish brown; 80% sand, fine to coarse grained; 40% gravel, 4–50 mm, subangular.
80	GP/SP	sandy GRAVEL/gravelly SAND: light olive brown; 50% sand, fine to coarse grained; 50% gravel, 4–50 mm, subangular. At 79.5 feet, 1.5 foot long boulder core, 8-inches wide. Rock flour is light gray.
85, 90	SP	gravelly SAND: light olive gray; 80% sand, fine to coarse grained; 40% gravel, 4–50 mm, subangular.
95	GP/SP	sandy GRAVEL/gravelly SAND: light olive gray, 50% sand, fine to coarse grained; 50% gravel, 4–50 mm, subangular.
100	SP	gravelly SAND: light gray; 80% sand, fine to coarse grained; 20% gravel, 4–50 mm, subangular.
	GP	sandy GRAVEL: light gray; 75% gravel, 4–50 mm, subangular to subrounded; 25% sand, fine to coarse grained, dry.
	GP/SP	

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-14

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *07/14-15/97*

CLIENT: *Pacific Gas and Electric Co.*

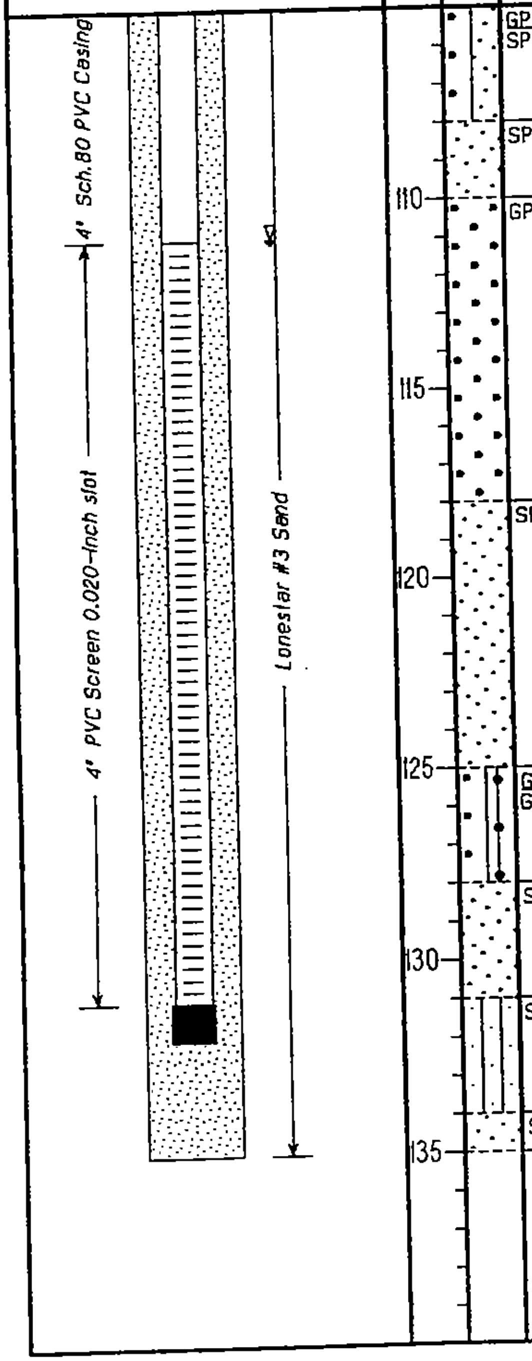
LOCATION: *Topock Compressor Station*

DRILLING METHOD: *Resonant Sonic, Continuous Coring*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *570.54*

LOGGED BY: *Ted Moise/Ken Simas* *APPROVED BY:* *Dan Salaices*

WELL DIAGRAM | DEPTH feet | GRAPHIC LOG | SOIL CLASS



SOIL CLASS	GEOLOGIC DESCRIPTION
GP SP	sandy GRAVEL/gravelly SAND: moderate brown; 50% gravel, 4-75 mm, subrounded to subangular; 50% sand, fine to coarse grained; damp.
SP	gravelly SAND: light olive brown; 80% sand, fine to coarse grained; 40% gravel, subangular, 4-40 mm; moist to wet.
GP	sandy GRAVEL: light olive gray; 80% gravel, subangular to subrounded, 4-75 mm; 40% sand, fine to coarse grained; wet at 111 feet. At 116 feet, color change to light brown; gravel 4-75 mm. At 117.5 feet, 140 mm cobble, light gray rock flour.
SP	gravelly SAND: pale yellowish brown; 85% sand, fine to coarse grained, 30% gravel, subangular, 4-75 mm; 5% fines; wet.
GP GM	sandy silty GRAVEL: pale yellowish brown; 55% gravel, subangular, 4-50 mm, occasional cobble to 80 mm; 35% sand, fine to coarse grained; 10% fines; wet.
SP	gravelly SAND: pale yellowish brown; 80% sand, fine to coarse grained; 35% gravel, subangular, 4-20 mm; 5% fines; wet.
SM	gravelly silty SAND: pale yellowish brown; 80% sand, fine to coarse grained; 20% gravel, subangular, 4-30 mm; 20% fines; wet.
SP	gravelly SAND: light olive gray; 85% sand, fine to coarse grained; 30% gravel, subangular, 4-25 mm; 5% fines; wet.

Total depth of the boring is 135 feet.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-15

ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *07/10-13/97*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

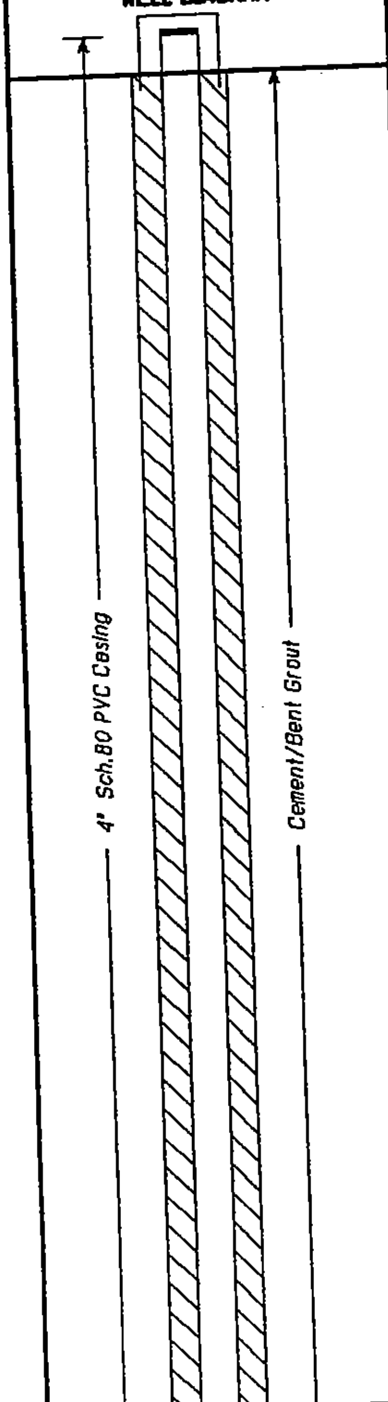
DRILLING METHOD: *Resonant Sonic, Continuous Coring*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *84109*

LOGGED BY: *Ted Moise/Ken Simas* APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM

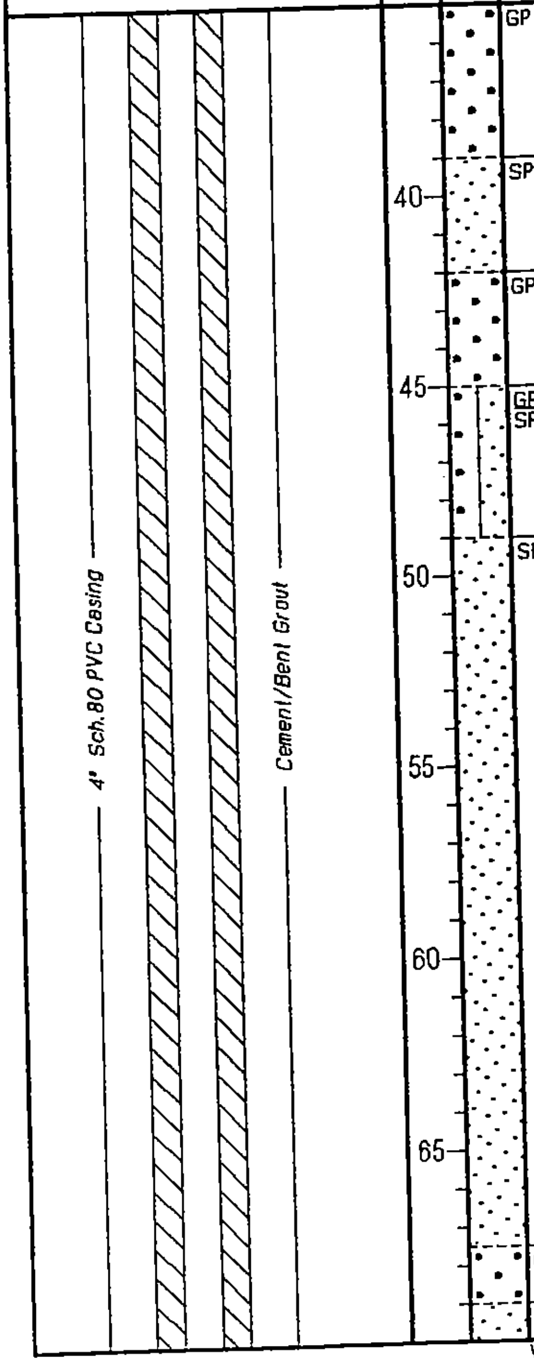


DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0	SP	gravelly SAND: pinkish gray; 80% sand, fine grained; 20% gravel, 4-75 mm, subangular; dry.
5		
10		
	GP SP	sandy GRAVEL/gravelly SAND: pale yellowish brown; 50% gravel, 4-70 mm, subangular; 50% sand, fine to coarse grained; dry.
15		
20		
	SP	gravelly SAND: pale yellowish brown; 60% sand, fine to medium grained; 40% gravel, 4-30 mm, subangular; dry.
25	GP	sandy GRAVEL: pale yellowish brown; 60% gravel, 4-60 mm, subangular; 40% sand, fine to medium grained; dry.
		At 27.5 feet, sandy GRAVEL: pale yellowish brown; 70% gravel, 4-60 mm, subangular; 30% sand, fine to medium grained; dry.
30		
		at 34.5 feet, subrounded gravel.

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-15	

SEE SITE PLAN	
	ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *07/10-13/97*
	CLIENT: *Pacific Gas and Electric Co.*
	LOCATION: *Topock Compressor Station*
	DRILLING METHOD: *Resonant Sonic, Continuous Coring*
	DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *641.09*
	LOGGED BY: *Ted Moise/Ken Simas* APPROVED BY: *Dan Salaices*

WELL DIAGRAM

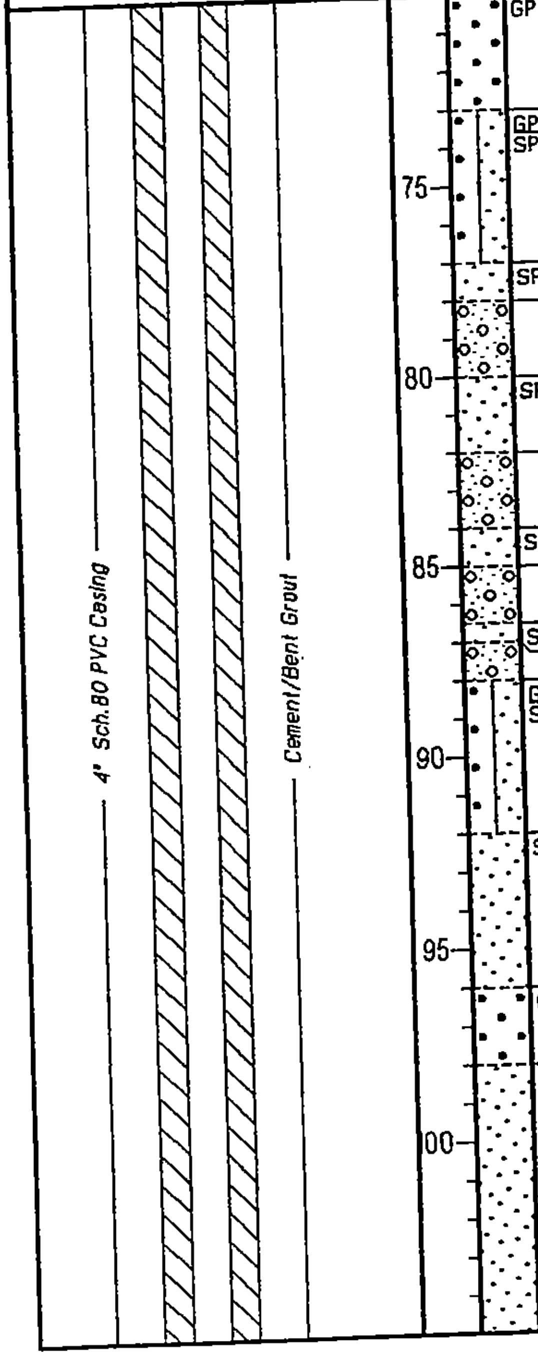


SOIL CLASS	GEOLOGIC DESCRIPTION
GP	Same
SP	gravelly SAND: pale yellowish brown; 60% sand, very fine to medium grained; 40% gravel, subrounded, 4–35 mm, some fractured conglomerate gravels; dry.
GP	sandy GRAVEL: pale yellowish brown; 60% gravel, subrounded to subangular, 4–150 mm; 40% sand, very fine to medium grained; dry.
GP SP	sandy GRAVEL/gravelly SAND: pale yellowish brown; 50% gravel, subrounded, 4–70 mm; 50% sand, very fine to medium grained; dry.
SP	gravelly SAND: pale yellowish brown; 70% sand, very fine to medium grained; 30% gravel, subrounded and fractured, 4–75 mm; dry. at 51 feet, 60% sand, very fine to coarse grained; 40% gravel, 4–70 mm, subrounded; dry. at 63 feet, 80% sand, very fine to medium grained; 20% gravel, 4–25 mm, subrounded; dry.
	At 67.5 feet, sandy GRAVEL: pale yellowish brown; 60% gravel, subrounded to angular, some conglomerate gravels, 4–75 mm; 40% sand, very fine to medium grained; dry.
GP	
SP	At 69 feet, gravelly SAND: pale yellowish brown; 70% sand, very fine to medium grained; 30% gravel, subrounded, 4–30 mm; dry.
GP	

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-15	

SEE SITE PLAN	
	ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *07/10-13/97*
	CLIENT: *Pacific Gas and Electric Co.*
	LOCATION: *Topock Compressor Station*
	DRILLING METHOD: *Resonant Sonic, Continuous Coring*
	DRILLING COMPANY: *Boart Longyear* CASING ELEVATION: *64109*
	LOGGED BY: *Ted Moise/Ken Simas* APPROVED BY: *Dan Salaices*

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	sandy GRAVEL: pale yellowish brown; 65% gravel, subrounded and fractured, 4-30 mm; 35% sand, very fine to medium grained; dry.
75	GP/SP	sandy GRAVEL/gravelly SAND: pale yellowish brown; 45% gravel, subrounded, 4-40 mm; 5% cobble, subrounded, up to 130 mm; 50% sand, very fine to medium grained; dry.
	SP	gravelly SAND: pale yellowish brown; 60% sand, very fine to medium grained; 40% gravel, subrounded, 4-20 mm; dry.
		COBBLES with sand: 30% sand, very fine to fine grained; 70% cobbles, fractured and subrounded, to 150 mm.
80	SP	gravelly SAND: pale yellowish brown; 60% sand, very fine to medium grained; 40% gravel, 4-40 mm, subrounded and fractured gravel; dry.
		COBBLES with sand: 30% sand, very fine to fine grained; 70% cobbles, fractured and subrounded, to 150 mm.
	SP	gravelly SAND: pale yellowish brown; 60% sand, very fine to medium grained; 40% gravel, 4-40 mm, subrounded and fractured gravel; dry.
85		COBBLES with sand: 30% sand, very fine to fine grained; 70% cobbles, fractured and subrounded, to 150 mm.
	SP	gravelly SAND: pale yellowish brown; 60% sand, very fine to medium grained; 40% gravel, 4-40 mm, subrounded; dry.
		COBBLES with sand: 30% sand, very fine to fine grained; 70% cobbles, fractured and subrounded, to 150 mm.
90	GP/SP	sandy GRAVEL/gravelly SAND: pale yellowish brown; 50% sand, very fine to medium grained; 50% gravel, subrounded, 4-70 mm.
	SP	gravelly SAND: pale yellowish brown; 70% sand, very fine to medium grained; 30% gravel, 4-30 mm, subrounded; dry.
95	GP	sandy GRAVEL: pale yellowish brown; 60% gravel, 4-75 mm, subrounded and fractured gravels; 40% sand, fine to medium grained; dry.
	SP	gravelly SAND: pale yellowish brown; 65% sand, very fine to medium grained; 35% gravel, 4-30 mm, subrounded; dry.
100		At 101 feet, 60% sand, 40% gravel.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-15

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-06 DATE DRILLED: 07/10-13/97

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Resonant Sonic, Continuous Coring

DRILLING COMPANY: Boart Longyear CASING ELEVATION: 64109

LOGGED BY: Ted Moise/Ken Simas APPROVED BY: Dan Salaices

WELL DIAGRAM: 4" Sch.80 PVC Casing; Cement/Bent Grout

DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	SP	Same
	GP	sandy GRAVELS: 80% gravel, 4-75 mm, fractured gravels; 40% sand, very fine to fine sand; dry.
110	SP	gravelly SAND: pale yellowish brown; 80% sand, fine to coarse grained; 20% gravel, 4-40 mm, subrounded; dry.
115		Rock fragments with very fine to fine sand.
	SP	gravelly SAND: pale yellowish brown; 65% sand, fine to coarse grained; 35% gravel, 4-30 mm, subrounded; dry.
120		At 120 feet, 75% sand; 25% gravel, 4-20 mm.
		At 121 and 123.5 feet, 100 mm cobbles.
125		
130	GP	sandy GRAVELS: 60% gravel, 4-70 mm, subrounded and fractured gravel; 40% sand, very fine to medium grained; dry.
	SP	gravelly SAND: pale yellowish brown; 80% sand, very fine to medium grained; 20% gravel, 4-30 mm, subrounded; dry.
		At 133 feet, 65% sand, 35% gravel.
		At 134 feet, 75% sand, 25% gravel.
135		

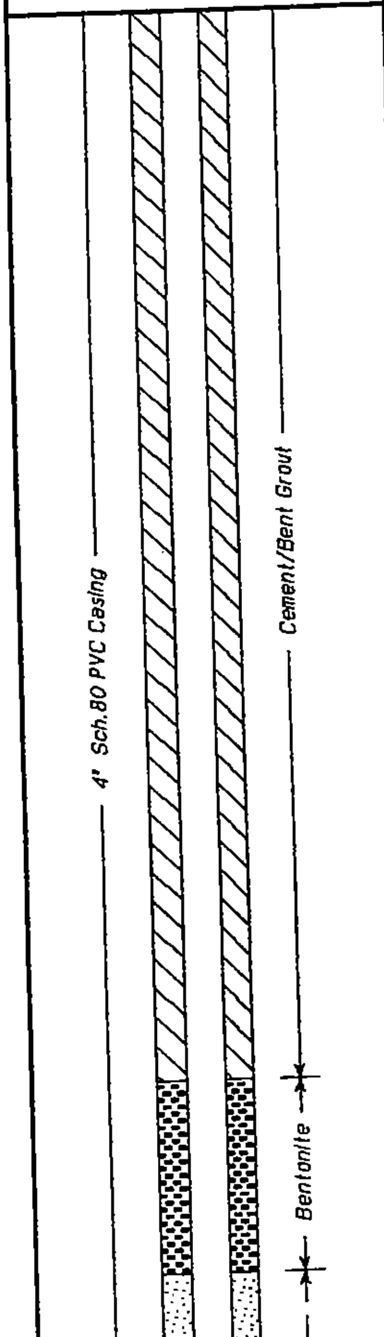
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-15

ALISTO PROJECT NO: 10-320-06	DATE DRILLED: 07/10-13/97
CLIENT: Pacific Gas and Electric Co.	
LOCATION: Topock Compressor Station	
DRILLING METHOD: Resonant Sonic, Continuous Coring	
DRILLING COMPANY: Boart Longyear	CASING ELEVATION: 84109
LOGGED BY: Ted Moise/Ken Simas	APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			SP	
	145			
				At 147 feet, 70% sand, 30% gravel, 4-40 mm.
	150			
				At 154 feet, 60% sand, fine to coarse grained; 40% gravel, 4-60 mm, subangular; dry.
	155			
	160			
				At 162 feet, light gray; 70% sand; 30% gravel, 4-75 mm.
	165			
	170		GP	sandy GRAVEL: light gray; 70% gravel, 4-60 mm; 30% sand, fine to coarse grained.
				At 174.5 feet; 65% gravel; 35% sand.



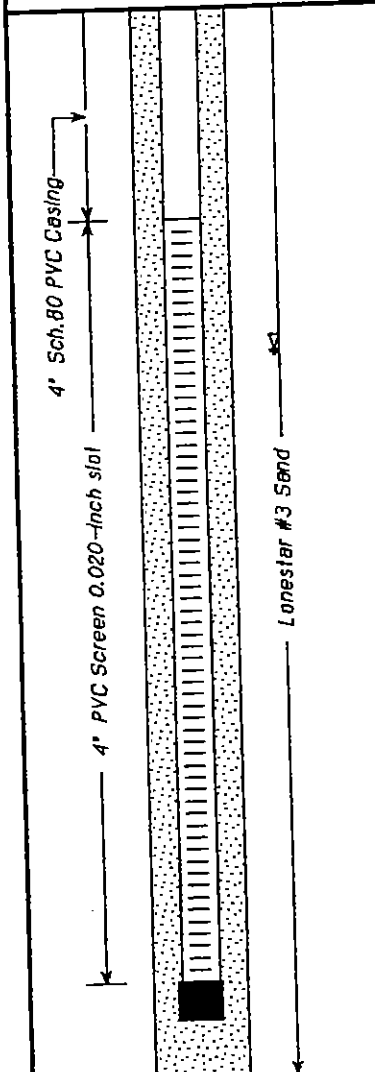
LOG OF WELL MW-15

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

ALISTO PROJECT NO: 10-320-06 DATE DRILLED: 07/10-13/97
CLIENT: Pacific Gas and Electric Co.
LOCATION: Topock Compressor Station
DRILLING METHOD: Resonant Sonic, Continuous Coring
DRILLING COMPANY: Boart Longyear CASING ELEVATION: 64109
LOGGED BY: Ted Moise/Ken Simas APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM



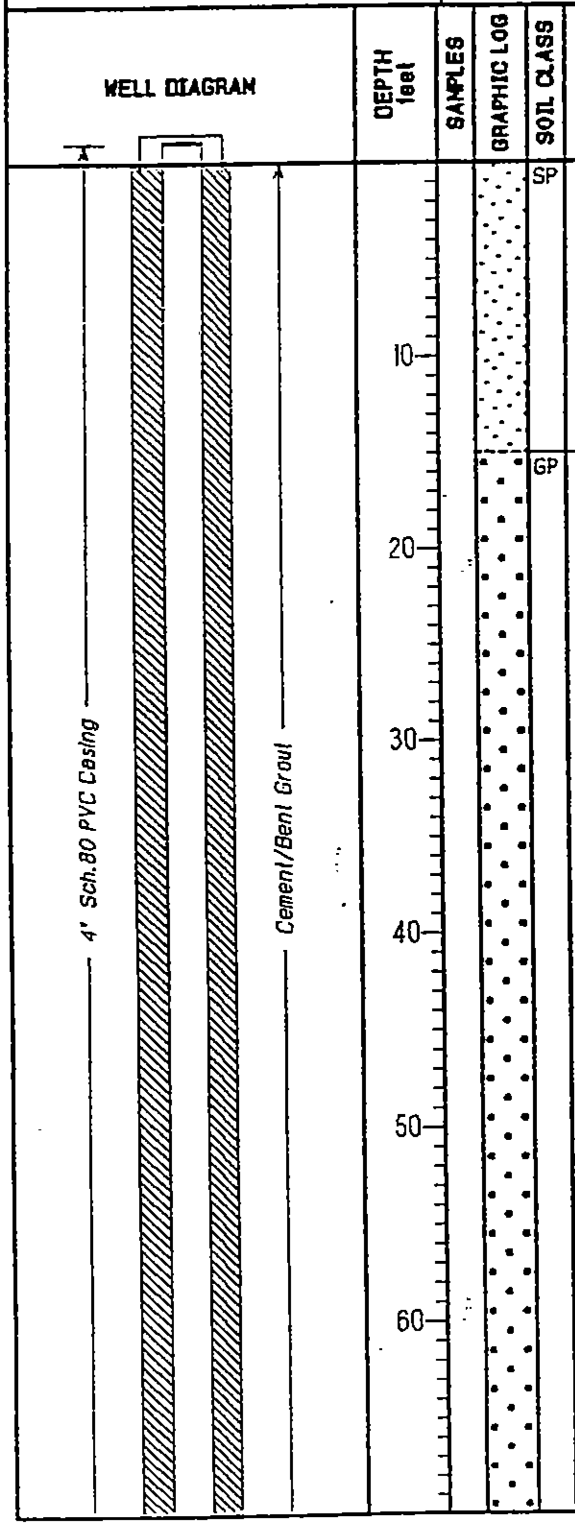
DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	Same
180		At 180 feet, damp to moist.
	SP	gravelly SAND: olive gray; 55% sand, fine to medium grained; 30% gravel, subangular, 4-30 mm; 15% fines; damp to moist.
		At 184 feet, 70% sand, fine to coarse grained; 30% gravel, subangular, 4-25 mm; wet.
185		At 185 feet, 60% sand, fine to medium grained; 30% gravel, subangular, 4-30 mm; 10% fines; wet.
		At 188 feet, 80% sand, fine to coarse grained; 20% gravel, subangular, 4-30 mm; wet.
190	SM	gravelly silty SAND: brownish gray; 60% sand, fine to coarse grained; 25% gravel, subangular, 4-60 mm; 15% fines; wet.
195	SP	gravelly SAND: brownish gray; 75% sand, fine to coarse grained; 25% gravel, subangular, 4-60 mm, wet.
	SM	gravelly silty SAND: brownish gray; 60% sand, fine to coarse grained; 25% gravel, subangular, 4-60 mm; 15% fines; wet.
200		
		Total depth of borehole is 204 feet.
205		

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-16

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08 DATE DRILLED: 04/09-10/98
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: Dan Salaices APPROVED BY: Dan Salaices

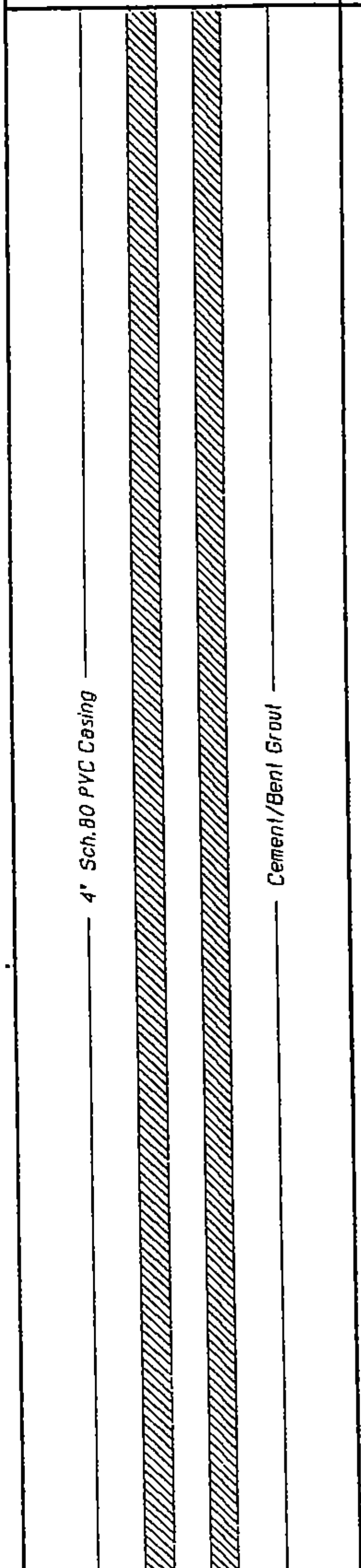


SOIL CLASS	GEOLOGIC DESCRIPTION
SP	gravelly SAND: light gray; ~60% sand, fine- to coarse-grained; ~40% gravel, subangular, 4-50 mm; dry.
GP	sandy GRAVEL: light olive-gray to olive-gray; ~80% gravel, subangular to angular (appears to be mechanically fractured); ~20% sand; dry.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-16

WELL DIAGRAM

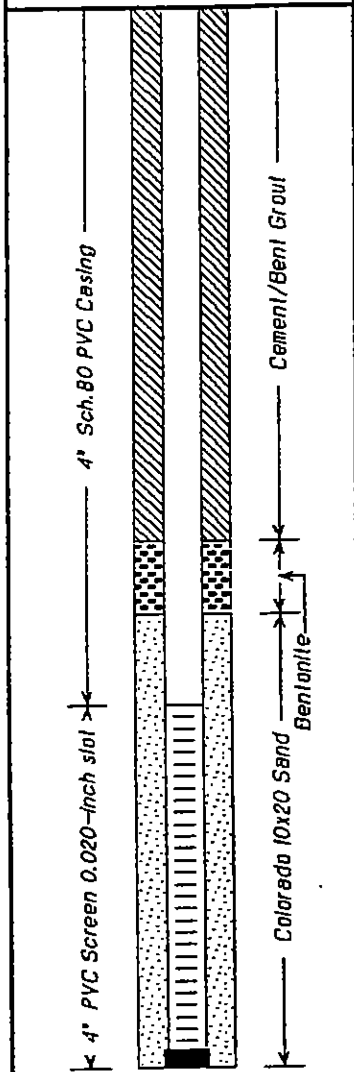


DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			GP	sandy GRAVEL continued.
80				
90				
100				
110				
			SP	gravelly SAND: light brownish-gray; ~80-80% sand, very fine- to fine-grained; gravel, light olive-gray, subangular to angular (crushed); dry.
120				
130				
			GP	sandy GRAVEL: light olive-gray; ~70-80% gravel, subangular to angular (crushed); ~20-30% sand, very fine- to coarse-grained; dry.
140				
150				

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-16

WELL DIAGRAM



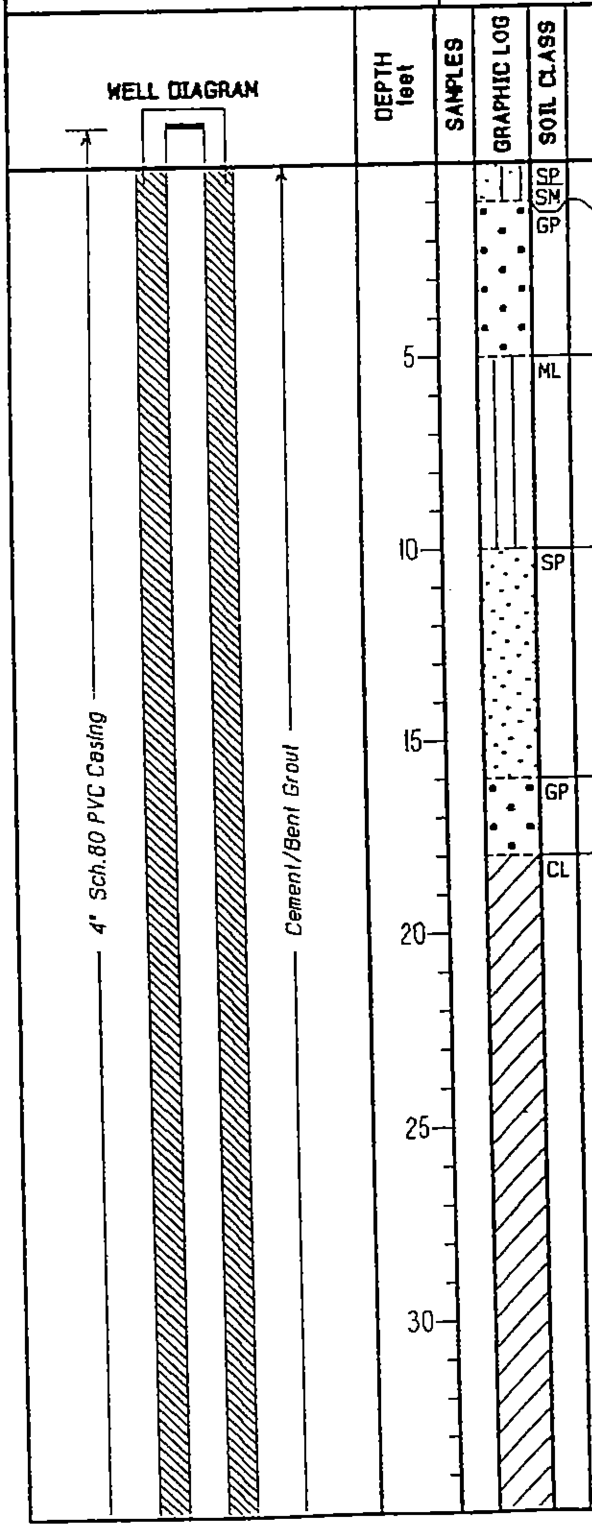
DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			GP	sandy GRAVEL continued.
200				Slight moisture at 200 feet.
			SP	gravelly SAND: olive-gray; ~60-70% sand, fine- to coarse-grained; ~30-40% gravel, subangular, 4-15 mm; wet.
				Total depth of borehole is 218 feet.

Depth scale: 170, 180, 190, 200, 210, 220, 230, 240

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-17	Page 1 of 4

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-08*	DATE DRILLED: *05/17-18/98*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *Rotosonic*	
DRILLING COMPANY: *Boart Longyear*	CASING ELEVATION:
LOGGED BY: *Ted Moise*	APPROVED BY: *Dan Saleices*



SOIL CLASS	GEOLOGIC DESCRIPTION
SP-SM	gravely silty SAND: light brown; ~50% sand, fine- to coarse-grained; ~40% gravel, angular to subrounded, to 20 mm; ~10% fines.
GP	sandy GRAVEL: light olive-gray; ~55% gravel, angular to subrounded, to 40 mm; ~40% sand, fine- to coarse-grained; ~5% fines.
ML	sandy SILT: grayish-orange-pink; ~90% fines; ~10% sand, fine- to coarse-grained; dry.
SP	SAND: grayish-orange; fine- to coarse-grained; dry.
GP	sandy GRAVEL: grayish-orange-pink to light gray; ~60% gravel, angular to subrounded, to 50 mm; ~40% sand, fine- to coarse-grained; cobble, to 140 mm; dry.
CL	silty CLAY: light gray.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-17

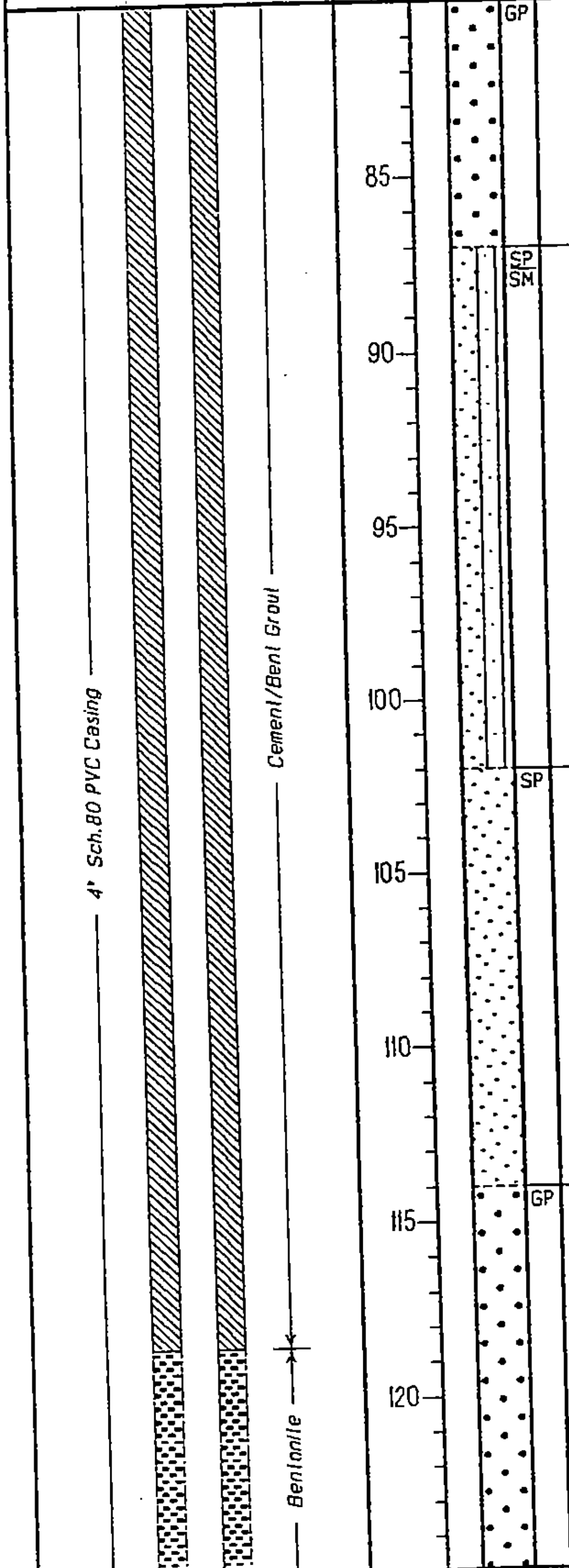
WELL DIAGRAM: 4" Sch.80 PVC Casing; Cement/Bent Grout

DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			CL	silty CLAY continued.
40				
45				
50				
55			ML	sandy SILT: very pale orange; ~35% sand, fine- to medium-grained; damp.
			GP-GM	sandy silty GRAVEL: yellowish-gray; ~50% gravel, angular to subrounded, to 40 mm; ~40% sand, fine- to coarse-grained; 10% fines; dry.
			SP	gravelly SAND: light-gray; ~55% sand, fine- to coarse-grained; ~45% gravel, subangular to rounded, to 50 mm.
60				At 61 feet, Cobble, to 100 mm.
				Color change to pale yellowish-brown at 64 feet.
65			GP	sandy GRAVEL: light gray; ~50 gravel, subangular to subrounded, to 80 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
70				
75				

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-17

WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION

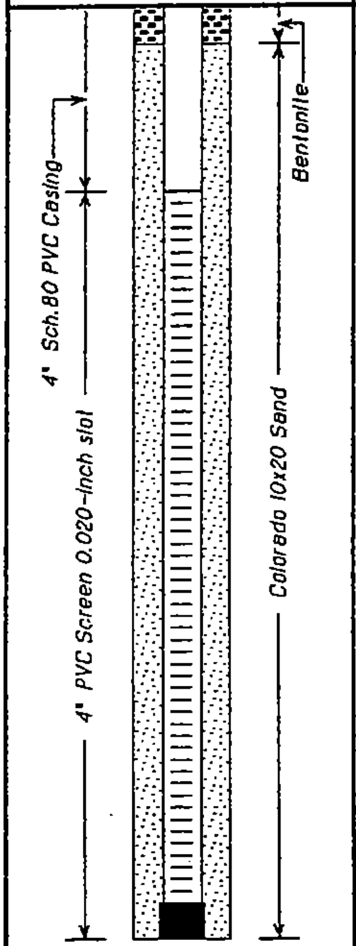


SOIL CLASS	GEOLOGIC DESCRIPTION
GP	sandy GRAVEL: light gray; ~65 gravel, subangular to subrounded, to 70 mm; ~30% sand, fine- to coarse-grained; ~5% fines.
SP/SM	gravelly silty SAND: light gray to pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~35% gravel, subangular to subrounded, to 80 mm; ~10% fines.
SP	gravelly SAND: light gray to pale yellowish-brown; ~65% sand, fine- to coarse-grained, ~30% gravel, subangular to subrounded, to 50 mm; ~5% fines.
	gravelly SAND: light gray to pale yellowish-brown; ~55% sand, fine- to coarse-grained, ~40% gravel, subangular to subrounded, to 80 mm; ~5% fines.
GP	sandy GRAVEL: light gray to pale yellowish-brown; ~50% gravel, subangular to subrounded, to 80 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
GP/GM	

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-17

WELL DIAGRAM



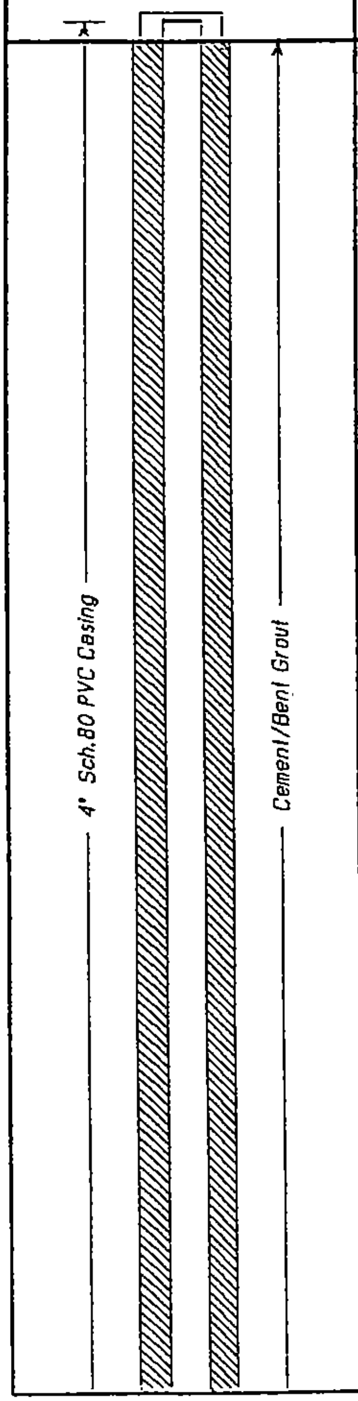
DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP GM	sandy silty GRAVEL: light gray to light brownish-gray; ~55% gravel, subangular to subrounded, to 70 mm; ~35% sand, fine- to coarse-grained; ~10% fines.
		damp at 129 feet.
130	GP	sandy GRAVEL: light olive-gray; ~30% sand, fine- to coarse-grained; ~65% gravel, angular to subrounded, to 55 mm; ~5% fines; wet.
	SP	gravelly SAND: light olive gray to pale-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subangular to subrounded, to 55 mm; ~5% fines.
135		
140	GP GM	sandy silty GRAVEL: olive-gray to brownish-gray; ~50% gravel, subangular to subrounded, to 70 mm; ~40% sand, fine- to coarse-grained; ~10% fines.
145		
150		Total depth of borehole is 150.5 feet.
155		
160		
165		

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-18	Page 1 of 2

SEE SITE PLAN

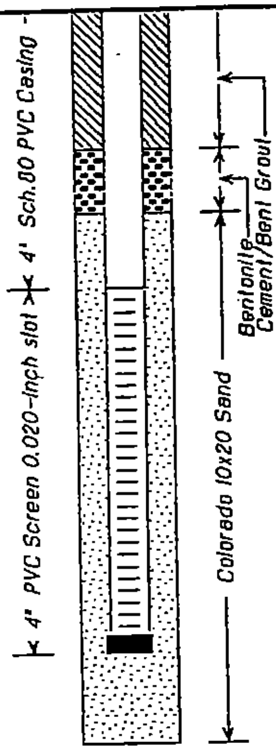
ALISTO PROJECT NO: *10-320-08*	DATE DRILLED: *04/08/98*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *Ingersol Rand STRATEX/Air rotary*	
DRILLING COMPANY: *THF Drilling*	CASING ELEVATION:
LOGGED BY: *Dan Salaices*	*APPROVED BY: Dan Salaices*

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			GP	sandy GRAVEL: light greenish-gray to gray; ~80% gravel appears angular and fractured, probably contains 50-150 mm angular clasts which are seen in outcrop; dry.
10				
20				
			SP	gravelly SAND: light greenish-gray to gray; ~80% sand, fine- to coarse-grained; gravel, subrounded, 4-8 mm; dry.
30				
			GP	sandy GRAVEL: light greenish-gray to gray; ~80% gravel appears angular and fractured; dry.
40				
			SP	gravelly SAND: light brownish-gray; ~60-80% sand, fine- to coarse-grained; gravel, subrounded to subangular (appears crushed); dry.
50				
60				

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-18	

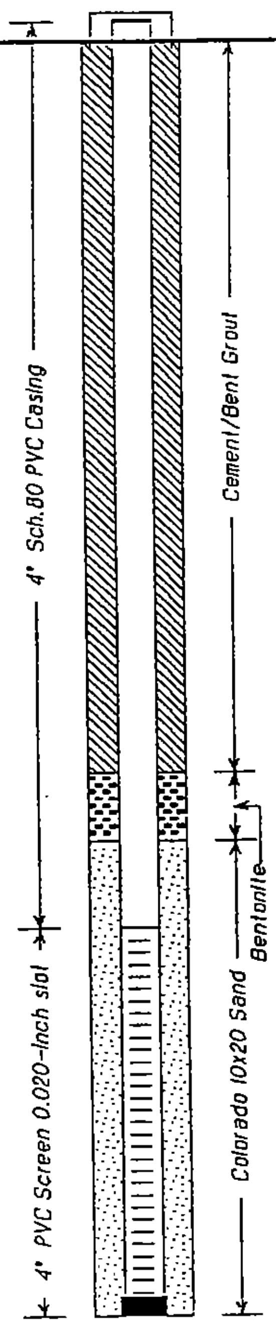


DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
80	SP	gravelly SAND continued.
90 100	GP	sandy GRAVEL: light brownish-gray to gray; ~70% gravel, subrounded to subangular (appears partly crushed), 4-15 mm; ~30% sand, fine- to coarse-grained. Appears moist at 90 feet.
110		Total depth of borehole is 110 feet.
120		
130		
140		
150		

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	# LOG OF WELL MW-19	*Page 1 of 1*

SEE SITE PLAN	ALISTO PROJECT NO: *10-320-06*	DATE DRILLED: *03/26-27/98*
	CLIENT: *Pacific Gas and Electric Co.*	
	LOCATION: *Topock Compressor Station*	
	DRILLING METHOD: *AP-1000 Dual Tube Percussion*	
	DRILLING COMPANY: *THF Drilling*	CASING ELEVATION:
	LOGGED BY: *Ted Moise*	*APPROVED BY: Dan Salaices*

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	sandy GRAVEL: moderate yellowish-brown; ~55% gravel, subrounded, to 80 mm; ~45% sand, fine- to coarse-grained; damp.
10	SP	SAND: light reddish-brown; fine-grained; damp.
20		gravelly SAND: light reddish-brown; ~60% sand, fine- to medium-grained; ~40% gravel, subrounded, to 40 mm; damp.
30		Change at 32 feet of ~75% sand; ~25% gravel, subangular, to 50 mm.
40	GP	sandy GRAVEL: brown; ~60% gravel, subrounded, to 20 mm; ~40% sand fine- to medium-grained; wet. Gravel change at 47 feet to angular to subangular, to 50 mm.
50		
60	SP	gravelly SAND: brown; ~70% sand, fine- to medium-grained; ~30% gravel, subrounded.
		Total depth of borehole is 66 feet.

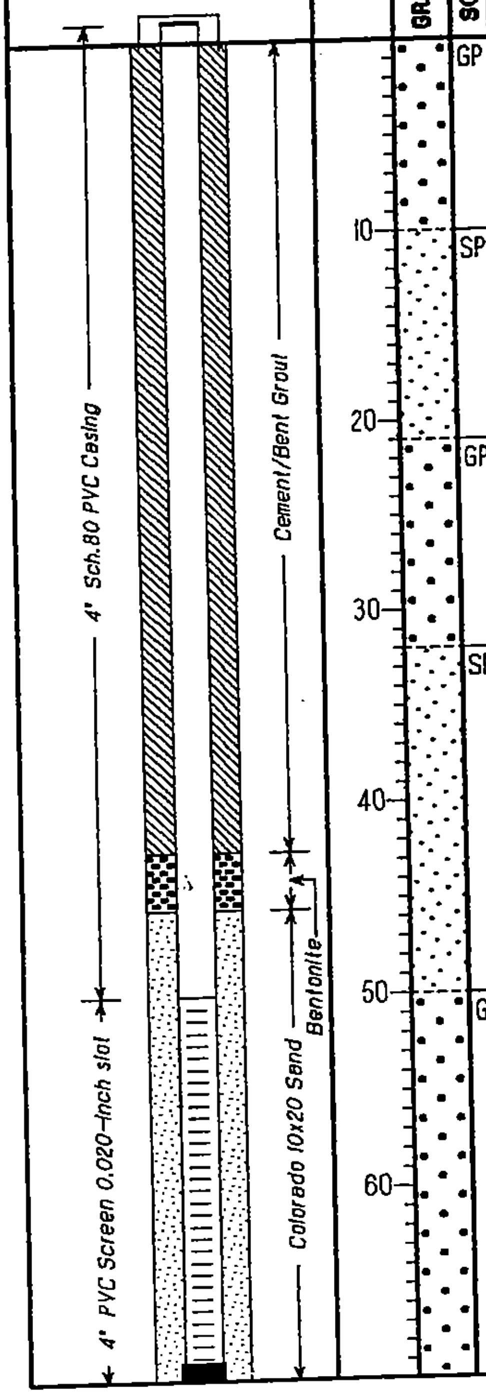
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF BORING MW-20/70

ALISTO PROJECT NO: *10-320-08*	DATE DRILLED: *03/24-25/98*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *AP-1000 Dual Tube Percussion*	
DRILLING COMPANY: *THF Drilling*	CASING ELEVATION:
LOGGED BY: *Dan Salaices*	APPROVED BY: *Dan Salaices*

SEE SITE PLAN

BORING DIAGRAM | **DEPTH feet** | **GRAPHIC LOG** | **SOIL CLASS** | **GEOLOGIC DESCRIPTION**



Depth (feet)	Soil Class	Geologic Description
0	GP	sandy GRAVEL: moderate yellowish-brown; ~60-70% gravel, subrounded, to 80 mm; ~30-40% sand.
10	SP	SAND: pale yellowish-brown; very fine- to fine-grained; ~5% gravel.
21	GP	sandy GRAVEL: light brownish-gray; cobble at 21-24 feet. Changes at 24 feet of color to moderate yellowish-brown; ~60-70% gravel, subrounded, to 80 mm.
32	SP	gravelly SAND: light gray; ~80% sand, very fine- to fine-grained; ~10% gravel, subrounded, to 50 mm. gravelly SAND continued.
45		SAND: reddish brown; fine- to very fine-grained; ~5% fines; damp.
50	GP	sandy GRAVEL: reddish-brown; ~55% gravel, subrounded, to 80 mm; ~45% sand. Appears wet at 60 feet.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF BORING MW-20/100

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-09* DATE DRILLED: *04/28-29/99*

CLIENT: *Pacific Gas and Electric Co.*

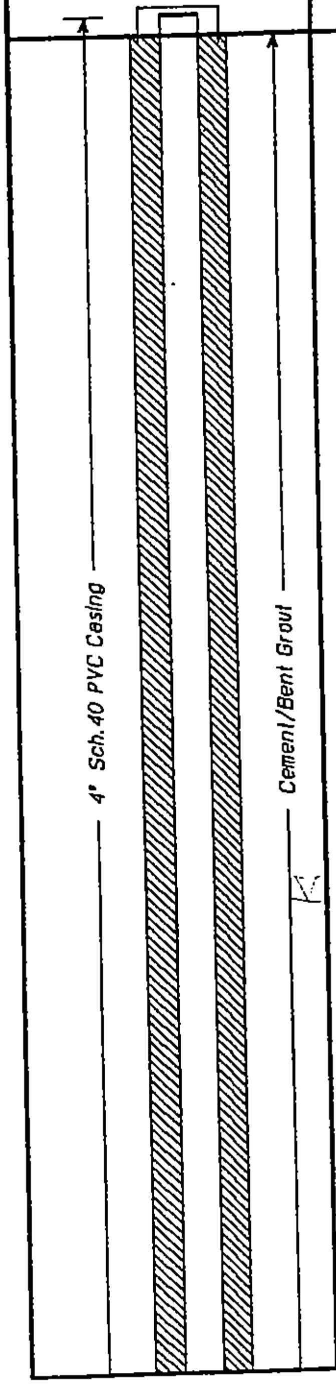
LOCATION: *Topock Compressor Station*

DRILLING METHOD: *Roto Sonic, Continuous Coring*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION:

LOGGED BY: *Chris Reinheimer* *APPROVED BY:* *Dan Hidalgo*

BORING DIAGRAM



SOIL CLASS	GEOLOGIC DESCRIPTION
GP	sandy GRAVEL: moderate yellowish-brown; ~60-70% gravel, subrounded, ~80 mm; ~30-40% sand.
SP	SAND: pale yellowish-brown; very fine- to fine-grained; ~5% gravel.
GP	sandy GRAVEL: light brownish-gray; cobble at 21 to 24 feet. At 24 feet color change to moderate yellowish-brown; ~60-70% gravel, subrounded, ~80 mm.
SP	gravelly SAND: light gray; ~80% sand, very fine- to fine-grained; ~10% gravel, subrounded, ~50 mm. gravelly SAND continued.
	SAND: reddish-brown; very fine- to fine-grained; ~5% fines; damp.
GP	sandy GRAVEL: reddish-brown; ~55% gravel, subrounded, ~80 mm; ~45% sand.
SP	gravelly SAND: brown to reddish-brown; 70% sand, fine- to coarse-grained; gravel, subrounded to subangular, 4 to 10 mm; wet.
SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.

LOG OF BORING MW-20/100

BORING DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.40 PVC Casing; Cement/Bent Grout; Bentonite; #3 Lonestar Sand			SC	gravelly clayey SAND continued.
			SP	SAND: reddish-brown; fine- to coarse-grained; minor gravel, fine-grained; wet.
	80		SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.
			SP	SAND: reddish-brown; fine- to coarse-grained; minor gravel, fine-grained; wet.
			SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.
			SP	gravelly SAND: reddish-brown; 85% sand, very fine- to coarse-grained; gravel; wet.
	90		SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.
			SP	gravelly SAND: reddish-brown; ~85% sand, very fine- to coarse-grained; gravel, ~4 to 20 mm; wet.
				At 98 feet color change to moderate yellowish-brown; 80% sand, medium- to coarse-grained.
				At 98 feet color change to brown; 85% sand, very fine- to coarse-grained.
	100			Total depth of borehole at 99.5 feet.
	110			
	120			
	130			
	140			
	150			

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF BORING MW-20/130	Page 1 of 2

ALISTO PROJECT NO: *10-320-09* DATE DRILLED: *04/25-27/99*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

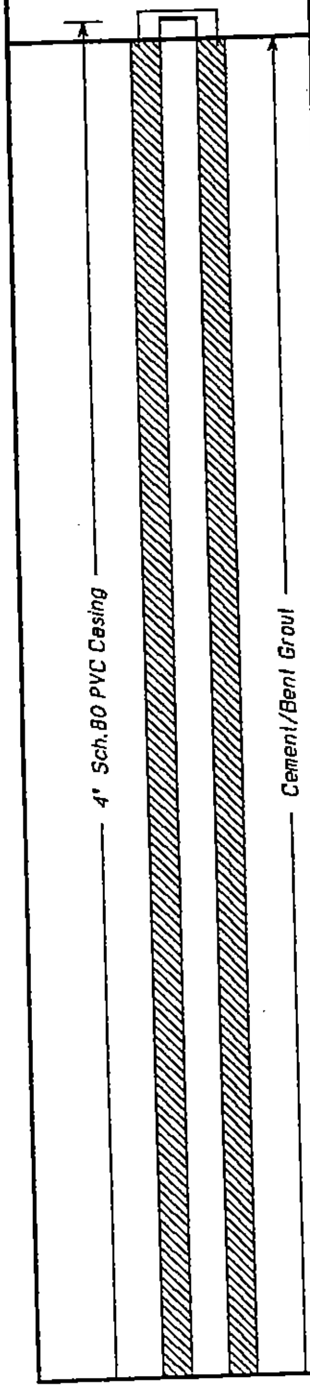
DRILLING METHOD: *Roto Sonic, Continuous Coring*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION:

LOGGED BY: *Dan Hidalgo & Chris Reinheimer* APPROVED BY: *Dan Hidalgo*

SEE SITE PLAN

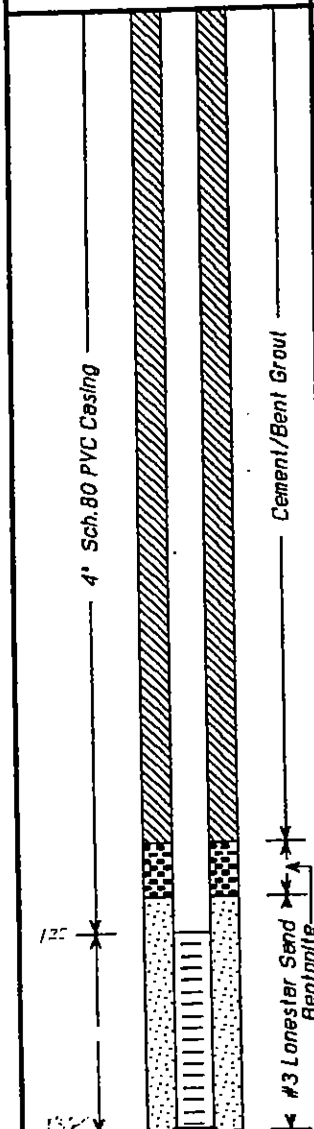
BORING DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	sandy GRAVEL: moderate yellowish-brown; ~60-70% gravel, subrounded, ~90 mm; ~30-40% sand.
10	SP	SAND: pale yellowish-brown; very fine- to fine-grained; ~5% gravel.
20	GP	sandy GRAVEL: light brownish-gray; cobbles at 21 to 24 feet. At 24 feet color change to moderate yellowish-brown; ~60-70% gravel, subrounded, ~90 mm.
30	SP	gravelly SAND: light gray; ~90% sand, very fine- to fine-grained; ~10% gravel, subrounded, ~50 mm. gravelly SAND continued.
40		SAND: reddish-brown; very fine- to fine-grained; ~5% fines; damp.
50	GP	sandy GRAVEL: reddish-brown; ~55% gravel, subrounded, ~90 mm; ~45% sand.
60	SP	gravelly SAND: brown to reddish-brown; 70% sand, fine- to coarse-grained; gravel, subrounded to subangular, 4 to 10 mm; wet.
	SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF BORING MW-20/130

BORING DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			SC	gravelly clayey SAND continued.
			SP	SAND: reddish-brown; fine- to coarse-grained; minor gravel, fine-grained; wet.
	80		SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.
			SP	SAND: reddish-brown; fine- to coarse-grained; minor gravel, fine-grained; wet.
			SC	No recovery.
			SP	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.
	90			gravelly SAND: reddish-brown; 85% sand, very fine- to coarse-grained; gravel, ~4 to 20 mm; wet.
			SC	gravelly clayey SAND: reddish-brown; 70% sand, fine- to coarse-grained; gravel, 4 to 8 mm; ~15% fines, plastic; wet.
			SP	gravelly SAND: reddish-brown; ~85% sand, very fine- to coarse-grained; gravel, ~4 to 20 mm; wet.
				At 98 feet color change to moderate yellowish-brown; 80% sand, medium- to coarse-grained.
	100		ML	At 98 feet color change to brown; 85% sand, very fine- to coarse-grained.
				gravelly sandy SILT: medium reddish-brown with less than 2% greenish-gray stain; ~80% fines, non-plastic; ~20% gravel to 2", coarse-grained; moist to wet.
				gravelly sandy SILT continued.
	110		SP	silty SAND: medium reddish-brown; ~80% sand, medium- to coarse-grained; ~10% gravel; ~10% fines, non-plastic; wet.
				At 114 feet change to ~30% gravel.
			ML	gravelly sandy SILT: medium reddish-brown with less than 2% greenish-gray stain; ~80% fines, non-plastic; ~20% gravel to 2", coarse-grained; moist to wet.
	120		SC	clayey SAND: medium-orange; 80% sand, medium- to coarse-grained; ~30% fines, medium plasticity; ~10% gravel to 2"; wet to saturated.
			GM	silty GRAVEL: medium reddish-brown; ~70% gravel to 3"; ~30% fines, non-slight plasticity; moist.
	130			At 129.5 feet changes to ~80% gravel to 3"; ~15% fines, non plastic; angular clast to 2"; damp.
				RED FANGLOMERATE cemented dry, drill refusal at 132 feet.
				Total depth of borehole at 132 feet.
	140			
	150			

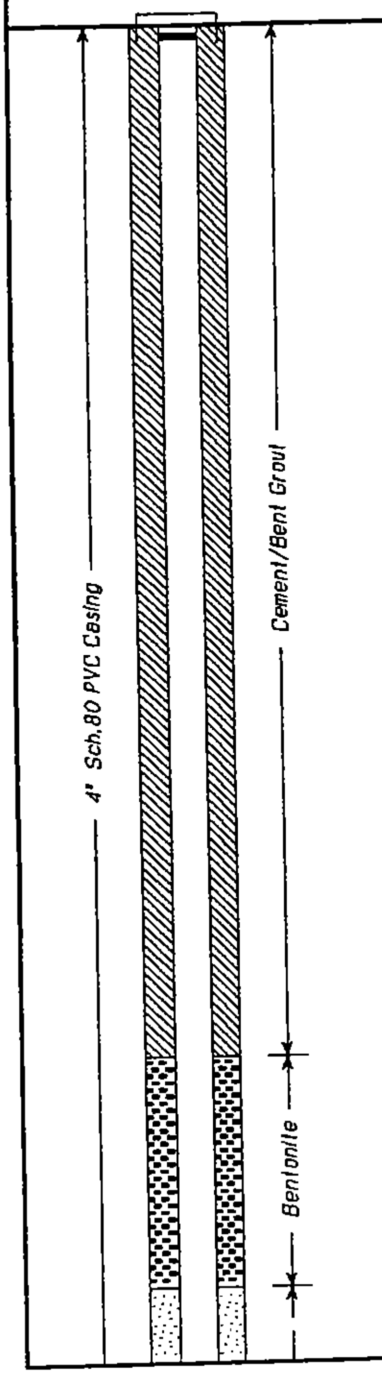
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-21

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: Rotosonic	
DRILLING COMPANY: Boart Longyear	CASING ELEVATION:
LOGGED BY: Ted Moise	APPROVED BY: Dan Salaices

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0	GP	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.
5	SP	gravelly SAND: grayish-orange-pink; ~60% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 65 mm; dry.
		Cobble, rounded, 120 mm at 8 feet.
10		
		Change at 14 feet of ~75% sand; ~20% gravel, angular to rounded; ~5% fines; cobble, to 120 mm.
15		
	GP	sandy GRAVEL: light brownish-gray; ~75% gravel, subangular to subrounded, to 60 mm; ~20% sand, fine- to coarse-grained; ~5% fines.
	SP	gravelly SAND: grayish-orange-pink; ~60% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 65 mm; ~5% fines; dry.
20	GP	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; ~60% gravel, angular to subrounded, to 45 mm; ~40% sand.
25		
30		
	SP	gravelly SAND: light brownish-gray; ~65% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 55 mm.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-21

ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *05/19/98*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

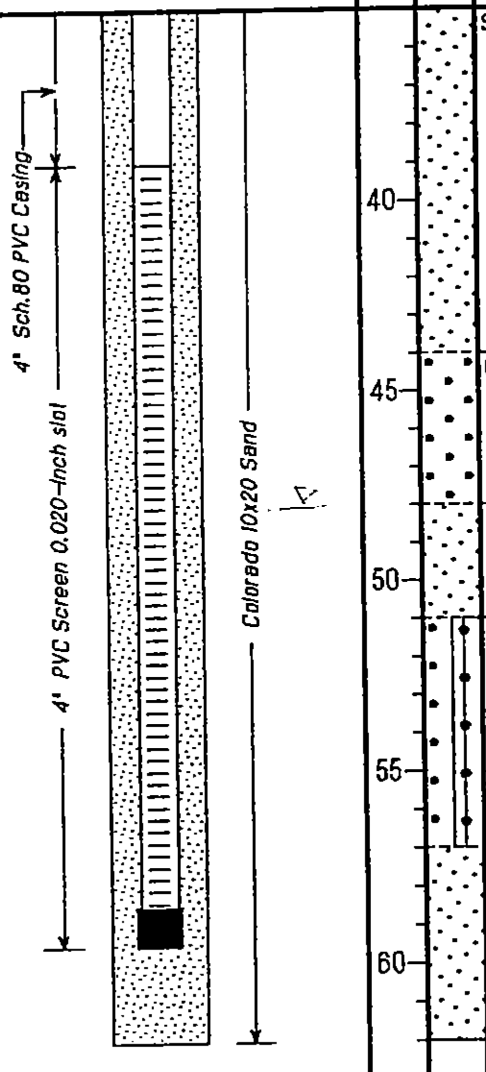
DRILLING METHOD: *Rotosonic*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION:

LOGGED BY: *Ted Moise* APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM

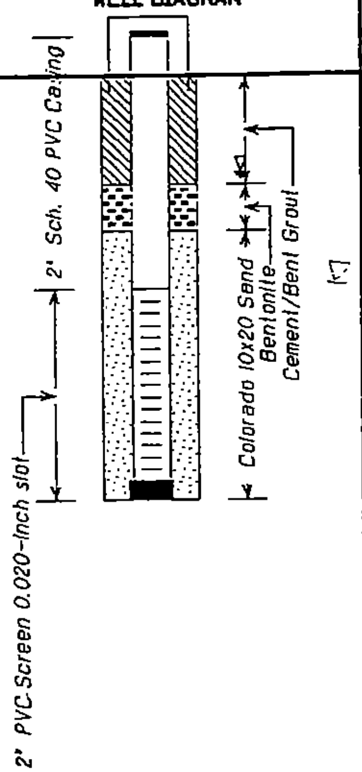


DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	SP	gravelly SAND continued.
40		Changes at 40 feet of ~50% sand; ~45% gravel, to 40 mm; ~5% fines.
		Color change at 42 feet to pale yellowish-brown.
45	GP	sandy GRAVEL: light brown to grayish-orange-pink; ~80% gravel, angular to subrounded, to 50 mm; ~35% 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.
50		gravelly SAND: light brownish-gray; ~65% sand, fine- to coarse-grained; ~35% gravel, angular to subrounded, to 55 mm.
	GP GM	sandy silty GRAVEL: pale-red to grayish-red; ~80% gravel, angular to subrounded, to 70 mm; ~30 sand, fine- to coarse-grained; ~10% fines.
55		Cobbles, rounded, to 100 mm at 56 feet.
	SP	gravelly SAND: dusky-red to grayish-red; ~55% sand, fine- to coarse-grained, ~45% gravel, subangular to rounded, to 70 mm.
60		
		Total depth of borehole is 62 feet.
65		

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	# LOG OF WELL MW-22	*Page 1 of 1*

SEE SITE PLAN	
	ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *04/23/98*
	CLIENT: *Pacific Gas and Electric Co.*
	LOCATION: *Topock Compressor Station*
	DRILLING METHOD: *Hand auger (3")*
	DRILLING COMPANY: *THF Drilling* CASING ELEVATION:
	LOGGED BY: *Ralph Lambert* *APPROVED BY: Dan Salaices*

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0–4	SM ML	silty SAND to sandy SILT: brown.
4–6.5	SP	gravelly SAND with silt: dark brown; rocks to 2".
6.5–7.5	OL	SILT: black; organics; wet and soft.
7.5–9.5	ML	clayey SILT: brown, stiff.
9.5–11	CL	silty CLAY: dark brown; stiff.
		RED FANGLOMERATE at 11 feet.
		Total depth of borehole at 11 feet.

Depth scale: 5, 10, 15, 20, 25, 30

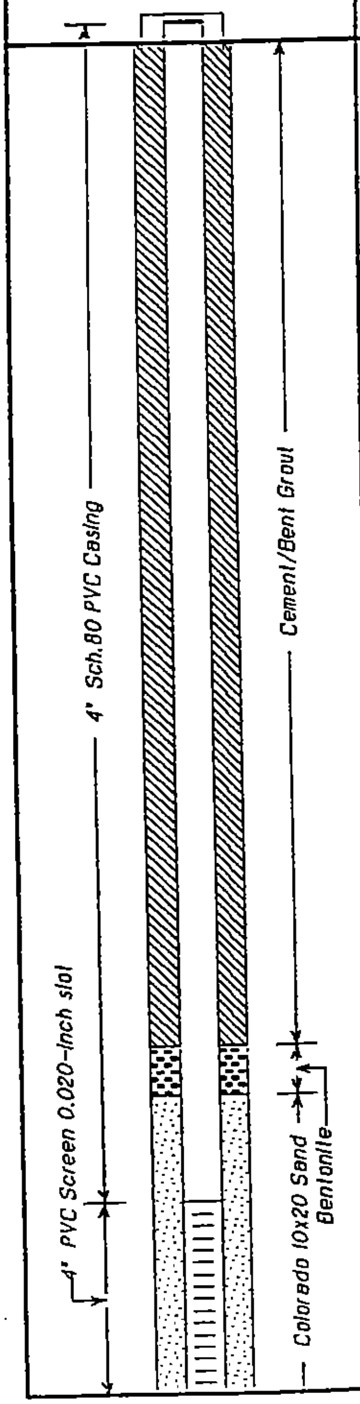
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-23

SEE SITE PLAN

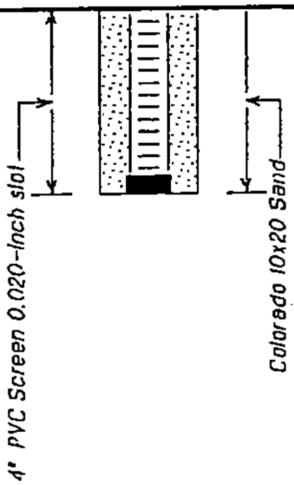
ALISTO PROJECT NO: *10-320-08*	DATE DRILLED: *04/06/98*
CLIENT: *Pacific Gas and Electric Co.*	
LOCATION: *Topock Compressor Station*	
DRILLING METHOD: *Ingersol Rand STRATEX/Air rotary*	
DRILLING COMPANY: *THF Drilling*	CASING ELEVATION:
LOGGED BY: *Dan Salaices*	APPROVED BY: *Dan Salaices*

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0			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.
10				
20				
30				
40				
50				
60				

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	# LOG OF WELL MW-23	

WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
					RED FANGLOMERATE continued.
	80				Total depth of borehole is 80 feet.
	90				
	100				
	110				
	120				
	130				
	140				
	150				

LOG OF WELL MW-24A

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08 DATE DRILLED: 05/12-13/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Rotosonic

DRILLING COMPANY: Boart Longyear CASING ELEVATION:

LOGGED BY: Ted Moise APPROVED BY: Dan Salaices

WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.80 PVC Casing; Cement/Bent Grout				ML	sandy SILT: light gray; ~15% sand, fine- to medium-grained; dry.
	5			GP	sandy GRAVEL: gray; ~60% 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, 20, 25			SP	gravelly SAND: gray; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 80 mm; ~5% fines; dry. Changes at 20' of color to light gray to gray; ~55% sand; ~40% gravel, subrounded to angular, to 40 mm.
	30	■		GP GM	sandy silty GRAVEL: light gray to gray; ~60% gravel, subrounded to angular, to 80 mm; ~30% sand, fine- to coarse-grained; ~10% fines. Cobble, subrounded, to 90 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.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24A

WELL DIAGRAM: 4" Sch.80 PVC Casing; Cement/Bent Grout

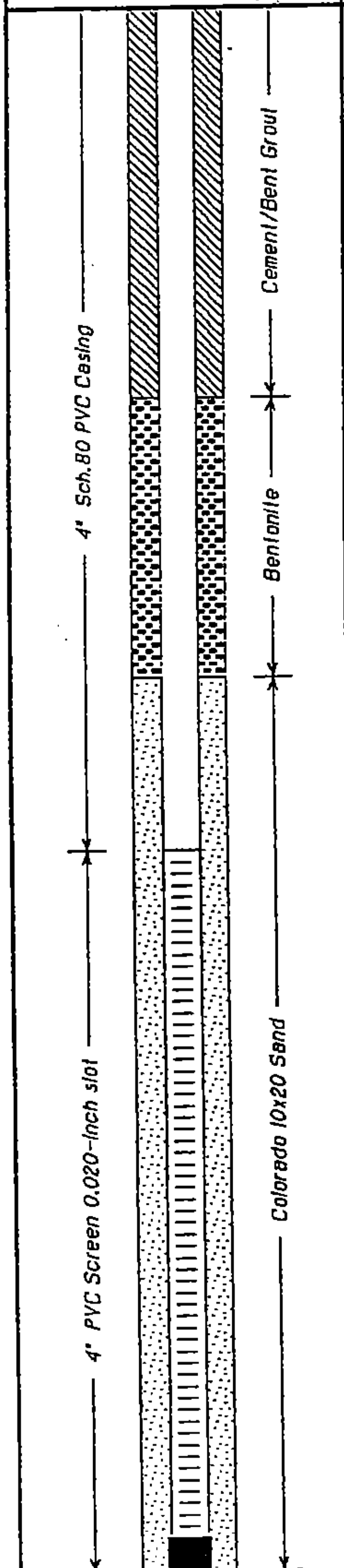
Depth (feet): 40, 45, 50, 55, 60, 65, 70, 75

Soil Class	Geologic Description
SP	gravelly SAND continued.
GP/GM	sandy silty GRAVEL: pale red to reddish-gray; ~65% 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.
SP	gravelly SAND: gray; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to angular, to 55 mm; ~5% fines.
GM	silty GRAVEL: light gray; ~60% gravel, subangular to angular, to 70 mm; ~40% fines (rock flour).
SP	gravelly SAND: gray; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to angular, to 55 mm; ~5% fines.
GP	sandy GRAVEL: gray; ~60% gravel, subrounded to subangular; ~35% sand, fine- to medium-grained; ~5% fines.
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.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24A

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			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.
85				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).
			GP	sandy GRAVEL: reddish-brown; ~50% gravel, subrounded to subangular, to 40 mm; ~45% sand, fine- to coarse-grained; ~5% fines; damp.
100				
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.
115				Changes at 117 feet of ~75% sand; ~15% gravel, to 50 mm.
120				
				Total depth of borehole is 124.5 feet.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24B

ALISTO PROJECT NO: 10-320-08 DATE DRILLED: 05/13-16/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

DRILLING METHOD: Rotosonic

DRILLING COMPANY: Boart Longyear CASING ELEVATION:

LOGGED BY: Ted Moise APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM

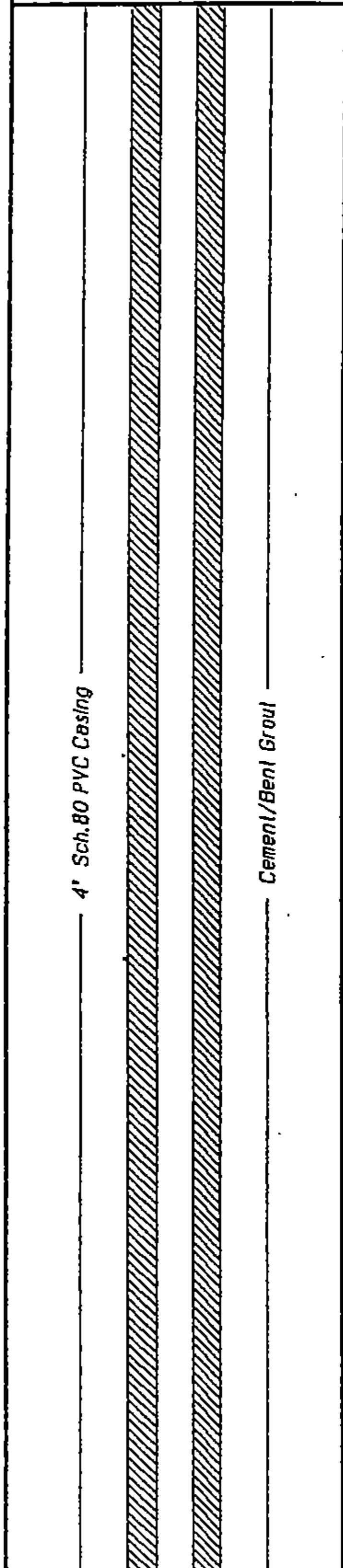
4" Sch.80 PVC Casing

Cement/Bent Grout

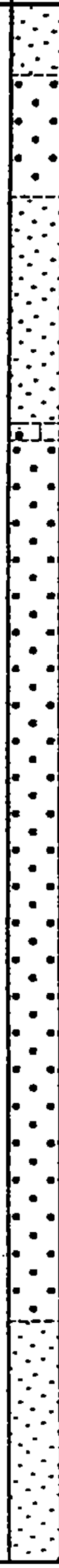
DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			SP SM	Gravelly silty SAND: light gray; ~50% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 40 mm; ~10% fines.
5			GP	sandy GRAVEL: light gray; ~50% gravel, subrounded to subangular, to 70 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
10			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.
15, 20			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, ~65% gravel; ~35% sand.
25, 30			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, ~65% sand, fine- to coarse-grained; ~30% gravel, to 50 mm.

LOG OF WELL MW-24B

WELL DIAGRAM



GRAPHIC LOG



SOIL CLASS	GEOLOGIC DESCRIPTION
SP	gravelly SAND continued.
GP	sandy GRAVEL: light gray to pale red: ~50% gravel, subrounded to subangular, to 60 mm; ~35% sand, fine- to coarse-grained; ~5% fines.
SP	gravelly SAND: pale yellowish-brown; ~55% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 50 mm; ~5% fines.
GM	silty GRAVEL: light gray; ~60% gravel, to 70 mm; ~40% fines (rock flour).
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. Changes at 61 feet are, ~65% gravel; ~30% sand.
SP	gravelly SAND: light gray; ~50% sand, fine- to medium-grained; ~45% gravel, subrounded to subangular, to 60 mm; ~5% fines. Changes at 76 feet of, color to light brownish-gray; ~60% sand; ~35% gravel.

DEPTH (feet): 40, 45, 50, 55, 60, 65, 70, 75

SAMPLES

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24B

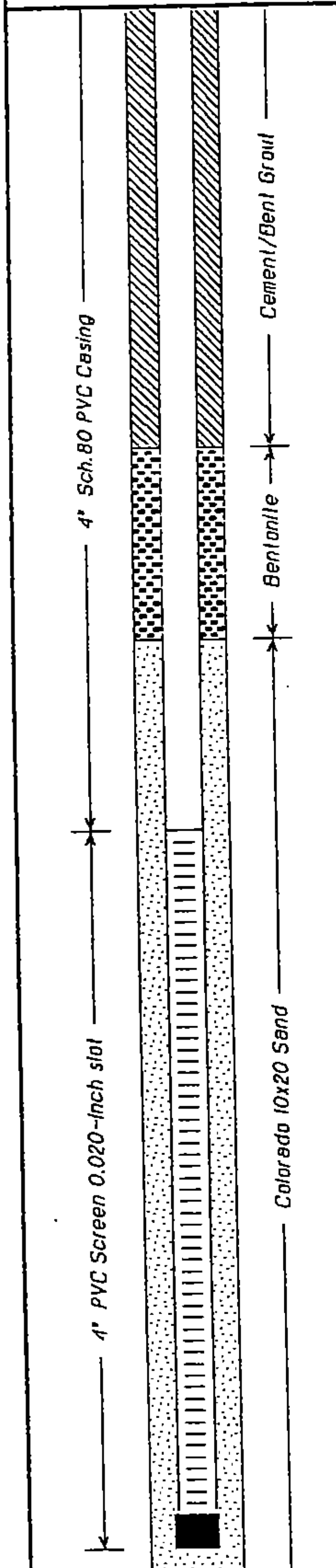
WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.80 PVC Casing; Cement/Bent Grout				SP	gravelly SAND continued.
				GP	sandy GRAVEL: light gray to light brownish-gray; ~50% gravel, subrounded to subangular, to 60 mm; ~45% sand, fine- to coarse-grained. ~5% fines.
	85				Changes at 86 feet of, ~75% gravel; ~20% sand; cobble, to 90 mm.
					Changes at 89 feet of, ~60% gravel; ~35% sand.
	90				
	95				
	100				
					Changes at 103 feet of, color to pale brown; ~50% gravel, to 50 mm; ~45% sand.
	▽				Wet at 104 feet.
	105				
	110				
				GP/GM	sandy silty GRAVEL: dark yellowish-brown; ~50% gravel, subrounded to subangular, to 65 mm; ~40% sand, fine- to coarse-grained; ~10% fines;
	115				
	120				
				GP/	

LOG OF WELL MW-24B

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

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24B



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP GM	sandy silty GRAVEL continued.
175	GP	sandy GRAVEL: grayish-red; ~50% gravel, subrounded to angular, to 65 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
180		
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; ~60% 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.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24B

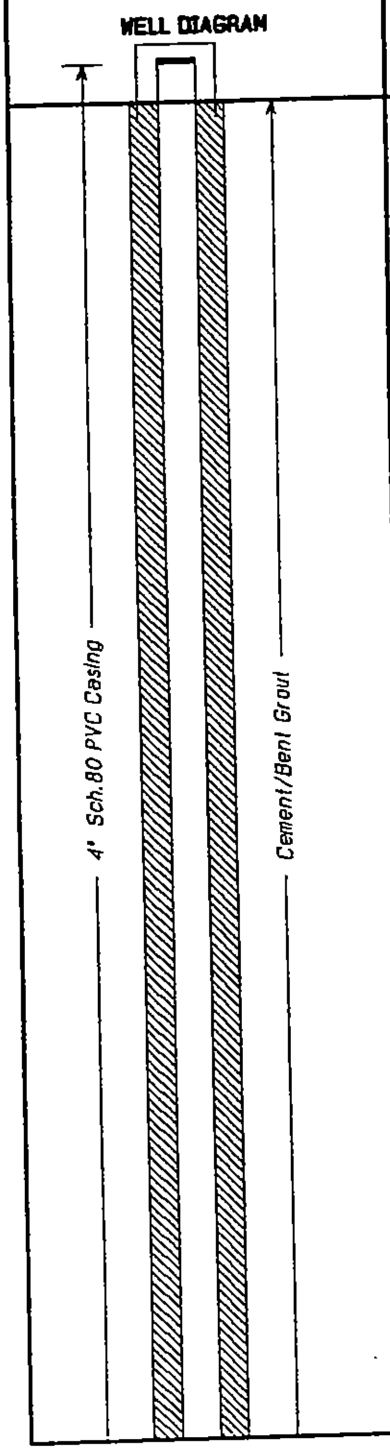
WELL DIAGRAM	DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
Colorado 10x20 Sand				GP	sandy GRAVEL continued.
					Total depth of borehole is 217.5 feet.
	220				
	225				
	230				
	235				
	240				
	245				
	250				
	255				

LOG OF WELL MW-24BR

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

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 Salaices

SEE SITE PLAN



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
0–2.5	SP SM	Gravelly silty SAND: light gray; ~50% sand, fine- to coarse-grained; ~40% gravel, subrounded to subangular, to 40 mm; ~10% fines.
2.5–8.5	GP	sandy GRAVEL: light gray; ~50% gravel, subrounded to subangular, to 70 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
8.5–14	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 85 mm.
14–23	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, ~65% gravel; ~35% sand.
23–	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, 95 mm. Changes at 28 feet of, ~65% sand, fine- to coarse-grained; ~30% gravel, to 50 mm.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

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 Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.80 PVC Casing; Cement/Bent Grout			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	silty GRAVEL: light gray; ~60% gravel, to 70 mm; ~40% fines (rock flour).
			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.
	50			
	55			
	60			Changes at 61 feet are, ~65% gravel; ~30% sand.
	65			

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

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 Salaices

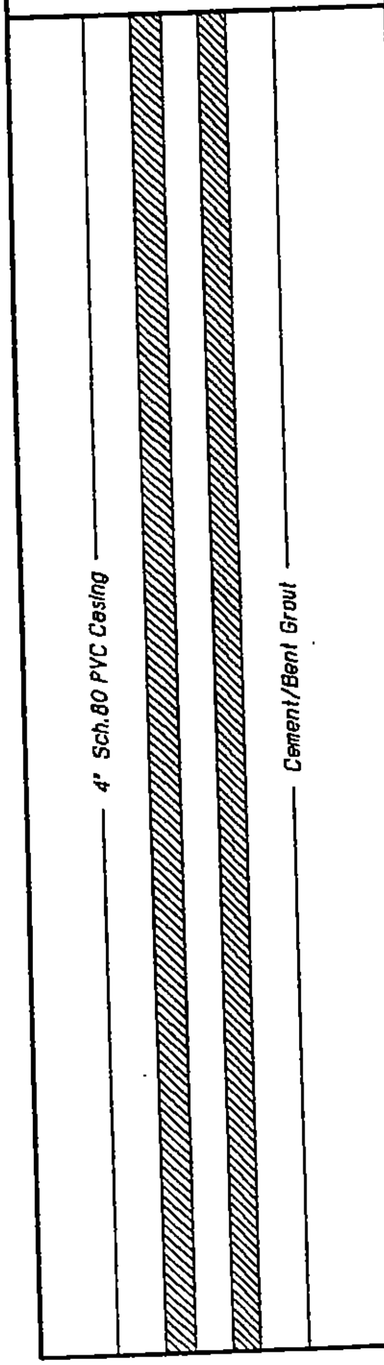
SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.80 PVC Casing; Cement/Bent Grout			GP	
			SP	gravelly SAND: light gray; ~50% sand, fine- to medium-grained; ~45% gravel, subrounded to subangular, to 80 mm; ~5% fines.
	75			Changes at 76 feet of, color to light brownish-gray; ~60% sand; ~35% gravel.
	80			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.
	85			Changes at 86 feet of, ~75% gravel; ~20% sand; cobble, to 90 mm.
				Changes at 89 feet of, ~60% gravel; ~35% sand.
	90			
	95			
	100			
				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	

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 Salaices*

WELL DIAGRAM



DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	
110	GP/GM	sandy silty GRAVEL: dark yellowish-brown; ~50% gravel, subrounded to subangular, to 85 mm; ~40% sand, fine- to coarse-grained; ~10% fines;
115		
120		
125	GP	sandy GRAVEL: pale brown; ~50% gravel, subrounded to subangular, to 85 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
130		
135		
	SP	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

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 Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.80 PVC Casing; Cement/Bent Grout		SP	
	145		
		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.
	150		
	155		
		SP	gravelly SAND: pale brown to grayish-red; ~50% sand, fine- to coarse-grained; ~45% gravel, subrounded to subangular, to 55 mm; ~5% fines.
	160		
	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.
	170		sandy silty GRAVEL continued.
		GP	

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

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 Salaices*

SEE SITE PLAN

WELL DIAGRAM: 4" Sch.80 PVC Casing; Cement/Bent Grout

DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
	GP	sandy GRAVEL: grayish-red; ~50% gravel, subrounded to angular, to 85 mm; ~45% sand, fine- to coarse-grained; ~5% fines.
180		
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.
	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.
205	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 208.5 feet to grayish-red to dark reddish-brown; ~70% gravel, ~25% sand.

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	# LOG OF WELL MW-24BR	

ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *04/22-28/98*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

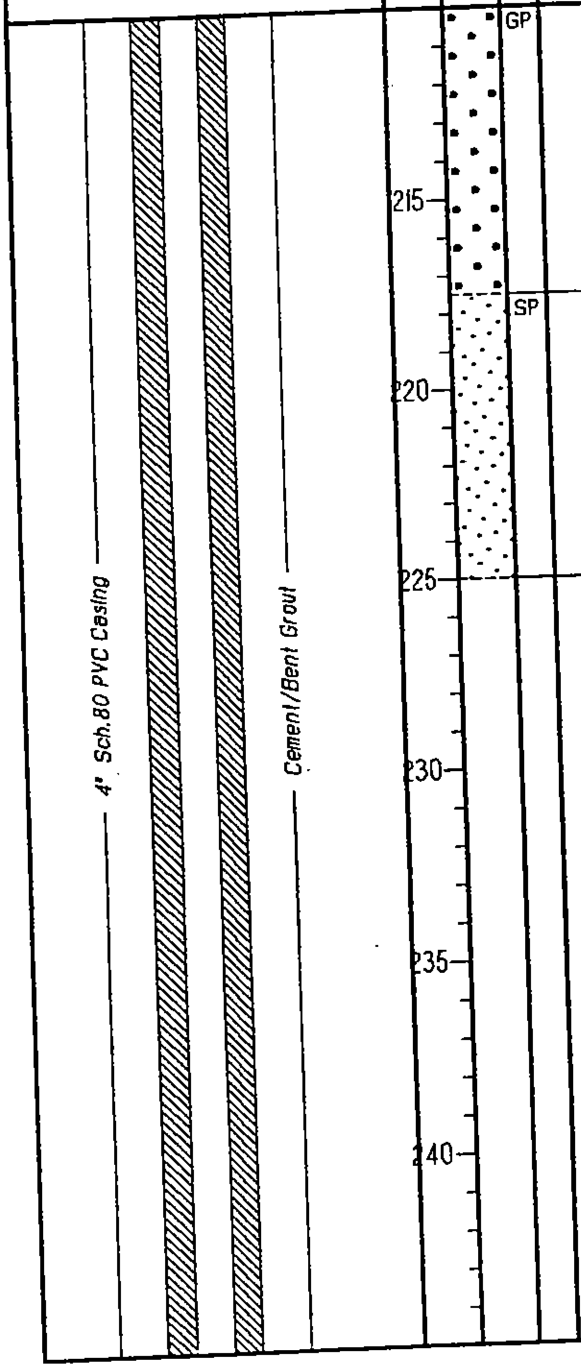
DRILLING METHOD: *Ingersol Rand STRATEX/Air rotary*

DRILLING COMPANY: *THF Drilling* CASING ELEVATION:

LOGGED BY: *Ted Moise* APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			GP	At 214.5 feet cobble, angular, 100 mm. sandy GRAVEL continued.
	215			
			SP	gravelly SAND: grayish-red; ~85% sand, fine- to coarse-grained; ~35% gravel, subrounded to subangular.
	220			
	225			RED FANGLOMERATE (rock): grayish-red; comprised of sands and gravels, very hard.
	230			
	235			
	240			



ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

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 Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" Sch.80 PVC Casing; Cement/Bent Grout	250			
	255			
	260			RED FANGOLMERATE continued.
	265			
	270			
	275			

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

ALISTO PROJECT NO: 10-320-08 DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

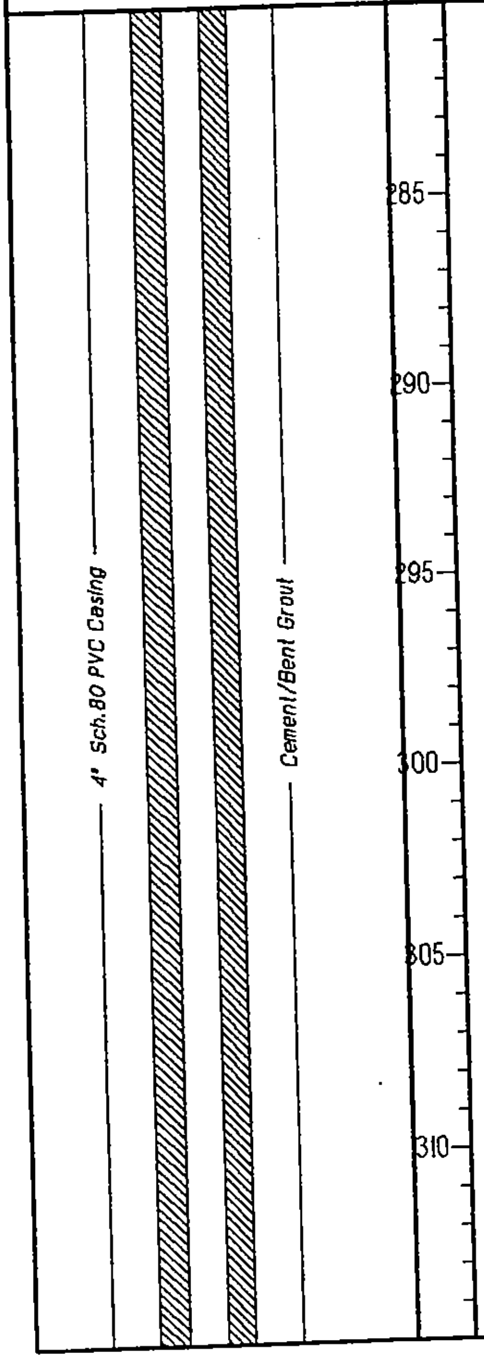
DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling CASING ELEVATION:

LOGGED BY: Ted Moise APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION



RED FANGOLMERATE continued.

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-24BR	

ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *04/22-28/98*

CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

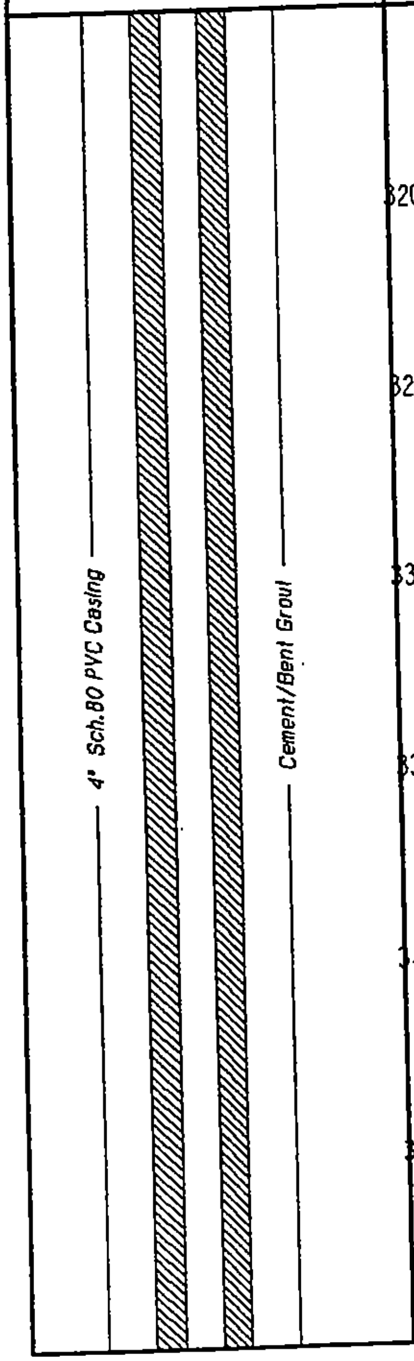
DRILLING METHOD: *Ingersol Rand STRATEX/Air rotary*

DRILLING COMPANY: *THF Drilling* CASING ELEVATION:

LOGGED BY: *Ted Moise* APPROVED BY: *Dan Salaices*

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
				SANDSTONE: pale yellowish-brown.
				RED FANGLOMERATE (rock): grayish-red.
	320			
	325			
	330			
	335			
	340			
	345			



ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

ALISTO PROJECT NO: 10-320-08 | DATE DRILLED: 04/22-28/98

CLIENT: Pacific Gas and Electric Co.

LOCATION: Topock Compressor Station

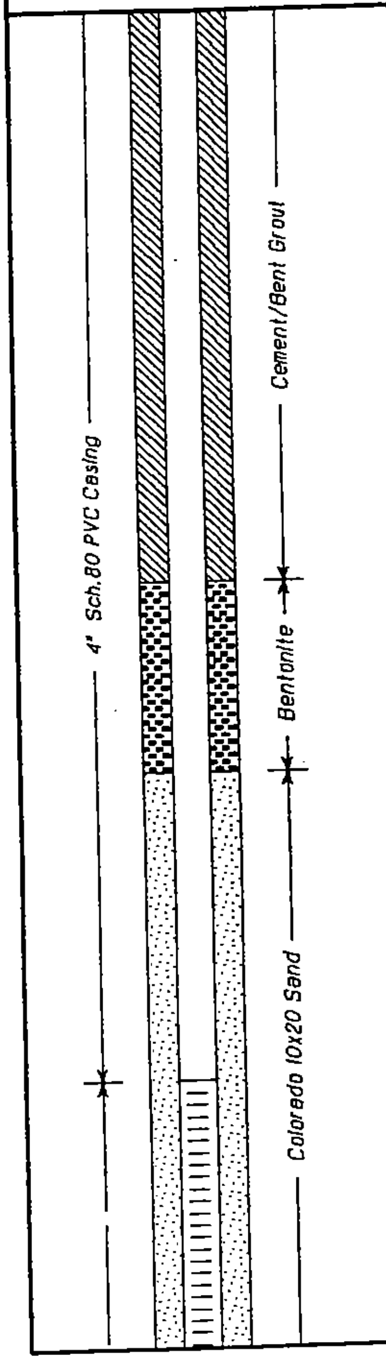
DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling | CASING ELEVATION:

LOGGED BY: Ted Moise | APPROVED BY: Dan Salaices

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
				RED FANGOLMERATE continued.
	355			
	360			
	365			
	370			
	375			
				SANDSTONE: pale yellowish-brown.
	380			



ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

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*

SEE SITE PLAN

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
4" PVC Screen 0.020-inch slot; Colorado 10x20 Sand	390			
	395			SANDSTONE continued.
	400			
	405			
	410			
	415			
				RED FANGLOMERATE (rock): grayish-red.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-24BR

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-08* DATE DRILLED: *04/22-28/98*

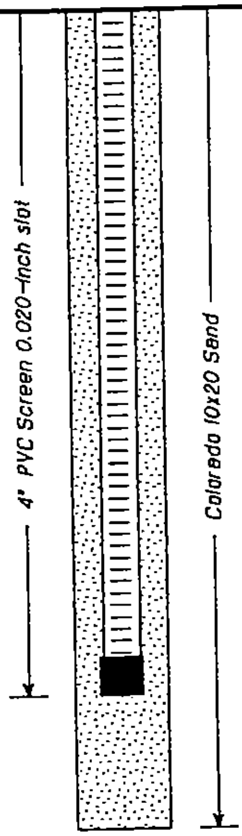
CLIENT: *Pacific Gas and Electric Co.*

LOCATION: *Topock Compressor Station*

DRILLING METHOD: *Ingersol Rand STRATEX/Air rotary*

DRILLING COMPANY: *THF Drilling* CASING ELEVATION:

LOGGED BY: *Ted Moise* APPROVED BY: *Dan Salaices*

WELL DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
	425			
	430			
	435			
	440			RED FANGOLMERATE continued.
				Total depth of borehole is 441.5 feet.
	445			
	450			

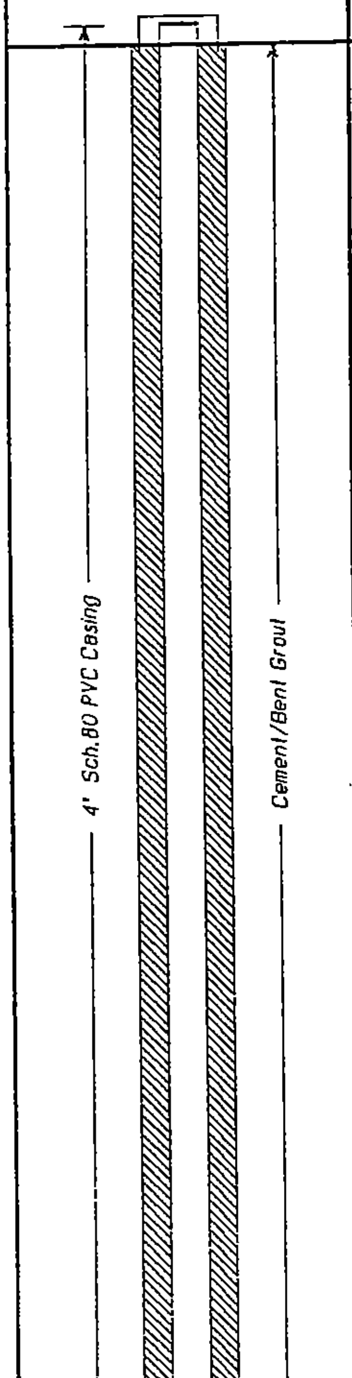
LOG OF WELL MW-25

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-09	DATE DRILLED: 4/20-21/99
CLIENT: Pacific Gas and Electric Co.	
LOCATION: Topock Compressor Station	
DRILLING METHOD: Roto Sonic, Continuous Coring	
DRILLING COMPANY: Boart Longyear	CASING ELEVATION:
LOGGED BY: Dan Hidalgo	APPROVED BY: Dan Hidalgo

WELL DIAGRAM

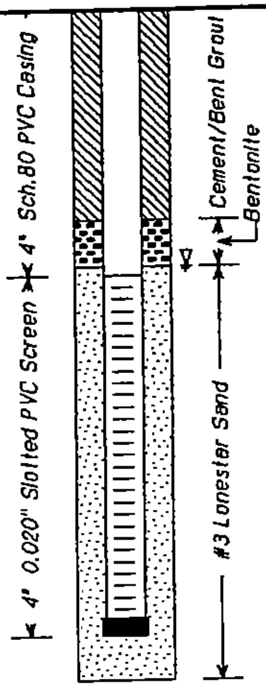


DEPTH feet	SAMPLES	SOIL CLASS	GEOLOGIC DESCRIPTION
0		SP	gravelly SAND: light brown; ~60% sand, very fine-grained; gravel, subangular, ~4 to 20 mm.
		GP	sandy GRAVEL: light brown; ~40-50% sand, very fine-grained; gravel, subangular, ~4 to 30 mm; cobble fragments; dry. At 7.5 feet color change to light olive-brown; ~80% gravel, subrounded to subangular, ~4 to 80 mm. At 11 feet color change to grayish-brown.
10			
20	■		
		SP	SAND: pale brown; very fine- to fine-grained; ~5% gravel, 4 to 10mm.
30			gravelly SAND: pale brown; sand, very fine- to fine-grained; ~20% gravel, 4 to 10 mm.
40	■		
50			
60	■	GP	sandy GRAVEL: very pale brown to yellow; ~80% gravel, subrounded, 4 to 20 mm; sand, very fine-grained; damp.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-25

WELL DIAGRAM



DEPTH feet	SAMPLES	SOIL CLASS	GEOLOGIC DESCRIPTION
		GP	sandy Gravel continued.
80	▬	SP	SAND: light yellowish-brown; very fine- to fine-grained; less than gravel; moist. Appears wet at 84 feet.
		ML	sandy SILT: dark yellowish-brown; ~40% sand, very fine- to fine-grained; trace of gravel; very moist.
90	▬	GM	silty GRAVEL: yellowish-brown, dense; ~70% gravel, 4 to 20 mm; fines, non-plastic; moist.
100		GP	sandy GRAVEL: brown; ~40-50% sand, fine- to coarse-grained; gravel, subrounded to subangular, ~4 to 20 mm; wet.
			Total depth of borehole is 107 feet.
110			
120			
130			
140			
150			

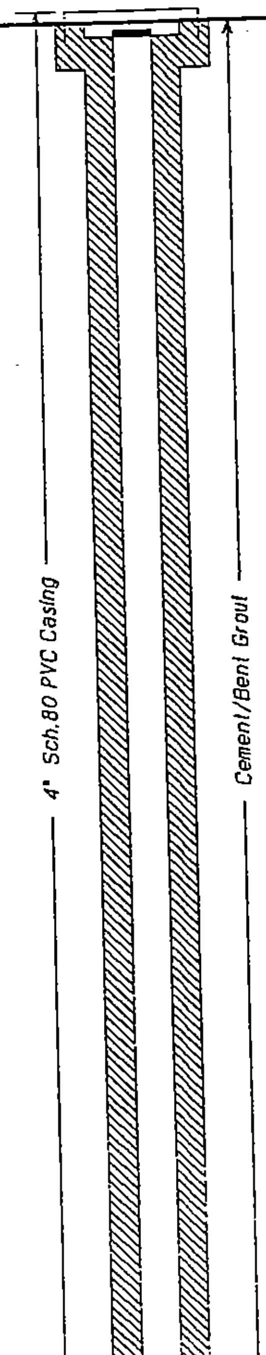
ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-26	Page 1 of 2

LOG OF WELL MW-26

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

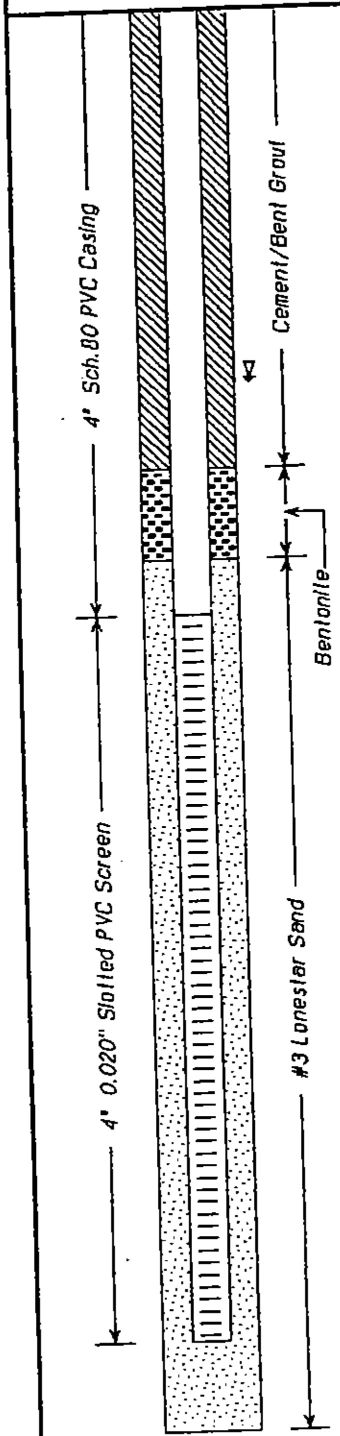


DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0			SP	gravelly SAND: medium reddish-brown; ~80% sand, medium- to coarse-grained; ~20% gravel, subrounded to angular; dry.
				Approximately 20% cobbles to 2".
5				
10				
15				
20				At 20 feet color change to medium grayish-green; 30% gravel; ~5% cobbles to 4".
25				
			SW	gravelly SAND: medium reddish-brown; sand, fine- to coarse-grained; ~30% gravel; ~10% cobbles to 2"; damp to dry.
30				

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-26

WELL DIAGRAM



SOIL CLASS	GEOLOGIC DESCRIPTION
SW	gravelly Sand continued.
GW	sandy GRAVEL: ~75% gravel, subrounded to angular, fine to coarse; fine- to coarse-grained sand; damp to moist. – At approximately 45 feet, wet.
ML	sandy SILT: medium reddish-brown; ~80% fines fraction, slightly plastic; ~30% sand, fine- to coarse-grained; ~10% gravel to 2"; moist to wet.
GW	sandy GRAVEL: medium reddish-brown; ~80% gravel, subrounded to angular; sand, fine- to coarse-grained; damp to moist.
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.
SP	gravelly SAND: sand, coarse-grained; ~10% gravel to 1.5"; ~5% fines; moist to wet.
ML	sandy SILT: medium reddish-brown; sand, fine- to medium-grained; ~20% gravel to 3/4"; ~40% fines, slightly plastic; damp to moist.
SP	gravelly SAND: sand, coarse-grained; ~10% gravel to 1.5"; ~5% fines; moist to wet. Chanes 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.

DEPTH feet: 40, 45, 50, 55, 60, 65, 70, 75

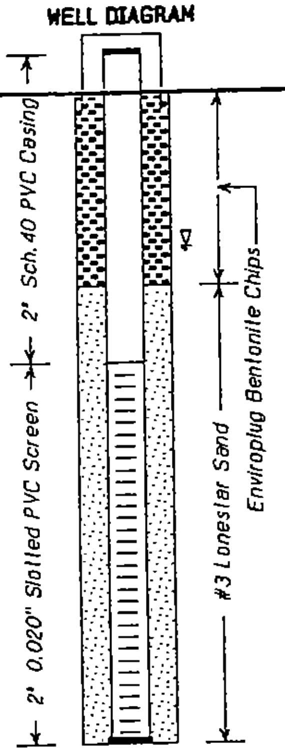
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-27

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-09	DATE DRILLED: 04/13/99
CLIENT: Pacific Gas and Electric Co.	
LOCATION: Topock Compressor Station	
DRILLING METHOD: Hollow-stem auger; split spoon	
DRILLING COMPANY: Gregg Drilling	CASING ELEVATION:
LOGGED BY: Dan Hidalgo	APPROVED BY: Dan Hidalgo

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
			SP	SAND: moderate yellowish-brown; very fine- to fine-grained; moist.
5				At approximately 4 feet, wet.
10	■ ■			
				At 12 feet color change to dark brownish-gray.
15				
				Total depth of borehole is 17 feet.
20				
25				
30				

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-27

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 107.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 458.4 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,290.53	**EASTING (CCS NAD 27 Z 5):** 7,616,540.35	**DATE STARTED:** 02/09/2005 **DATE COMPLETED:** 02/10/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: Approx 600' southeast of TW-2D, near MW-27, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–7		Box 1	5.6	SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, 98% f sand, 2% fines, subrnd fine qtz-rich sand, loose, dry.	collect bag samples for archive description and potential grain-size testing.
5						soil becomes compacted and pushed aside. 7ft run becomes 4ft
					- becomes moist and brn 7.5YR5/4	
9–17		Box 2 Box 3	10	SP	**POORLY GRADED SAND WITH SILT (SP)** - very dk gray 7.5YR3/1, 95% sand, 5% fines (silt), wet, organic zone 10-15ft, some roots noted.	collect bag sample MW27D-GS-10@12:45 saturated at ~11ft
15				SP	**POORLY GRADED SAND (SP)** - becomes brn 7.5YR5/3 at 15ft and below, 98% sand, 2% fines.	
17–27		Box 4 Box 5	9.5	SP	**POORLY GRADED SAND WITH SILT (SP)** - very dk gray 7.5YR3/1, 95% sand, 5% fines, no rocks observed, dk organic zone 17-19.5 ft.	
20				SP	**POORLY GRADED SAND (SP)** - brn 7.5YR4/3, 98% sand, 2% fines, no gravel, few lithics, subrnd qtz-rich sand, loose, wet	20ft samples at 13:00
25						water sample at 14:10
27–35		Box 6 Box 7	9		- brn 7.5YR5/3, few mafic minerals, qtz-rich fine sand	
30						sands fine upwards from 30 to 38ft, 30ft samples collected at 14:25
					- grades to m sand by 33 ft, 98% sand, 2% fines	water sample collected at 32-37ft MW27D-24.5
35						

PROJECT NUMBER: 326228.IM

BORING NUMBER: MW-27

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)	**HOLE DEPTH (ft):** 107.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.4 ft. MSL **NORTHING (CCS NAD 27 Z 5):** 2,102,290.53	**EASTING (CCS NAD 27 Z 5):** 7,616,540.35	**DATE STARTED:** 02/09/2005	**DATE COMPLETED:** 02/10/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Approx 600' southeast of TW-2D, near MW-27, Colorado River floodplain.		**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					POORLY GRADED SAND (SP) - brn 7.5YR4/3, 98% sand, 2% fines, no gravel, few lithics, subrnd qtz-rich sand, loose, wet	bag sample MW27D-GS-35 collected at 14:20
					- grades to c sand by 35ft, 98% sand, 2% fines, ~85% qtz, 5% feldspars, ~10% mafics, no gravel	
40						40ft samples collected at 14:40
					- 1st isolated rounded fluvial pebble	
		Box 8 Box 9	9		- 95% sand, 3% subrnd to rnd gravel up to 1", 2% fines, gravel composed of chert metamorphics and one weathered limestone	collect groundwater sample from 42-47ft MW27D-44.5
45				SP	- 89% sand, 10% gravel, 1% fines	
					- 94% sand, 5% gravel, 2% fines, subrnd medium qtz-rich sand as above, no gravel	
50						bag sample MW27D-GS-50 collected at 15:50
		Box 10 Box 11	8.5			
55					**WELL GRADED SAND WITH GRAVEL (SW)** - brn, 58% rnd f to c qtz-rich sand, 40% gravel, 2% fines, gravel is igneous and metamorphic, rnd up to 2.5", medium density, wet	bag sample collected MW27D-GS-56 at 16:00
				SW		
60					**POORLY GRADED SAND (SP)** - brn 7.5YR5/3, 93% qtz-rich sand, 5% gravel, 2% fines, subrnd, fine, loose, wet	60ft samples collected at 16:10
		Box 12 Box 13	8.5			collect groundwater sample at 62-67ft MW27D-64.5
					- poorly graded fine sand as above, 91% f sand, 7% rnd quartzite gravel, 2% gravel	soft drilling
65				SP		
					- becomes gravelly at 67ft with gravels up to 1.7 inch long	
					- 88% sand, 10% gravel, 2% fines	
70						

CH2MHILL

SHEET 3 of 4	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-27

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 107.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.4 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,290.53	**EASTING (CCS NAD 27 Z 5):** 7,616,540.35	**DATE STARTED:** 02/09/2005	**DATE COMPLETED:** 02/10/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Approx 600' southeast of TW-2D, near MW-27, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		Box 14 Box 15	10	SP	**POORLY GRADED SAND (SP)** - brn 7.5YR5/3, 88% qtz-rich sand, 10% gravel, 2% fines, subrnd, fine, loose, wet - 93% subrnd qtz-rich sand, 5% rnd to subrnd gravel up to 2 inch long, 1% fines	
75				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR5/2, 57% subrnd sand, 40% rnd to subrnd gravel, 3% fines, 3.5" long cobbles (weathered metamorphic and igneous), medium density, wet - vesicular basalt cobble	harder, slower drilling below 75ft bag sample taken in gravel zone at 77ft MW27D-GS-77
80		Box 16 Box 17	9.5	SC	**CLAYEY SAND (SC)** - gray 7.5YR5/1, 80% sand, 20% silt and clay, silty plastic, soft, wet	
				GW	**WELL GRADED GRAVEL WITH SAND AND COBBLES (GW)** - brn 7.5YR5/2, 80% gravel, 18% sand, 2% fines, subrnd metamorphic gravel and cobbles, medium dense, wet - 1st granitic boulder - 75% gravel, 23% sand, 2% fines, igneous rnd gravel	
85				SM	**SILTY SAND WITH GRAVEL (SM)** - reddish brn 2.5YR4/4, 60% sand, 30% silty fines, 10% f gravel, subrnd, medium to hard, moist to wet	reworked Tmc with fluvial sand and gravel
90 95		Box 18 Box 19	8.5	BR	**CONGLOMERATE (BR)** - reddish brn 2.5YR4/4, 60% sand, 30% silty fines, 10% f gravel, subrnd, medium to hard density, moist - core is shattered and dry, reddish brn indurated conglomerated with subang cobbles and gravels, fines are primarily composed of red silt. When crushed : 42% sand, 40% cobbles and gravels, 18% silty fines, color: pale reddish brn 10YR5/4 (on rock color)	Top Miocene Conglomerate at 87 ft moisture introduced below 92ft during drilling
100 105		Box 20 Box 21	8.5	BR	- some intact core at 99, 100 and 103 ft	

CH2MHILL

PROJECT NUMBER: 326228.IM	BORING NUMBER: MW-27

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		HOLE DEPTH (ft): 107.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.4 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,290.53	EASTING (CCS NAD 27 Z 5): 7,616,540.35	DATE STARTED: 02/09/2005	DATE COMPLETED: 02/10/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft):	DRILLING EQUIPMENT: Track Mounted Sonic	
LOCATION: Approx 600' southeast of TW-2D, near MW-27, Colorado River floodplain.			LOGGED BY: B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					CONGLOMERATE (BR) - reddish brn 2.5YR4/4, 60% sand, 30% silty fines, 10% f gravel, subrnd, medium to hard density, moist	
					- same conglomerate to 107 ft, Boring Terminated at 107 ft	

ABBREVIATIONS

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

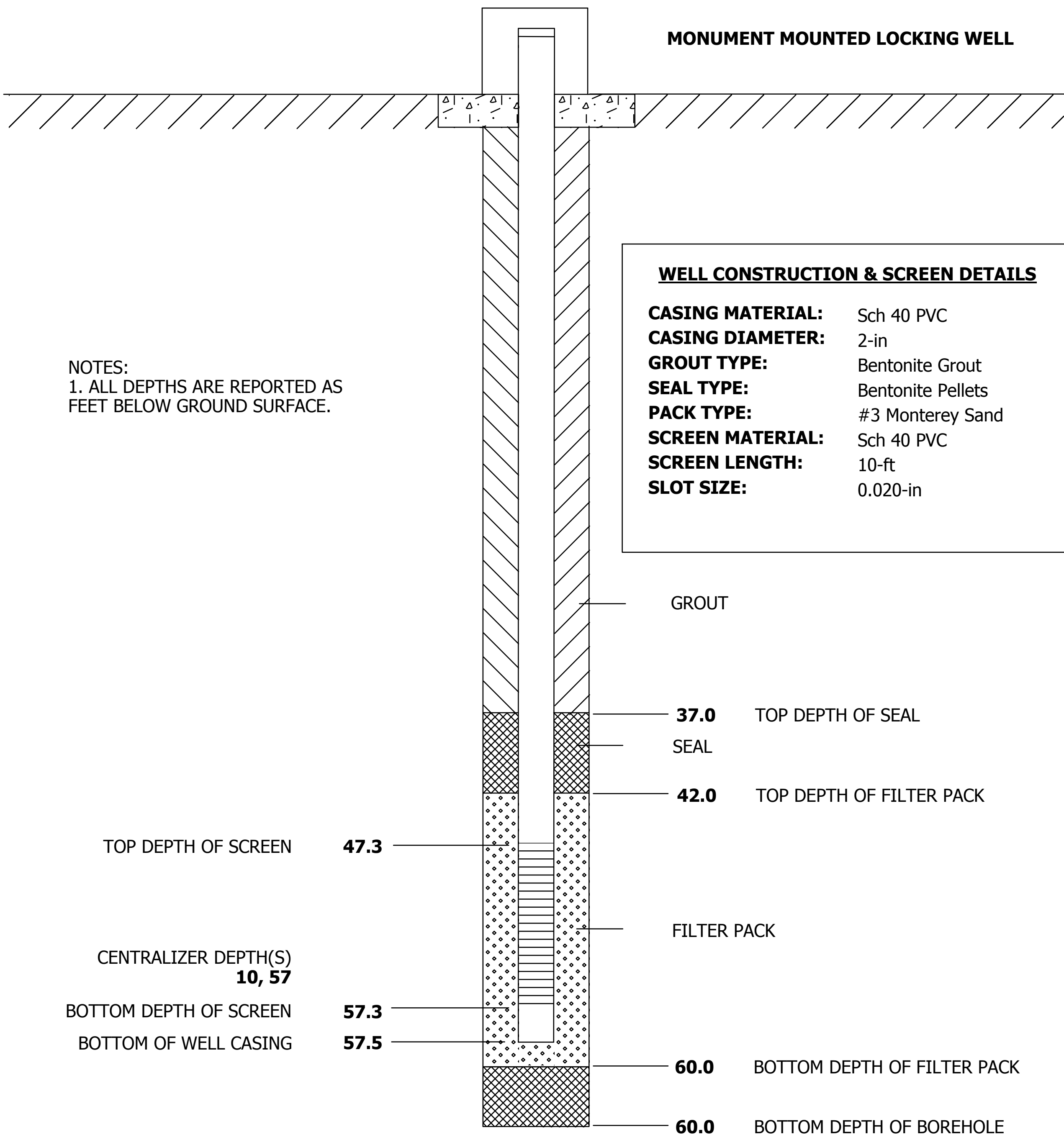
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-27-060**

LOCATION: Approx 600' southeast of TW-2D, near MW-27, Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/10/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/11/2005
LOGGER: B. Moayyad, B. Trebble	**WELL COMPLETION DATE:** 02/11/2005
TOP OF WELL CASING (NGVD 29): 461.38	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102288.26
GROUND SURFACE ELEVATION (NGVD 29): 458.37	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616534.75



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in

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

WELL DIAGRAM IS NOT TO SCALE

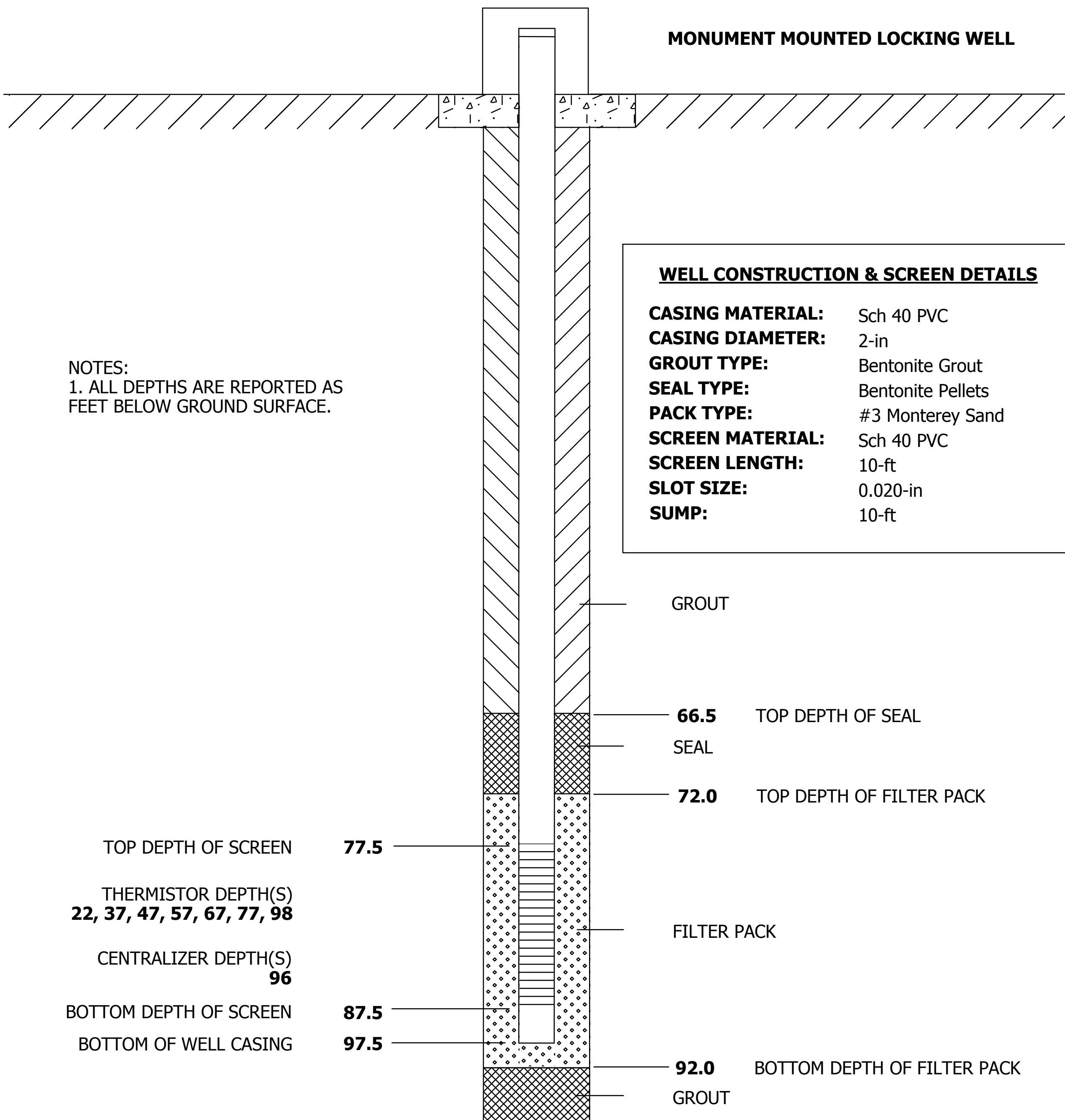
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-27-085**

LOCATION: Approx 600' southeast of TW-2D, near MW-27, Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/09/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/10/2005
LOGGER: B. Moayyad, B. Trebble	**WELL COMPLETION DATE:** 02/11/2005
TOP OF WELL CASING (NGVD 29): 460.99	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102290.53
GROUND SURFACE ELEVATION (NGVD 29): 458.44	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616540.35



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in
SUMP:	10-ft

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

THERMISTOR DEPTH(S)
22, 37, 47, 57, 67, 77, 98

CENTRALIZER DEPTH(S)
96

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

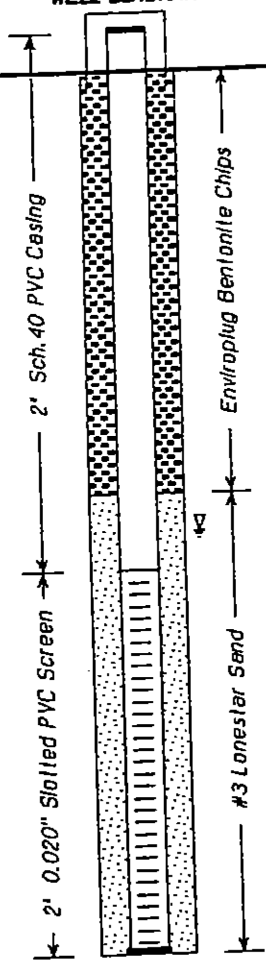
LOG OF WELL MW-28

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

ALISTO PROJECT NO: 10-320-09 DATE DRILLED: 04/13/99
CLIENT: Pacific Gas and Electric Co.
LOCATION: Topock Compressor Station
DRILLING METHOD: Hollow-stem auger; split spoon
DRILLING COMPANY: Gregg Drilling CASING ELEVATION:
LOGGED BY: Dan Hidalgo APPROVED BY: Dan Hidalgo

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0			SP	SAND: pinkish-gray; very fine- to fine-grained, dune sand; moist.
12				At approximately 12 feet, wet.
15	■			
20	■			At 20 feet color change to light brown.
23				Total depth of borehole is 23 feet.
25				
30				

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-28

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 148.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 464.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,005.68	EASTING (CCS NAD 27 Z 5): 7,616,289.73	DATE AND TIME STARTED: 04/15/2004 10:00:00 AM	DATE AND TIME COMPLETED: 04/16/2004 5:30:00 PM
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: All Terrain Sonic Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain area, approx. 400' northeast of MW-20 bench			LOGGED BY: J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		Box 25		SW/SC	**WELL GRADED SAND WITH CLAY (SW/SC)** - reddish brn 5YR4/4, 55% f-vc sand, 30% clay, 15% gravel up to 0.25 (few up to 2), rnd, compacted/cemented, dry interior.	core is hot
110				SW	**WELL GRADED GRAVELLY SAND (SW)** - reddish brn 5YR4/4, 60% f-vc sand, 40% ang gravel up to 1.5.	hard drilling
		CC12 Box 25 Box 26 Box 27	10			
115						
				SW/SM	**WELL GRADED SAND WITH GRAVEL AND SILT (SW/SM)** - reddish brn 5YR4/4, 35% subrnd gravel up to 1/2, 45% vf-c sand, 10% silt, clast supported.	
120					- reddish brn 5YR4/3 to 3/3	
		CC13 Box 18 Box 19 Box 30	10			
125						
130					- brn 10YR4/3 to 10YR3/3, gravels up to 1.25, loose, wet	
		CC14 Box 30 Box 31 Box 32	10		- subang to ang gravels up to 3	
135						
				GW	**SANDY GRAVEL (GW)** - reddish brn, 55% subang gravel, 40% f-vc sand, 5% fines, loose, wet.	pause to decon pipe, resume @ 16:30
140						

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SHEET 5 of 5	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-28

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 148.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 464.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,005.68	EASTING (CCS NAD 27 Z 5): 7,616,289.73	DATE AND TIME STARTED: 04/15/2004 10:00:00 AM	DATE AND TIME COMPLETED: 04/16/2004 5:30:00 PM
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: All Terrain Sonic Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain area, approx. 400' northeast of MW-20 bench			LOGGED BY: J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				GW	**SANDY GRAVEL (GW)** - sandy gravel with fines up to 20%, wet.	
145		CC15 Box 33 Box 34 Box 35	10	BR	**CONSOLIDATED CONGLOMERATE (BR)** reddish brn, 40% gravel, 40% sand, 20% clay / silt, stiff	reworked Miocene conglomerate (Tmc unit) hard drilling less transmissive
					Boring Terminated at 148 ft	Stop drilling @ 17:30

ABBREVIATIONS
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

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-28

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 148.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 464.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,005.68	**EASTING (CCS NAD 27 Z 5):** 7,616,289.73	**DATE AND TIME STARTED:** 04/15/2004 10:00:00 AM / **DATE AND TIME COMPLETED:** 04/16/2004 5:30:00 PM
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** All Terrain Sonic Rig with continuous 4" core, 6" casing
LOCATION: Floodplain area, approx. 400' northeast of MW-20 bench			**LOGGED BY:** J. Wellmeyer / PHX

DEPTH BGS (feet)	SAMPLE: USCS CODE	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	SPT RESULTS 6"-6"-6" (N)	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.
0	SP				**POORLY GRADED SAND (SP)** - pale brn 10YR6/3, 50% m sand, 25% f sand, 10% vf sand, 5% c sand, <2% fines, subround to subang, loose, dry.	04/15/2004, start exploratory pilot hole 10:00 AM. Collect standard penetration tests (SPT) using 24" split-spoon sampler at 10 foot intervals at base of sonic-advance continuous core (CC) runs.
					- plastic and organics	
5		CC1 Box 1 Box 2				runs. lost 2' of sample at bottom of run, auger bit used to recover it heaving sands, used water
					- moist	
8				11-8-7-8		
10						saturated
					- dark grayish brn 10YR4/2, 90% f-m sand with some clay, rounded, qtz dominated, loose, some black fines increasing at depth	
15		CC2 Box 2 Box 3 Box 4				
18				7-5-5-5		
20						
					- brn 10YR4/3, fewer black fines	
25		CC3 Box 5 Box 6			- brn 10YR4/3, 95% f-m sand, 5% vf sand, rounded, qtz dominated, loose	
28				6-5-14-20		
30						
35		CC4 Box 7 Box 8 Box 9				

PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-28

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 148.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 464.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,005.68	**EASTING (CCS NAD 27 Z 5):** 7,616,289.73	**DATE AND TIME STARTED:** 04/15/2004 10:00:00 AM / **DATE AND TIME COMPLETED:** 04/16/2004 5:30:00 PM
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** All Terrain Sonic Rig with continuous 4" core, 6" casing
LOCATION: Floodplain area, approx. 400' northeast of MW-20 bench			**LOGGED BY:** J. Wellmeyer / PHX

DEPTH BGS (feet)	SAMPLE: USCS CODE	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	SPT RESULTS 6"-6"-6" (N)	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.
	SP				**POORLY GRADED SAND (SP)** - pale brn 10YR6/3, 50% m sand, 25% f sand, 10% vf sand, 5% c sand, <2% fines, subround to subang, loose, dry.	
				15 - 60(6")	- brn 10YR4/3, 50% m sand, 40% c sand, 10% f sand, rounded	stopped drilling 12:30, resumed at 14:00
40	SW	CC5 Box 9 Box 10 Box 11			**WELL GRADED SAND WITH GRAVEL (SW)** - lt brn, 80% f-vc sand, 20% gravel up to 1.75", subang, qtz, loose.	
					- 75% f-vc sand, 25% gravel up to 3", rounded to subang gravel, well rounded sand	
45					- gravel up to 1.5", sand coarser at depth	
				5-15-50(3.5")		
50						
	SP	CC6 Box 11 Box 12 Box 13			**POORLY GRADED SAND (SP)** - 90% f-c sand with few rounded cobbles up to 3", no small gravels.	
	GW				**WELL GRADED GRAVEL (GW)** - lt brn, 50% gravel, 50% c-f sand, well rounded up to 1", moist, massive, loose.	fluvial
55	SP				**POORLY GRADED SAND WITH GRAVEL (SP)** - brn 10YR3/5, 95% f-m sand, well rounded up to 0.75", qtz dominated with some pyroxene, loose.	
				11-12-15-11		
60	SW	CC7 Box 13 Box 14 Box 15			**WELL GRADED SAND (SW)** - lt brn 7.5YR4/3, clay pocket, trace gravel, massive, soft.	
					- 85% vf-c sand,15% vc sand & gravel up to 4", rounded to subang, loose, light brn	
	SC				**CLAYEY SAND** - brn 10YR4/3, 40% c-sand, 35% f-m sand, 25% clay, organic content.	
65					- large woody debris, green staining	wood fragment preserved for analysis
	GW				**WELL GRADED GRAVEL (GW)** - 60% gravel, 30% f-c sand, ang to rounded, tuff & granite, loose.	
				17-8-9-10		
70						

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SHEET 3 of 5	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-28

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 148.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 464.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,005.68	EASTING (CCS NAD 27 Z 5): 7,616,289.73	DATE AND TIME STARTED: 04/15/2004 10:00:00 AM	DATE AND TIME COMPLETED: 04/16/2004 5:30:00 PM
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: All Terrain Sonic Rig with continuous 4" core, 6" casing	
LOCATION: Floodplain area, approx. 400' northeast of MW-20 bench			LOGGED BY: J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE: USCS CODE	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	SPT RESULTS 6"-6"-6" (N)	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.
	SP				**POORLY GRADED SAND WITH GRAVEL (SP)** - brn 10YR4/3, 80% f-m sand, 20% gravel up to 0.75", mostly subround, massive, loose.	fining upwards
		CC8 Box 16 Box 17			- 70% f sand, 20% m sand, 10% vf sand	
75						
				4- 50(6")		
80						stopped drilling at 6:45 and resumed on 4/16/04 @ 8:25
		CC9 Box 18 Box 19				
85	SW				**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 70% f-vc sand, 30% gravel to 4", mostly subround qtz sand , mostly subang to rounded gneiss and schist gravel, moist.	fining upwards
				26- 50(3")		
	SP				**POORLY GRADED SAND (SP)** - brn 10YR4/3, 60% m sand, 30% f sand, 10% vf sand, loose, rounded.	
90	GP				**POORLY GRADED GRAVEL (GP)** - dk yellowish brn 10YR4/4, 80% gravel up to 4", 20% m-c sand, very well rounded, tight packing, clast supported.	
	GW/SW	CC10 Box 20 Box 21 Box 22			**WELL GRADED GRAVELLY SAND (GW/SW)** - reddish brn 5YR4/3, 50% m-vc sand, 45% rounded to subaang gravel 0.25" up to 3", 5% silt.	hard drilling
95						
				62- 50(3")	- 60% f-vc sand, 40% granitic gravel, less silt	
100						
		CC11 Box 22 Box 23 Box 24 Box 25				
105						

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-28

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 148.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 464.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,005.68	EASTING (CCS NAD 27 Z 5): 7,616,289.73	DATE AND TIME STARTED: 04/15/2004 10:00:00 AM	DATE AND TIME COMPLETED: 04/16/2004 5:30:00 PM
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: All Terrain Sonic Rig with continuous 4" core, 6" casing	
LOCATION: Floodplain area, approx. 400' northeast of MW-20 bench			LOGGED BY: J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE: USCS CODE	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	SPT RESULTS 6"-6"-6" (N)	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.
	SW/SC				**WELL GRADED SAND WITH CLAY (SW/SC)** - reddish brn 5YR4/4, 55% f-vc sand, 30% clay, 15% gravel up to 0.25" (few up to 2"), rounded, compacted/cemented, dry interior.	core is hot
		CC12 Box 25 Box 26 Box 27		45- 60(5")		
110	SW				**WELL GRADED GRAVELLY SAND (SW)** - reddish brn 5YR4/4, 60% f-vc sand, 40% ang gravel up to 1.5".	hard drilling
115						
	SW/SM				**WELL GRADED SAND WITH GRAVEL AND SILT (SW/SM)** - reddish brn 5YR4/4, 35% subrnd gravel up to 1/2", 45% vf-c sand, 10% silt, clast supported.	
		CC13 Box 18 Box 19 Box 30		43- 50(3")		
120					- reddish brn 5YR4/3 to 3/3	
125						
		CC14 Box 30 Box 31 Box 32		34 - 50(5")		
130					- brn 10YR4/3 to 10YR3/3, gravels up to 1.25, loose, wet	
					- subang to ang gravels up to 3"	
135						
	GW			70	**SANDY GRAVEL (GW)** - reddish brn, 55% subang gravel, 40% f-vc sand, 5% fines, loose, wet.	pause to decon pipe, resume @ 16:30
140						

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PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-28

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock IM Investigation (Phase 1 2004)	148.0	Prosonic Corp. Maretta, OH	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE AND TIME STARTED:	DATE AND TIME COMPLETED:
464.9 ft. MSL	2,103,005.68	7,616,289.73	04/15/2004 10:00:00 AM	04/16/2004 5:30:00 PM

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic	---	All Terrain Sonic Rig with continuous 4" core, 6" casing

LOCATION:	LOGGED BY:
Floodplain area, approx. 400' northeast of MW-20 bench	J. Wellmeyer / PHX

DEPTH BGS (feet)	SAMPLE: USCS CODE	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	SPT RESULTS 6"-6"-6" (N)	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.
	GW				**SANDY GRAVEL (GW)** - sandy gravel with fines up to 20%, wet.	
145	BR	CC15 Box 33 Box 34 Box 35		100	**CONSOLIDATED CONGLOMERATE (BR)** reddish brn, stiff, consolidated conglomerate, 40% gravel, 40% sand, 20% clay / silt	141' - top of weathered Miocene conglomerate (Tmc unit) hard drilling less transmissive
					Boring Terminated at 148 ft	Stop drilling @ 17:30

ABBREVIATIONS

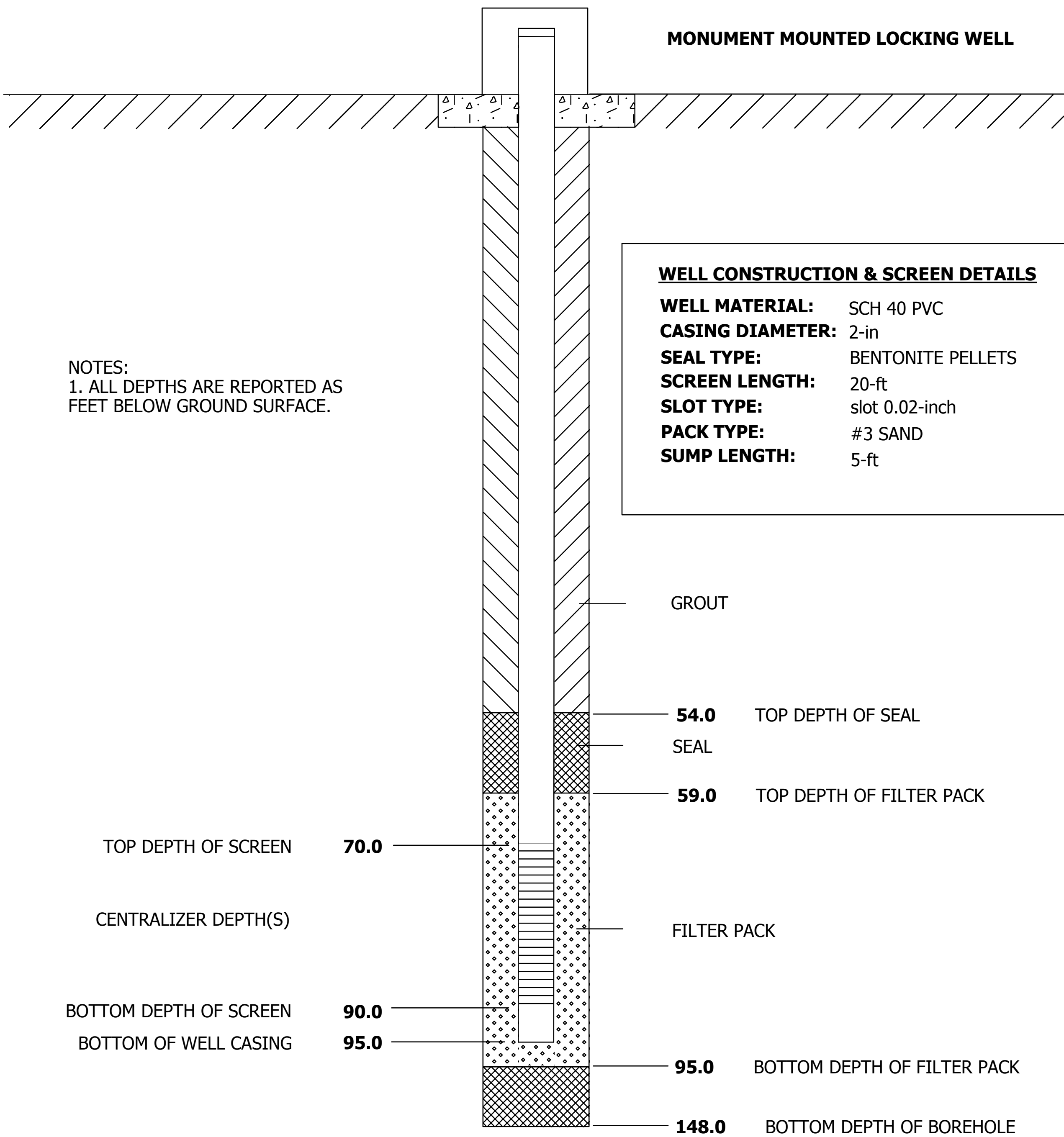
cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-28-90**

LOCATION: Floodplain well field Topock, CA. - Adjacent to Colorado R. approximately 900' north of railroad, 550' east of old Route 66

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 04/15/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 04/16/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/17/2004
TOP OF WELL CASING (NGVD 29): 467.66	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2103005.68
GROUND SURFACE ELEVATION (NGVD 29): 464.89	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616289.73



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	5-ft

WELL DIAGRAM IS NOT TO SCALE

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ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-29

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-09* DATE DRILLED: *04/12/99*

CLIENT: *Pacific Gas and Electric Co.*

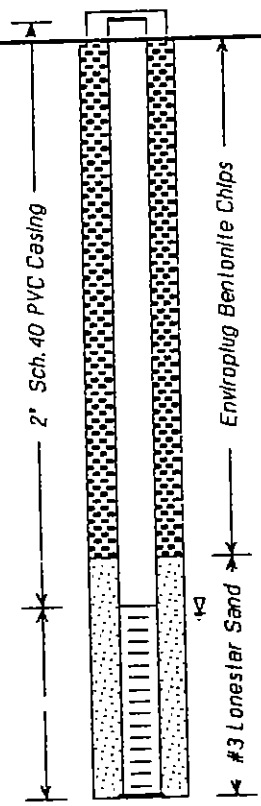
LOCATION: *Topock Compressor Station*

DRILLING METHOD: *Hollow-stem auger; split spoon*

DRILLING COMPANY: *Gregg Drilling* CASING ELEVATION:

LOGGED BY: *Dan Hidalgo* APPROVED BY: *Dan Hidalgo*

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0			SP	SAND: pinkish-gray, loose; very fine- to fine-grained, dune sand; dry.
30				At approximately 30 feet, wet.
36			ML	clayey SILT: dark grayish-brown, wet.
39.5				Total depth of borehole is 39.5 feet.

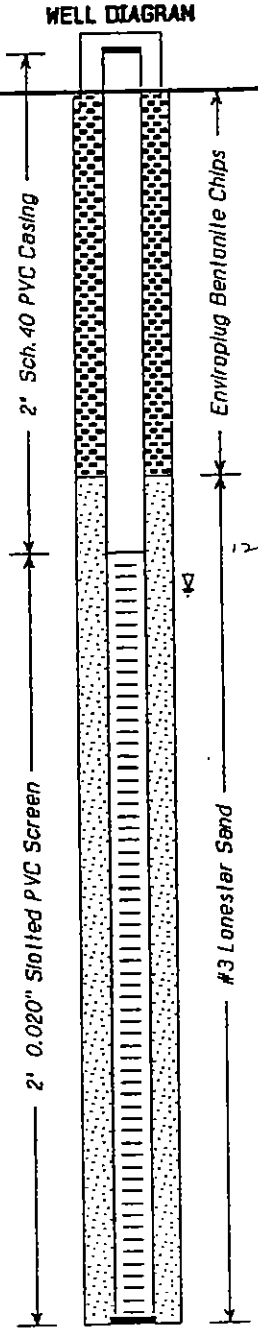
Depth scale: 10, 20, 30, 40, 50, 60

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-30/30	Page 1 of 1

ALISTO PROJECT NO: 10-320-09	DATE DRILLED: 04/12/99
CLIENT: Pacific Gas and Electric Co.	
LOCATION: Topock Compressor Station	
DRILLING METHOD: Hollow-stem auger; split spoon	
DRILLING COMPANY: Gregg Drilling	CASING ELEVATION:
LOGGED BY: Dan Hidalgo	APPROVED BY: Dan Hidalgo

SEE SITE PLAN

WELL DIAGRAM



DEPTH feet	SAMPLES	SOIL CLASS	GEOLOGIC DESCRIPTION
0		SP	SAND: pinkish-gray, loose; very fine- to fine-grained, dune sand.
13			At approximately 13 feet, wet.
17		SM	silty SAND: dark grayish-brown; ~60-70% sand, very fine-grained; wet.
20	■		
25	■		
32			Total depth of borehole is 32 feet.

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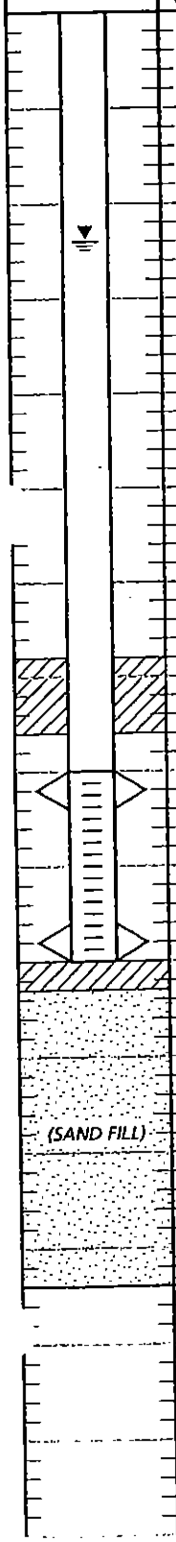
LITHOLOGIC LOG

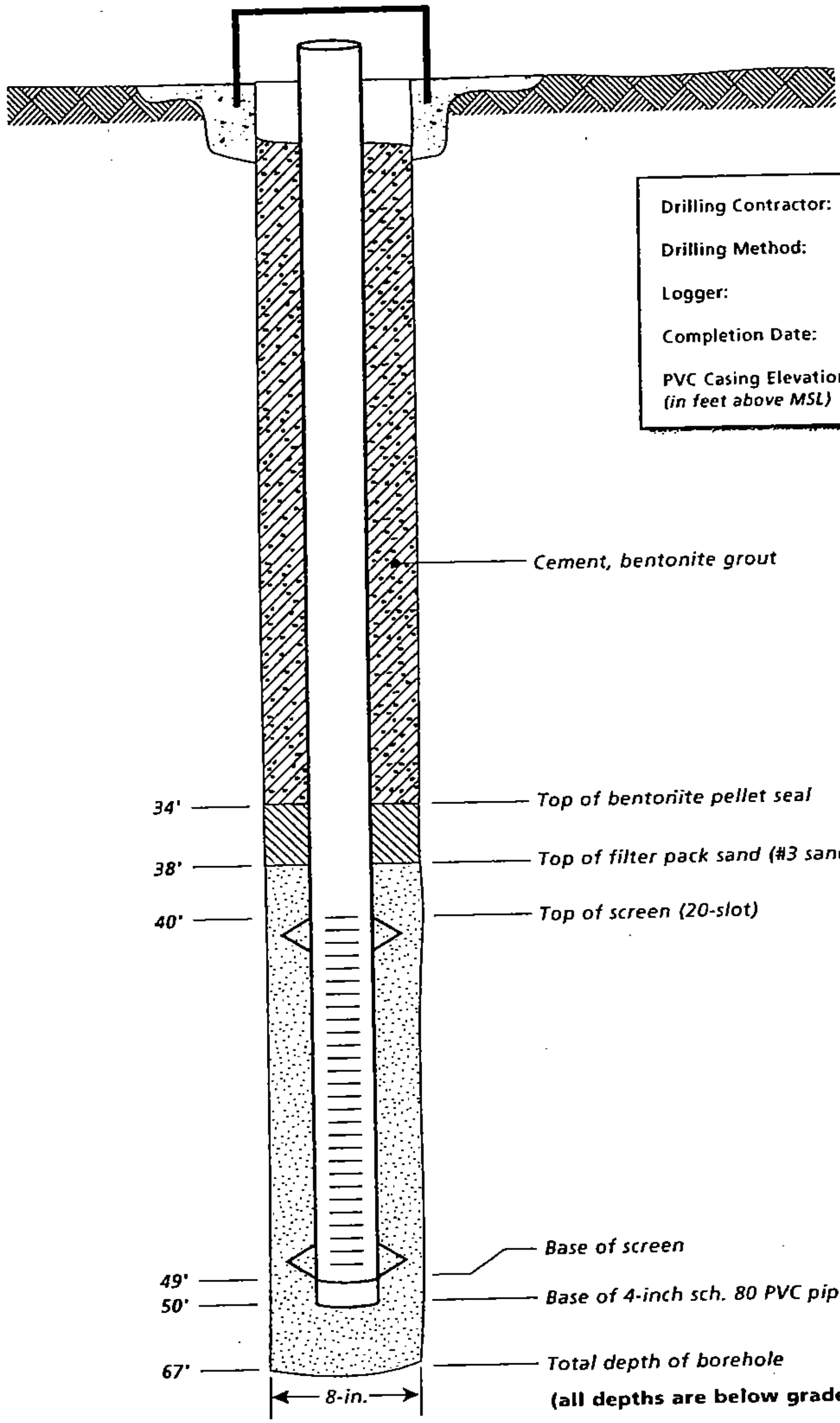
Well Number **MW-30-50**

Elevation of concrete pad 465.94 (in feet)
Completion date 3/5/03
Location 2,102,504 (northing); 7,616,151 (easting)
Drilling contractor / method Boart Longyear/Sonic
Logger R. Lambert
Borehole diameter 8 in., 4-in. PVC

COMPLETION DIAGRAM



DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
0	Sand, light brown, loose, fine- to medium-grained, moist at 2'. *(sand dredged from the river)*	SP	*Spud 11:55* MW-30-3
10	Same as above, wet.		MW-30-10: *Sand falling out of core, barrel even with catcher* *@12 noon – Switch to 4-in. core barrel with catcher*
20	Sand, dark gray, fine- to medium-grained. Clay, dark gray, soft, moderately soft, plastic, and cohesive, (8-in. thick), rare organic streak. Sand, dark gray, fine-grained, loose.	CL SP	MW-30-20 (olive gray, 5Y 4/1) *12:42*
	Sand, dark yellowish brown, medium-grained (10YR 4/2)		
30			MW-30-33 *13:00*
40	Sand	SP	MW-30-40
	Clay (2-in. thick), olive gray, soft, plastic, and cohesive.	CL	*13:14*
	Gravelly sand, olive gray, coarse-grained, some gravel to 1.5-in., rounded.	SW	*(archive)* MW-30-50
50	Sand gets coarser, up to 3-in. cobbles.		
	Clay, dark yellowish brown, with cobbles to 4-in., well rounded.	CL	*(archive)* MW-30-54
	Sand with silt and gravel.	SM	*13:39*
	Silt and fine-grained sand, brown.	ML	
60	Picking up gravel. Thin, gravelly, silty sand, dark gray.	SM	MW-30-60 *(plus archive)*
	Red fanglomerate, hard, cemented.	RF	**TD 67'** *(13:55)* *(archive)* MW-30-66
70			
80			



Drilling Contractor:	Boart Longyear
Drilling Method:	Sonic
Logger:	R.E. Lambert
Completion Date:	03/05/03
PVC Casing Elevation: (in feet above MSL)	468.36

(all depths are below grade)

NOT TO SCALE

ComplDiag_MW-30-50 (Z.68) 07/0

Well Completion Diagram for MW-30-50

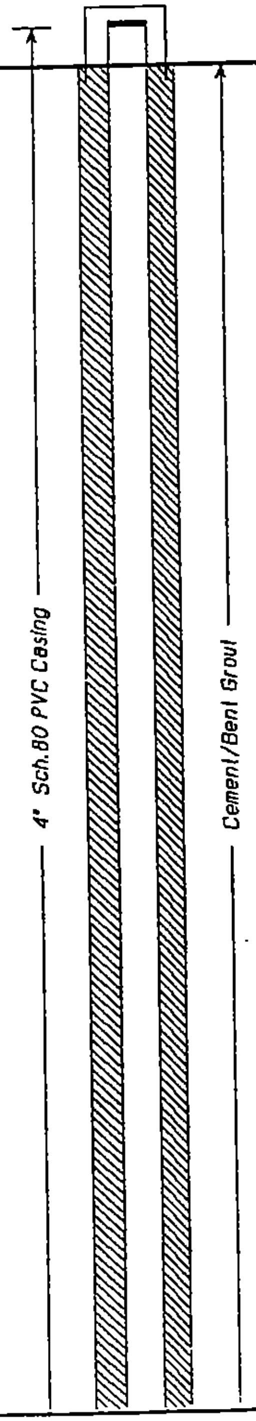
PG&E Topock

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL MW-31	Page 1 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-09	DATE DRILLED: 4/22-23/99
CLIENT: Pacific Gas and Electric Co.	
LOCATION: Topock Compressor Station	
DRILLING METHOD: Roto Sonic, Continuous Coring	
DRILLING COMPANY: Boart Longyear	CASING ELEVATION:
LOGGED BY: Dan Hidalgo	APPROVED BY: Dan Hidalgo

WELL DIAGRAM

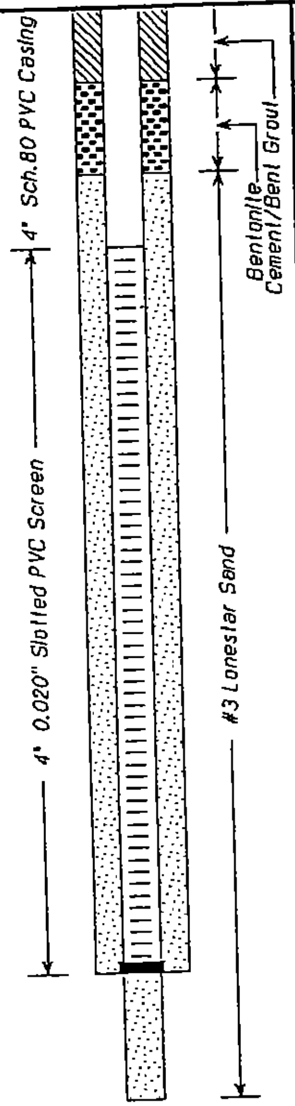


DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–5			SP	gravelly SAND: pale brown; ~80-80% sand, very fine-grained; gravel, subrounded, ~4 to 20 mm; dry.
5			GP	sandy GRAVEL: pale brown; ~80% gravel, subrounded, ~4 to 60 mm; sand, very fine-grained; dry.
			SP	gravelly SAND: pale brown; ~80-80% sand, fine-grained; gravel, subrounded, ~4 to 20 mm; dry.
10			GP	sandy GRAVEL: pale brown; ~80% gravel, subrounded, ~4 to 70 mm; sand, fine-grained; dry.
15, 20, 25, 30			SM	gravelly silty SAND: light brownish-gray; ~80% sand, very fine- to fine-grained; ~20% gravel, subrounded, ~4 to 50 mm; ~20% fines, non-plastic; dry. Boulder at 22 to 23 feet.
			SP	See page 2 for description.

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL MW-31

WELL DIAGRAM



DEPTH feet	SAMPLES	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
40–45	■ (approx. 43 ft)		SP	gravelly SAND: brown; ~75% sand, fine- to coarse-grained; gravel, subrounded to subangular, ~4 to 30 mm; moist. Cobble fragments at 43 to 44 feet.
45–55			SM	gravelly silty SAND: brown; ~70% sand, very fine- to coarse-grained; ~15% gravel, subrounded to subangular; fines, non-plastic; wet.
55–65			SP	gravelly SAND: brown; ~80-70% sand, fine- to coarse-grained; gravel, subrounded, ~4 to 10 mm; wet.
65				Total depth of borehole is 65 feet.

Depth scale: 40, 45, 50, 55, 60, 65, 70, 75

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-31

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 168.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 495.1 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,835.29	**EASTING (CCS NAD 27 Z 5):** 7,615,819.13	**DATE AND TIME STARTED:** 03/23/2004	**DATE AND TIME COMPLETED:** 03/26/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.		**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–3				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 7.5YR6/3, vf subang to ang sand, some m-c sand, rnd gravel clasts, quartzite, limestone, gneiss, dry.	
3–5	X	CC16	2	SW		
5–10	X	CC17	7	SW		9:50, let sample barrel cool
10–15				SW		
15–18	X	CC18	3	SM	**SILTY SAND (SM)** - 7.5YR7/2, c sand, f pebbles, subrnd to rnd gravel, quartzite, chert.	10:25, let sample barrel cool
18–23	X	CC19	10	SC	**CLAYEY SAND WITH GRAVEL (SC)** - 7.5YR4/1-3/1, dry. - gravelly zone	
23–24				SM	**SILTY SAND (SM)**	
24–28				SC	**CLAYEY SAND (SC)** - 7.5YR4/1-3/1, clayey, moist. - clasts more ang - gravelly, increasing clay, moist - gravel gneiss and foliated mm rocks	
28–30	X	CC20	10	SM	**SILTY SAND WITH GRAVEL (SM)** - some weakly cemented zones, dry.	
30–33.5				SC	**CLAYEY SAND (SC)** - 7.5YR6/2, gneiss cobbles, grades finer, moist.	
33.5–35				CL	**LEAN CLAY (CL)** - 7.5YR5/2, weakly cemented, green mm clasts, moist.	

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-31

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 168.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 495.1 ft. MSL; **NORTHING (CCS NAD 27 Z 5):** 2,102,835.29	**EASTING (CCS NAD 27 Z 5):** 7,615,819.13	**DATE AND TIME STARTED:** 03/23/2004	**DATE AND TIME COMPLETED:** 03/26/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.		**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				CL	**LEAN CLAY (CL)** - 7.5YR5/2, weakly cemented, moist.	
				SM	**SILTY SAND (SM)** - 7.5YR6/2 to 7/2, dry.	
40		CC21	10	SC	**CLAYEY SAND (SC)** - 7.5YR4/2, clayey sand, grades to silty, weakly cemented, dry. - f-c pebbles are ang to subang, clast of greenish mm with qtz weathering out in relief, f qtz pebbles, c gneiss sand	clayey zones >25' suggest debris flow EOD
45						
50		CC22	10	SC	**CLAYEY SAND WITH GRAVEL (SC)** - 7.5YR5/3-4/3, gravelly, moist. - caliche cemented zone	USGS pour water at 49', and 53'
55						
60		CC23	5	SM	**SILTY SAND WITH GRAVEL (SM)** - 7.5YR5/2, 25% gravel, interbedded silt, ang qtz, weathered mm rocks, grades coarser at depth, slightly moist. - thin silt layers	
65		CC24	11	SC	**CLAYEY SAND WITH GRAVEL (SC)** - 7.5YR4/2, 15% gravel, f-m pebbles, ang to subang clasts, gneiss and green mm, wet. - 30% gravel	water in sonic string after advance 63-74, examine sluff in pipe above 63'bgs
70				SM	**SILTY SAND WITH GRAVEL (SM)** - 7.5YR5/1, 15% gravel, moist.	

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-31

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 168.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 495.1 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,835.29	EASTING (CCS NAD 27 Z 5): 7,615,819.13	DATE AND TIME STARTED: 03/23/2004	DATE AND TIME COMPLETED: 03/26/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.			LOGGED BY: J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**SILTY SAND WITH GRAVEL (SM)** - 7.5YR5/1, 15% gravel, moist.	
75					**CLAYEY SAND WITH GRAVEL (SC)** - 7.5YR4/3, c sand, f pebbles, 25% gravel, weakly cemented, wet.	well graded sand and f gravel brought up when casing advanced 38-73'
80		CC25	14	SC		USGS samples at 63'/sluff, 64', 67.5', 73', 79, 87'
85					- 50% gravel, gravelly silt, moist, 7.5YR4/4.	
				SM	**SILTY SAND WITH GRAVEL (SM)** - 10% gravel, 2-3 cobbles, moist.	
90					**SILTY GRAVEL WITH SAND (GM)** - 7.5YR4/3, well graded sand, f-m pebbles, wet.	
		CC26	10			
95				GM	- 30% gravel, silt drapes, sand, clasts are qtz, black-gray and greenish mm, wk cement in sandy/gravelly zones.	
100						
		CC27	10			USGS samples at 103', 107'
105						

CH2MHILL

SHEET 4 of 6	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-31

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 168.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 495.1 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,835.29	EASTING (CCS NAD 27 Z 5): 7,615,819.13	DATE AND TIME STARTED: 03/23/2004	DATE AND TIME COMPLETED: 03/26/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.			LOGGED BY: J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				GM	**SILTY GRAVEL WITH SAND (GM)** - 7.5YR4/3, well graded sand, f-m pebbles, wet.	
110 115		CC28	10	SM	**SILTY SAND (SM)** - 5YR4/3, sand, f-m pebbles, some silt, mm or qtz clasts, moist. - subround pebble clasts	10' of sluff in barrel above 108-118 sample USGS sample at 117'?
		CC29	15	SC	**CLAYEY SAND (SC)** - moist to wet.	
120 125				SM	**SILTY SAND WITH GRAVEL (SM)** - silty sand and gravel, wet. - coarsens with depth - sand fining, silt, and caliche cementing - more silt, sand rnd	wet water sample collected from 125-128 core
130				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - sandy gravel with silt, loose. - coarsens with depth	
		CC30	5	GM	**SILTY GRAVEL WITH SAND (GM)** - silty sand and gravel, moist.	
135				CL	**SANDY LEAN CLAY WITH GRAVEL (CL)** - top of red fanglomerate dense clay, 5YR4/3, 20% gravel, clayey or silty vf sand, f laminations.	driller reports void at 113-116(casing dropped when advancing for 133' core run)
140				GM	**SILTY GRAVEL WITH SAND (GM)** - 5YR4/4, 50% sand and gravel, clay.	fravel in shoe

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-31

SOIL BORING LOG

PROJECT NAME:		HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock IM Investigation (Phase 1 2004)		168.0	WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 495.1 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,835.29	**EASTING (CCS NAD 27 Z 5):** 7,615,819.13	**DATE AND TIME STARTED:** 03/23/2004	**DATE AND TIME COMPLETED:** 03/26/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.			**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY GRAVEL WITH SAND (GM) - 5YR4/4, 50% sand and gravel, clay.	
					- 3 cobbles, mm, qtz, gneiss, foliated schist, ang to subang	
145						
		CC31	10		- very gravelly	8:20 run core 158-168' log 148-158 from sluff
					- grades finer	
150				GM		
						core barrel advanced 148-158 push (no resistance)
					- more gravel	
155						
					- 5YR4/4, clayey, silty, well graded sand and gravel	sonic core past 158'
160				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 50% f-c sand.	
					SILTY SAND WITH GRAVEL (SM) - silty sand with gravel, few cobbles.	
		CC32	10	SM		
165						
				GM	**SILTY GRAVEL WITH SAND (GM)** - 5YR4/3, 25% gravel and well graded sand, dense.	
					Boring Terminated at 168 ft	

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-31

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock IM Investigation (Phase 1 2004)	168.0	WDC Exploration and Wells, Montclair, CA	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE AND TIME STARTED:	DATE AND TIME COMPLETED:
495.1 ft. MSL	2,102,835.29	7,615,819.13	03/23/2004	03/26/2004

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic	---	Standard Access Rig with continuous 4 core, 6 casing

LOCATION:	LOGGED BY:
MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.	J. Piper

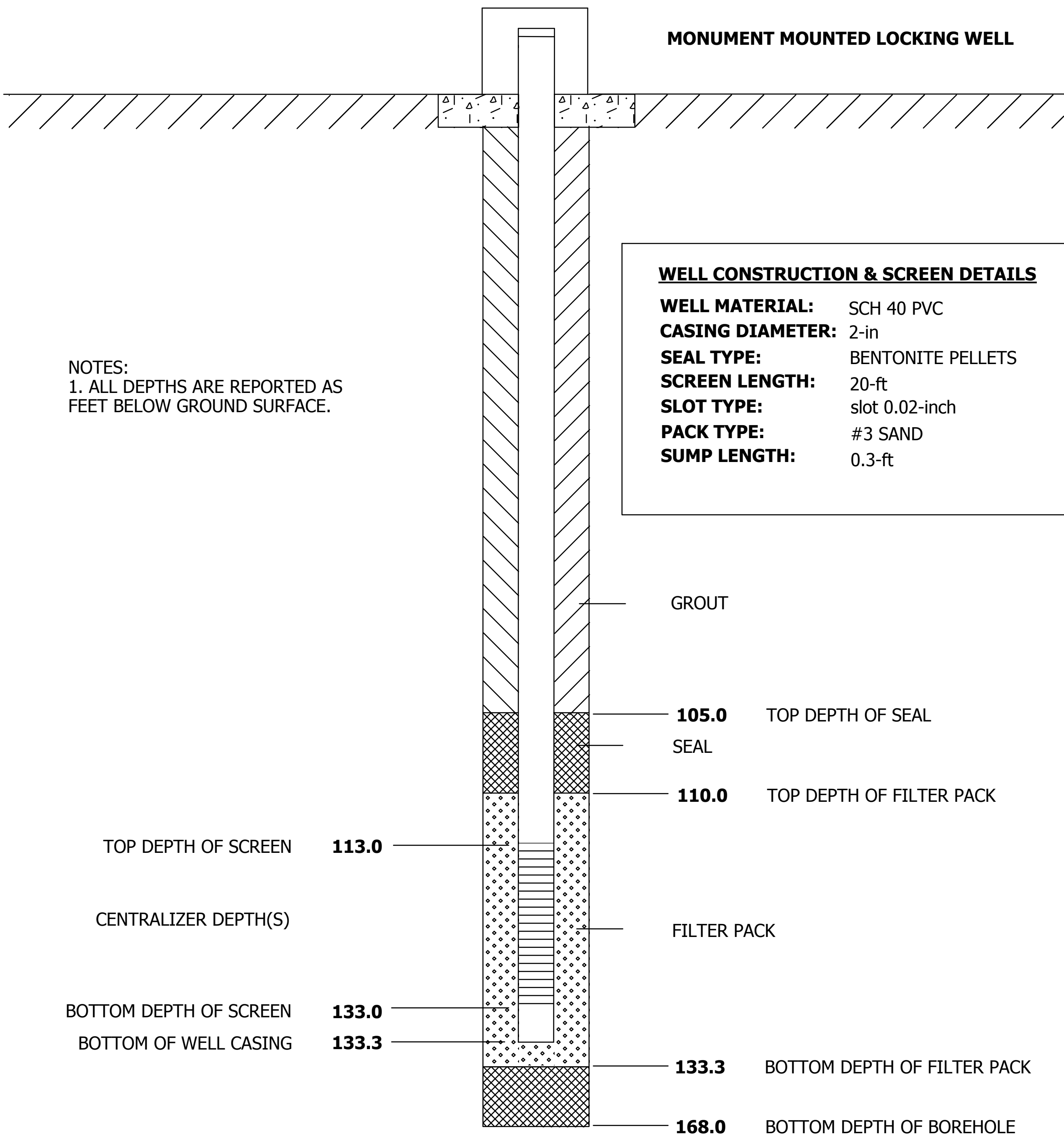
DEPTH BGS (feet)	SAMPLE			USCS CODE	SOIL DESCRIPTION	COMMENTS
	INTERVAL	TYPE/ NUMBER	RECOVERY (ft)		SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
					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

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-31-135**

LOCATION: MW20 Bench Topock, CA. - Along east side of old Route 66 just north of extraction well structures.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 03/23/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 03/26/2004
LOGGER: J. Piper	**WELL COMPLETION DATE:** 03/26/2004
TOP OF WELL CASING (NGVD 29): 498.11	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102835.29
GROUND SURFACE ELEVATION (NGVD 29): 495.10	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7615819.13



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

ecology and environment, inc.

LITHOLOGIC LOG

Well Number MW-32-20

Elevation of concrete pad 458.70 (in feet)

Completion date 3/10/03

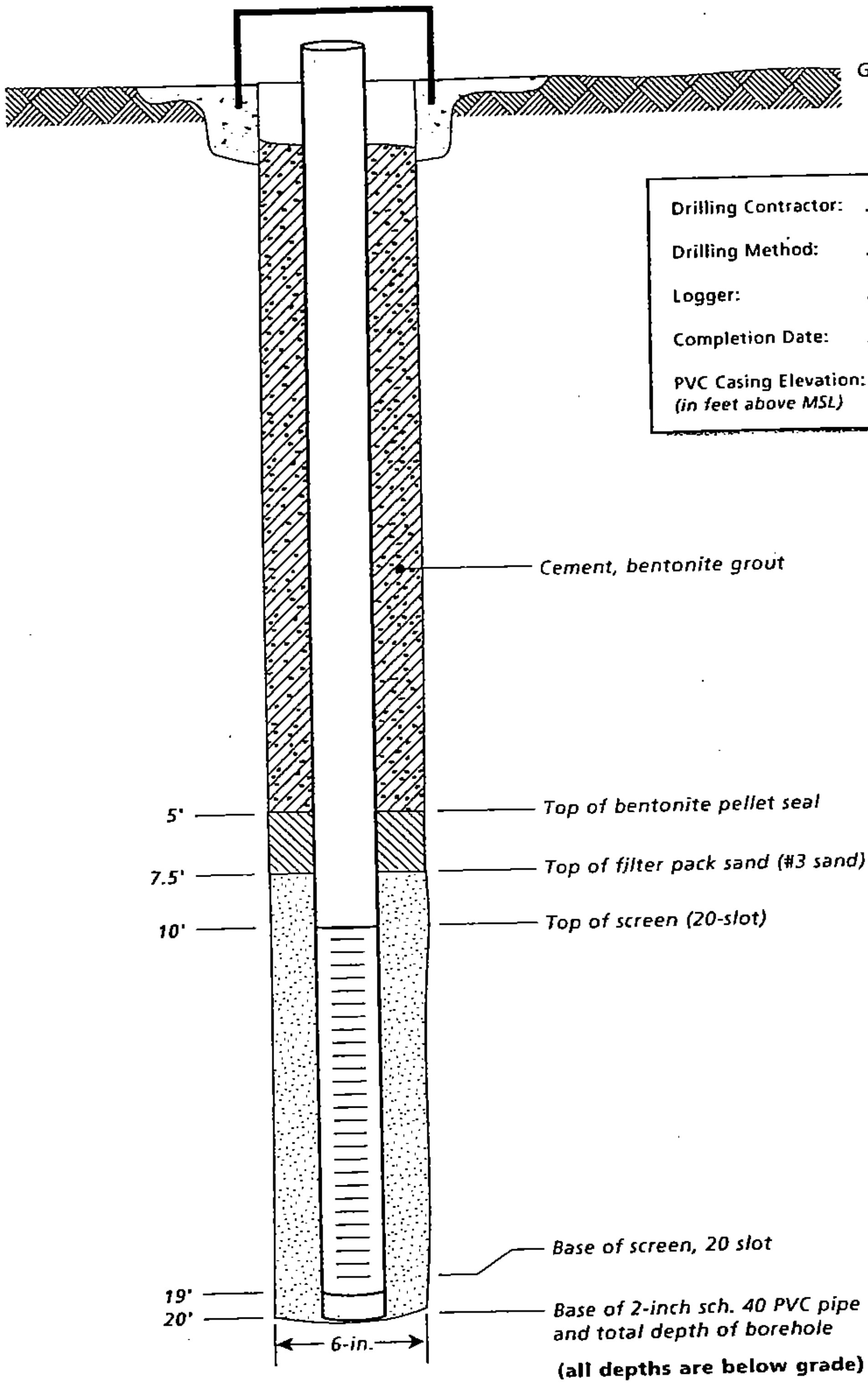
Location 2,102,045 (northing); 7,616,305 (easting)

Drilling contractor / method Boart Longyear / Sonic

Logger R. Lambert

Borehole diameter 6 in., 2-in. PVC

COMPLETION DIAGRAM	DEPTH BELOW SURFACE (in feet)	SAMPLE INTERVAL	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
					Spud 14:06
			Sand, light brown, loose, fine-grained, moist.	SP	
	10		Sand, greenish gray, fine- to medium-grained, wet, loose.		
			Silt, dark gray, non-cohesive, non-plastic, wet, soft.	ML	
			Sand, brown, medium- to coarse-grained, loose.	SP	
	20		Sand, gray, fine- to medium-grained.		**TD 20'** *14:14*
	30				
	40				
	50				
	60				
	70				
	80				



Drilling Contractor:	Boart Longyear
Drilling Method:	Sonic
Logger:	R.E. Lambert
Completion Date:	03/10/03
PVC Casing Elevation: (in feet above MSL)	461.05

(all depths are below grade)

NOT TO SCALE

ComplDiag_MW-32-20 (Z.68) 07/01/2003

Well Completion Diagram for MW-32-20

PG&E Topock

ecology and environment, inc.

LITHOLOGIC LOG

Well Number **MW-32-35**

Elevation of concrete pad 458.78 (in feet)

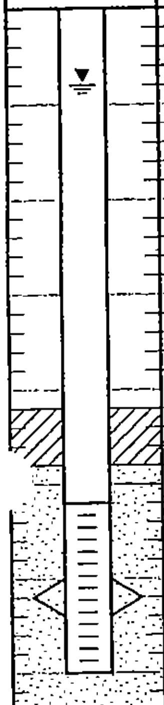
Drilling contractor / method Boart Longyear / Sonic

Completion date 3/9/03

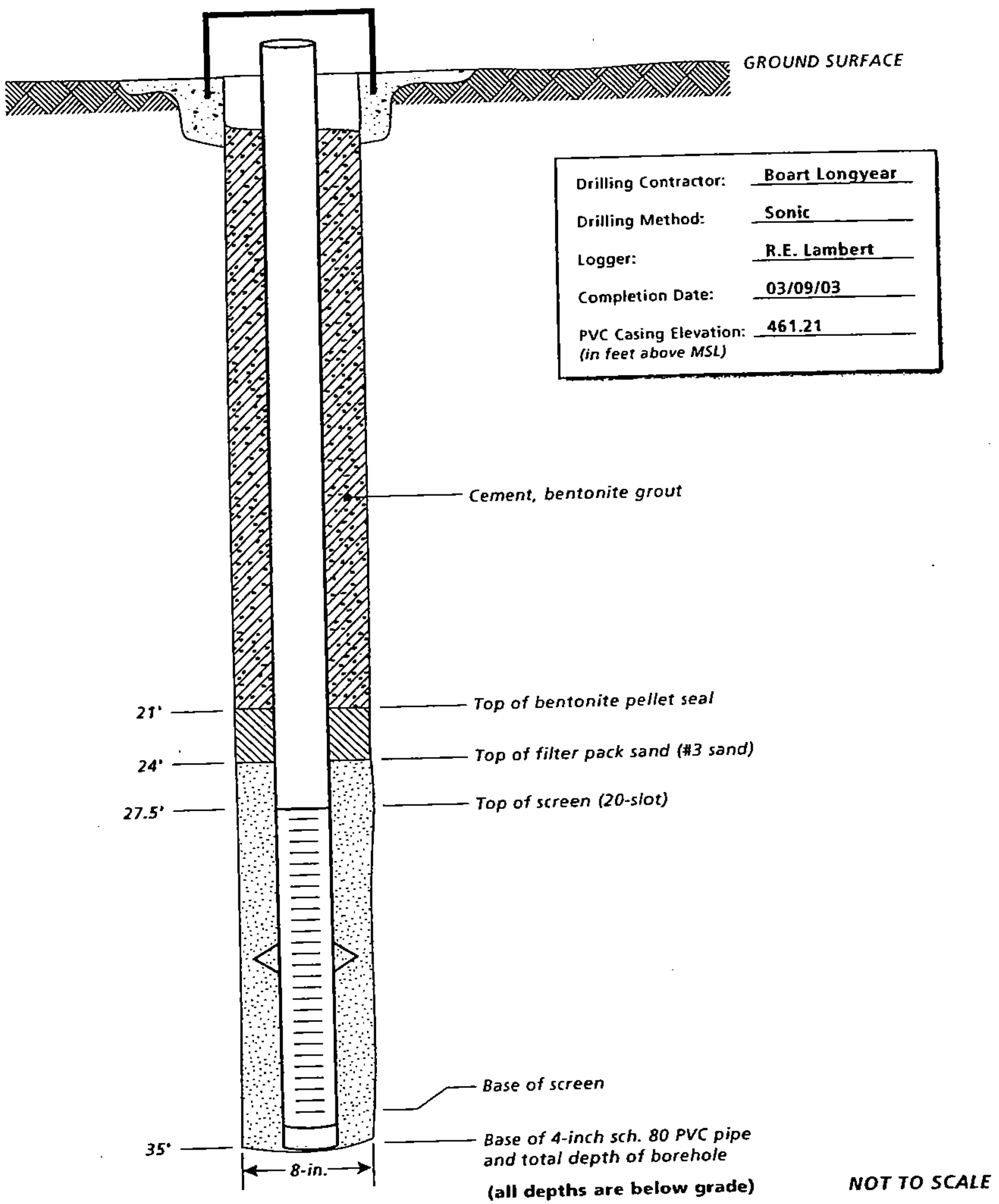
Logger R. Lambert

Location 2,102,034 (northing); 7,616,307 (easting)

Borehole diameter 8 in., 4-in. PVC



DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
			Spud 07:57
	Sand, light brown, loose, fine-grained, moist.	SP	MW-32-3
10	Sand, greenish gray, fine- to medium-grained, wet, loose.		MW-32-10: *Flowing sand*
	Silt, dark gray, non-cohesive, non-plastic, wet, soft.	ML	
	Sand, brown, medium- to coarse-grained, loose.	SP	
20	Sand, gray, fine- to medium-grained.		MW-32-20
	Clay, 18 inches thick, olive gray, medium- to high-plasticity, soft; dark gray, organic-rich at 23'.	CL	(olive gray, 5Y 4/1)
	Sand, gray, fine- to medium-grained.	SP	*12:42*
30	Sand, light brown, coarse-grained.		MW-32-30
	Red fanglomerate, reddish brown; cemented, silty gravel with sand; tight, hard.	RF	MW-32-35 *Archive sample of red fanglomerate* **TD 37'**
40			
50			
60			
70			



Well Completion Diagram for MW-32-35
PG&E Topock

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Bat Cave Wash Project
LITHOLOGIC LOG

Well Number **MW-33-40**

Elevation of concrete pad 484.48 (in feet)

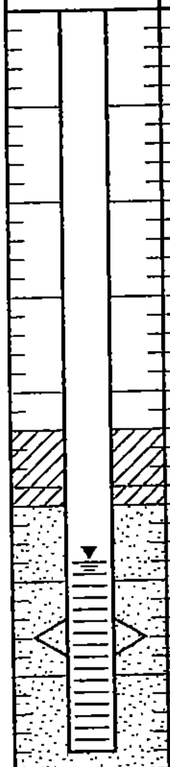
Completion date 3/8/03

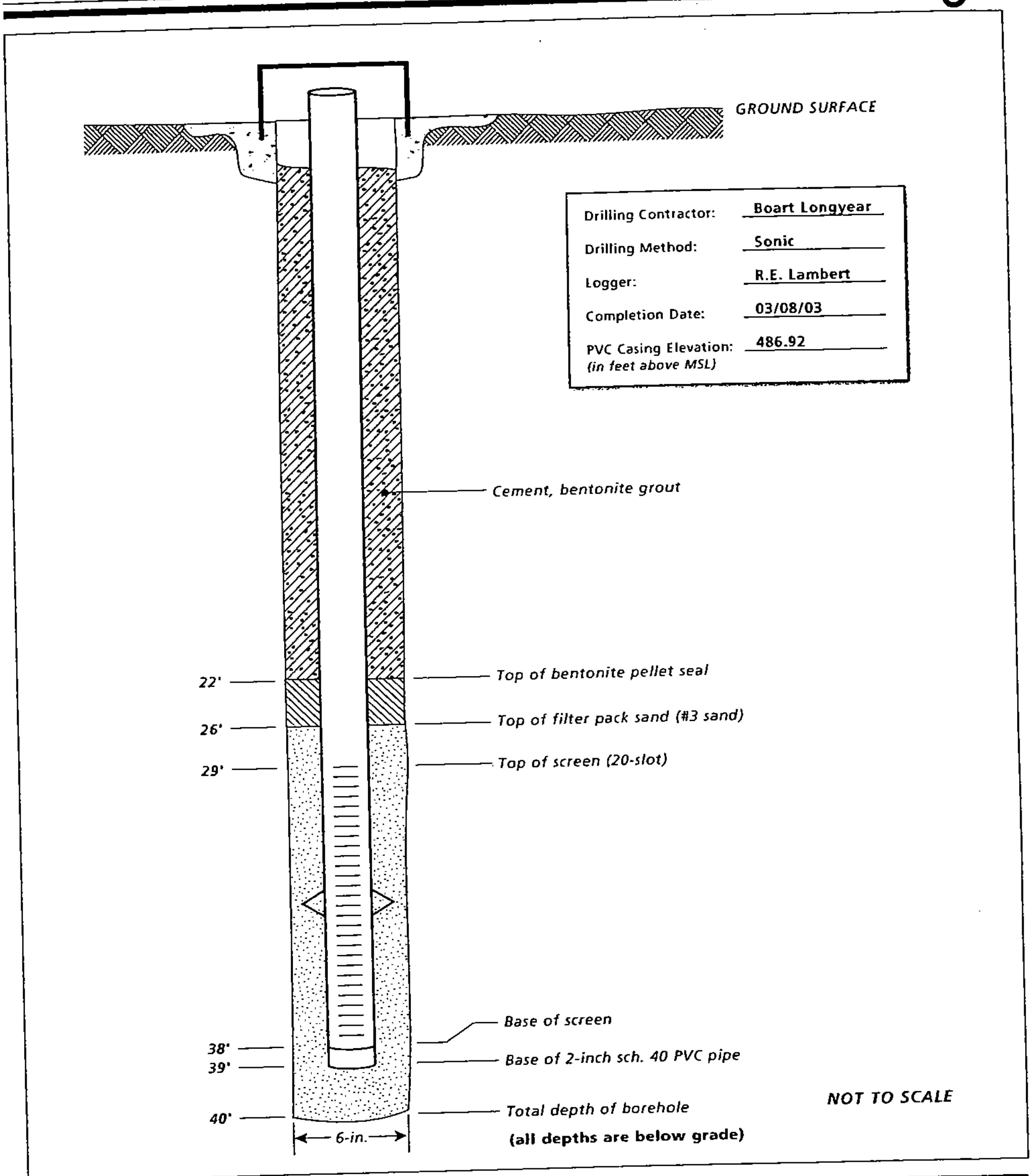
Location 2,103,281 (northing); 7,615,916 (easting)

Drilling contractor / method Boart Longyear, Sonic

Logger R. Lambert

Borehole diameter 6 in., 2-in. PVC

COMPLETION DIAGRAM	DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
		Sand, light brown, loose, fine- to medium-grained, dry (dredged sands).	SP	Spud 14:37 (7 feet away from MW-33/90)
	10	Sand, tan, fine-grained, loose.		
		Sand, tan, fine-grained, loose.		Must add water while drilling due to flowing sands.
	20	Sand, light brown, fine- to medium-grained.		
	30	Sand, dark yellowish brown, medium-grained (10YR 4/2), loose.		Wet.
		Silty sand lens.	SM	
		Sand, medium yellowish brown.	SP	
		Clayey silt with cobbles (<4-inch. diameter).	ML	(10YR 5/4)
	40	Clayey silt with gravel (rounded), medium yellowish brown.	CL	**TD 40'**
	50			
	60			
	70			
	80			



ComplDiag_MW-33-40 (Z.68) 07/01/2003

Well Completion Diagram for MW-33-40

PG&E Topock

ecology and environment, inc.

Bat Cave Wash Project
LITHOLOGIC LOG

Well Number **MW-33-90**

Elevation of concrete pad 484.64 (in feet)
Completion date 3/7/03
Location 2,103,287 (northing); 7,615,915 (easting)

Drilling contractor / method Boart Longyear, Sonic
Logger R. Lambert
Borehole diameter 8 in., 4-inch PVC, Sch. 80

DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
	Sand, light brown, loose, fine- to medium-grained, dry (dredged sands).	SP	*Spud 13:25* MW-33-03 *(Dredged sands)*
10	Sand, tan, fine-grained, loose.		MW-33-10
	Sand, tan, fine-grained, loose.		*13:28*
20	Sand, light brown, fine- to medium-grained.		MW-33-20 *(Adding water while drilling)*
			14:00
30	Sand, dark yellowish brown, medium-grained (10YR 4/2), loose.		
	Silty sand lens.	SM	*14:30*
	Sand, medium yellowish brown.	SP	*(Down for mechanical problems)*
	Clayey silt with cobbles (<4-inch. diameter). Clayey silt with gravel (rounded), medium yellowish brown.	ML/CL	MW-33-40 *(Archive sample)*
40	Silty clay with pebbles (<1/3" dia.), moderate yellow brown (10YR 4/2), moderately plastic, cohesive. Silty sand with gravel. Gravelly sand with some silt, moderate brown, coarse-grained, rounded gravel to 2-inch diameter.	SM/SW	*7:50*
	Silt grading downward to medium subrounded sand, moderate brown, to gravelly, coarse-grained sand.	ML SP	(5YR 4/4)
50	Gravelly, sandy silt, coarse-grained sand, dark, yellowish brown, very stiff.	ML/SM	(10YR 4/2) *8:18 (Down for more pipe, 25 min.)*
	Less silt. Gravelly, coarse-grained sand, dark, yellowish brown (10YR 4/2), rare cobbles.	SW	*9:08* MW-33-60
60	As above, with coarse- to very coarse-grained sand, subangular gravel (<1/2-inch diameter); a few thin zones (≤ 6") of silt, approx. 10% gravel.		*(Archive sample; when washed, the sand has a salt and pepper appearance)* *9:45 (Casing is tight driving in)*
70	As above.	SW	
	Thin gravel, sand and silt, dark, yellowish brown. Gravelly sand, minor silt, medium- to very coarse-grained sand, occasionally more silt.	SM SW	*10:30*
80			*11:19* MW-33-80

ecology and environment, inc.

Bar Cave Wash Project LITHOLOGIC LOG

Well Number MW-33-90

Elevation of concrete pad 484.64 (in feet)

Completion date 3/7/03

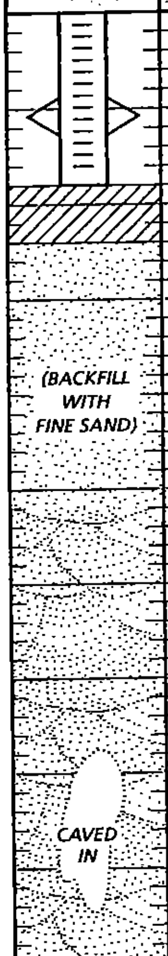
Location 2,103,287 (northing); 7,615,915 (easting)

Drilling contractor / method Boart Longyear, Sonic

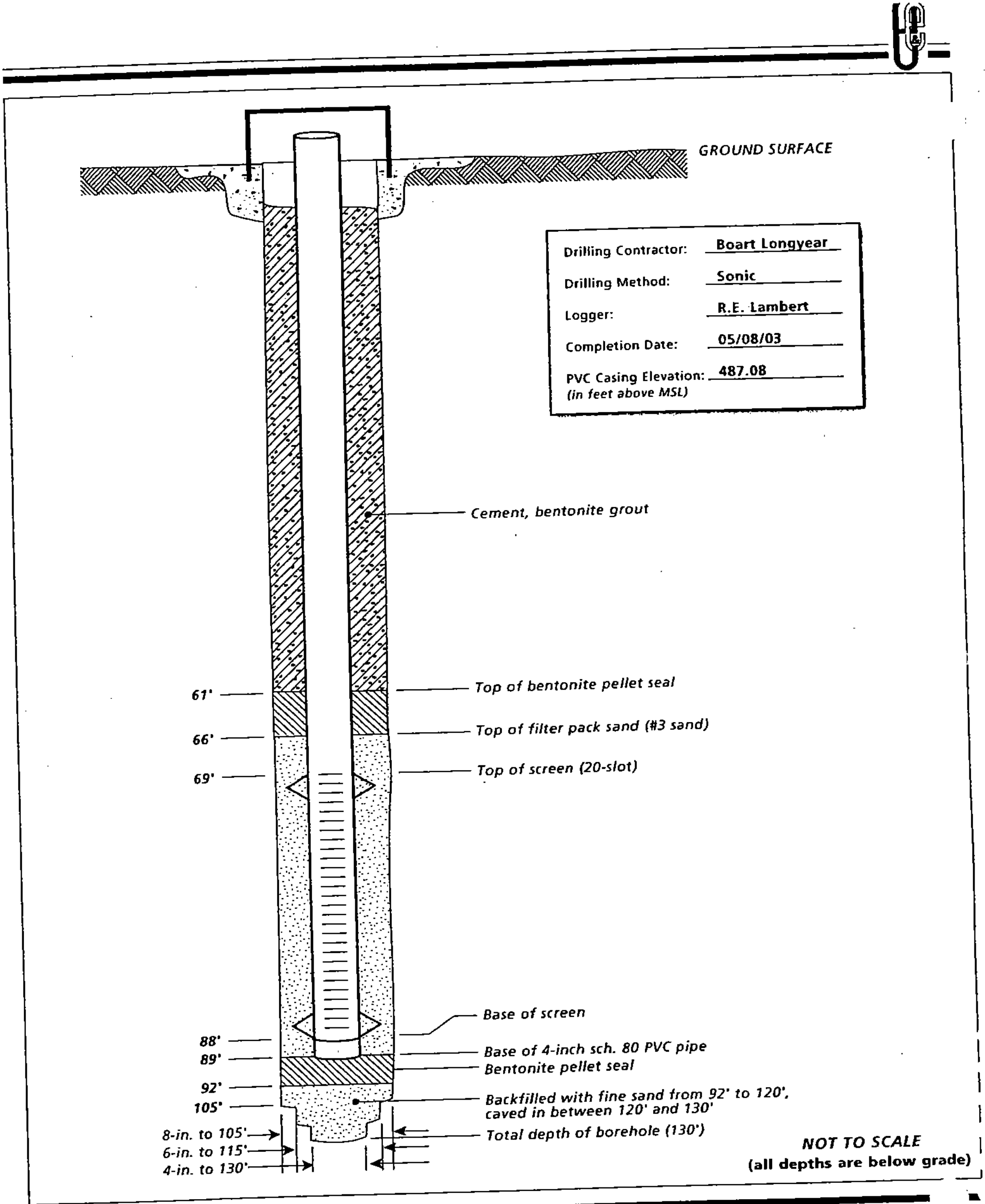
Logger R. Lambert

Borehole diameter 8 in., 4-inch PVC, to 89'

COMPLETION DIAGRAM



DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
80	Gravelly sand, medium- to very coarse-grained, dark, yellowish brown (grayer than sand above). Est. 30% angular gravel, 50% very coarse sand, 10% coarse sand, 10% finer sand.	SW	(Archive sample) (Down for alternator / lunch)
	Gravelly silt with sand, dark yellowish brown (10YR 4/2), very stiff.	ML	14:05
100	Gravelly sand, moderate brown (5YR 3/4)	SW	(Archive sample) MW-33-100
	Sandy silt with gravel, dark greenish gray (5GY 4/1), in part, hard.	ML	Very stiff at 102' 14:40 Drive 8-in. casing to 105', then 6-inch diamter core.
110	Some cobbles to 3-inch diameter, subangular, gabbro.		15:30 Very stiff.
	Silty sand with cobbles, pale yellowish brown (10YR 6/2), very stiff.	SM	16:00 Core is hot. (using 4-in. core barrel at 115')
	Sandy silt with rare gravel.	ML	(Archive sample)
120	Cemented conglomerate, silty, dry appearance, mottled colors (green, gray, brown).		MW-33-120 16:35
	Silty sand with occasional cobbles, fine- to coarse-grained. Sand with low permeability, occasional sandy lens, wet.	SM	
	Conglomerate, silty matrix, with subangular pebbles, mottled, some olive gray (5Y 3/2), tight, can crumble (Red Fanglomerate?).	GM	(Archive sample)
130			TD 130' 17:20 (Archive sample)
140			
150			
160			



ComplDiag_MW-33-90 (Z.68) 07/0?/2007

Well Completion Diagram for MW-33-90

PG&E Topock

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-33

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock, Interim Measures, Phase 2 (2005)	237.0	Prosonic Corp. Phoenix, AZ	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
484.6 ft. MSL	2,103,295.06	7,615,909.82	02/12/2005	02/15/2005

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic		Track Mounted Sonic

LOCATION:	LOGGED BY:
600 ft NE of TW-2D, Colorado River floodplain.	B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0				SP	**POORLY GRADED SAND (SP)** - brn 7.5YR5/4, 99% subrnd to subang f sand, 97% qtz, ~3% mafics, <1% fines, loose, moist	collect bag samples for archive description and potential grain-size testing. moisture from rain on 02/11/05
0–7	0–7	Box 1	5.6			
5						no bag sample collected above water
7					- as above, 98% sand, <2% fines, becomes dry	soft drilling
7–17	7–17	Box 2 Box 3	8			
10						poor recovery as loose dry sands are pushed aside by core barrel, 10ft soil sample @ 13:30
15						
17					- 90% qtz, 10% mafics, dry, some feldspar	
17–27	17–27	Box 4 Box 5	8.5			
20						soil samples at 20ft @ 13:45
25					- vf-f sand, no gravel, massive, loose, dry	
27				SP	**POORLY GRADED FINE SAND (SP)** - brn 7.5YR5/3, 99% qtz rich fine sand, 1% fines, no gravel, loose, moist	becomes moist at 27 ft
27–35	27–35	Box 6 Box 7	9			
30						30ft soil sample @14:00
35						

SHEET 2 of 8	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005 **DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED FINE SAND (SP)** - brn 7.5YR5/3, 96% qtz rich fine sand, 2% fines, 2% m subrnd gravel, loose, dry	bag sample at 35ft: MW33D-GS-35 @ 14:10
40		Box 8 Box 9	9	ML	**SILT (ML)** - brn 7.5YR4/3, 65% silty fines, 35% vf sand, non-sticky, very plastic, soft, wet - yellow mottled with roots	bag sample at 39ft: MW33D-GS-39 @ 14:10 40ft soil sample @14:10
45				ML	**CLAYEY SILT (ML)** - lt brn, 85% clayey fines, 15% vf sand, non sticky, very plastic, soft, wet	
				GW	**WELL GRADED GRAVEL WITH SAND AND CLAY (GW)** - brn, 60% gravel up to 2" long, 27% subrnd well graded sand, 13% clayey fines, subrnd igneous & metamorphic, medium density	
50		Box 10 Box 11	9	SM	**SILTY SAND (SM)** - lt brn 7.5YR5/4 with iron oxide staining, 80% vf sand, 20% silty fines, loose to medium, wet	
55				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - dk brn 7.5YR3/2, 80% subrnd lithic sand, predominantly medium coarse, 15% silty fines, 5% gravel, hard to medium density, wet, very little pore space - becomes moist below 54ft, clay rich zone 54-55ft - 17% clayey fines - 62% sand, 30% gravel, 8% fines, overall subang with 2% rounded, metamorphic	bag MW33D-GS-53 in cleaner SW collect isoflow groundwater sample between 52 & 57 ft, MW-33D-GS-54.5 @15:45
60 65		Box 12 Box 13	9	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/2, 70% subrnd lithic sand with red sand stone, 25% rnd gravel up to 2.6" long, 5% fines, gray metamorphic and brn chert, medium to hard, wet - as above, less gravel, 87% sand, 10% gravel, 3% fines - 65% sand, 20% gravel up to 1 1/2", 15% fines	60ft soil samples @16:00 bag sample at 63ft: MW33D-GS-63 @16:00
				SM	**SILTY SAND (SM)** - brn 7.5YR5/3, 77% rnd well graded lithic sand, 20% silty fines, 3% f gravel, soft, wet	
70				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn 7.5YR5/3 fine, and gray 7.5YR5/1 sand, 80% subrnd lithic sand, 10% silty fines, 7% gravels, 3% cobbles	hard drilling

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005 **DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
70–77		Box 14 Box 15	9	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR5/3 fine, and gray 7.5YR5/1 sand, 77% subrnd lithic sand, 30% gravel, 3% silty fines - sand becomes greenish gray and subang, very poorly sorted vf-vc - one 3.5 inch MM cobble - brn 7.5YR4/3, 58% sand, 40% gravel, 2% silty fines, subang, hard, wet	70ft soil sample @16:30 collect isoflow groundwater sample between 72 & 77 ft, MW-33D-GS-74.5 @16:45
77–87		Box 16 Box 17	8.5	SW	- subang to subrnd - one metamorphic subang cobble at 78ft, and one at 83ft - moist, not wet	partial cementation? 80ft soil sample @ 7:55 on 2/13/05
84–88				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 7.5YR4/4, 80% well packed sand, 15% fines, 5% gravel, subang to well sorted, hard, moist, color due to fines - some clay in fines from 86-87ft	igneous and metamorphic: source for greenish gray sand
88–90		Box 18 Box 19	0	SC	**CLAYEY SAND (SC)** - greenish gray sand/ brn fines/ brn overall, 80% subrnd sand, 20% clayey fines, hard, well sorted and well packed, moist	collect bag sample MW33D-88.5 @8:45
90–94				SM	**SILTY SAND WITH GRAVEL (SM)** - brn overall (greenish gray sand) as above, 73% subang sand, 20% fines, 7% f MM gravels, hard, well sorted and well packed, moist	no water for isoflow sample 92-97ft
94–104		Box 20 Box 21	9	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn, 80% sand, 10% gravel, 10% fines, subrnd, hard, moist to wet - clayey fines - brn overall 7.5YR5/3, greenish gray MM sand and gravel, 78% subang sand, 15% f gravel, 7% silty fines, wet - more fines, 79% sand, 12% gravel, 9% silt and clay	bag sample collected at 98ft:MW33DGS-98@ 9:10 100ft soil sample @9:10
105						

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)	**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005 **DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.		**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**SILTY SAND WITH GRAVEL (SM)** - brn overall, 75% sand, 15% silty fines, 10% gravel, subang MM sands and gravels, hard, moist	partially cemented, hard drilling reworked older alluvium?
		Box 22 Box 23	9	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn 7.5YR5/3, 85% sand, 10% gravels, 5% fines, subrnd, medium density, wet	
110				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 7.5YR5/3, subang greenish gray sand and gravel, 75% sand, 20% silty fines, 5% gravel, hard, moist	110ft soil sample @9:55
115				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 7.5YR4/2, 60% sand, 22% clay and silt, 18% gravel up to 2.7" long, subang to ang, metamorphic sands and gravels, hard, well sorted, well packed, moist (near dry)	groundwater isoflow sample 115-122 ft:MW33D-GS-113.5 @12:25
		Box 24 Box 25	8.5	SW	**WELL GRADED SAND WITH SILT (SW)** - brn overall 5YR5/3, 85% sand, 10% fines, 5% f gravel, subrnd MM sands and gravels, medium to hard, wet	
120				SM	**SILTY SAND (SM)** - brn 5YR5/3, 75% well packed sand, 20% silty fines, 5% f gravel, subang, hard, well graded, well packed, moist	partially cemented, hard drilling
				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn, 60% subang well graded sand, 30% clayey fines, 10% gravel, hard, moist	
125				SM	**SILTY SAND WITH GRAVEL (SM)** - brn, 70% sand, 18% silty fines,12% gravel and cobbles, subang, hard, moist	
		Box 26 Box 27	9	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn 5YR4/3, 80% sand, 13% f gravel, 7% silty fines, subrnd metamorphic sand and gravel, medium density, wet	
130 135 140				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 5YR5/3, 80% sand, ~60% qtz, ~30% mafics, 15% f gravel, ~10% feldspar, 5% fines, subrnd metamorphic sand and fine gravel, medium to hard, wet - larger gravel up to 1 inch below 135ft, 75% sand, 20% gravel, 5% silty fines - well graded sand as above, 75% sand, 18% f subang gravel up to 1 inch long, 7% silty fines	bag sample @130ft: MW33D-GS-130 @14:45 collect groundwater isoflow sample between 132-137ft: MW33D-134.5 @ 15:35

SHEET 5 of 8	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005	**DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		Box 28 Box 29	9	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 5YR5/3, 80% sand, ~60% qtz, ~30% mafics, 15% f gravel, ~10% feldspar, 5% fines, subang to ang sharp metamorphic sand and fine gravel, medium to hard, wet - 73% sand, 25% gravel up to 2.5 inch, 2%fines	collect 140ft soil sample @15:55
145						
					- as above with smaller gravels up to 1.5 inch long, becomes reddish brn 2.5YR5/3	
150						collect 150ft soil sample @16:30
		Box 30 Box 31	9	SM	**SILTY SAND WITH GRAVEL (SM)** - reddish brn 2.5YR5/3, 72% sand, 18% silty fines, 10% f gravel, subang metamorphic gravel and sand, hard, wet	hard, cemented, possibly reworked fanglomerate collect groundwater 152-157: MW33D-154.5 @17:15 collect bag sample at 155ft: MW33D-GS-155 @16:30
155						
				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - reddish brn 2.5YR5/3, 70% sand, 18% gravel, 12% fines, subang metamorphic sand and gravel, medium density, wet	
160						collect bag sample at 160 ft: MW33D-GS-160 @07:30
		Box 32 Box 33	9		- less gravel below 161.5ft, 78% sand, 12% fines, 10% gravel,	
165						
					- 72% sand, 15% gravel, 13% red fines, subang metamorphic sand and gravel, medium to hard	
170						collect 170ft soil sample @8:10, reworked fanglomerate ?
		Box 34 Box 35	9.5		- fractured metamorphic cobbles at 171.5ft - 70% sand, 20% gravel, 10% silty fines	
175				SM	**SILTY SAND (SM)** - reddish brn, 72% sand, 18% silty fines, 10%	collect groundwater isoflow sample

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)	**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005 / **DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.		**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					gravel, subang, hard	between 172-177ft: MW33D-174.5 @ 09:00
				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - 75% sand, 15% gravel, 10% fines	
				GM	**SILTY GRAVEL WITH SAND (GM)** - reddish brn, subang to ang, moist	
				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - 77% sand, 15% gravel, 8% fines	
				SM	**SILTY SAND WITH GRAVEL (SM)** - 60% sand, 20% fines, 20% gravel and cobbles	
180		Box 36 Box 37	9.5	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - reddish brn 2.5YR5/3, 72% sand, 20% gravel, 8% silty fines, subang metamorphic sand and gravel up to 2" long, medium density, wet	collect 180ft soil sample at 9:50 reworked fanglomerate ?
185				SC	**CLAYEY SAND WITH GRAVEL (SC)** - reddish brn, 60% sand, 20% gravel, 20% clay and silt, subang, hard	
190		Box 38 Box 39	9.5	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - reddish brn 2.5YR5/3, subang metamorphic sand and gravel, loose to medium, wet - 70% sand, 20% gravel, 10% fines - cobbles - more gravel below 194.5 ft, 65% sand, 25% gravel, 10% fines - as above with more silt and less gravel, 72% sand, 15% gravel, 13% fines	collect 190ft soil samples @10:50, easier drilling bag sample collected in gravel rich zone at 196ft: MW33D-GS-196 @10:50
195						
200		Box 40 Box 41	9.5	SM	**SILTY SAND WITH GRAVEL (SM)** - 65% sand, 20% silty fines, 15% gravel	
				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - reddish brn 2.5YR5/3, 68% sand, 20% gravel, 12% silty fines, subang metamorphic sand and gravel up to 1.5" long, loose to medium, wet	collect 200ft soil sample @12:00 reworked fanglomerate
205				SM	**SILTY SAND WITH GRAVEL (SM)** - reddish brn, 65% sand, 20% fines, 15% gravel, subang, hard, moist	
					WELL GRADED SAND WITH SILT AND GRAVEL (SW) - reddish brn 2.5YR5/3, 73% sand, 15% gravel, 12% silty fines, subang metamorphic sand and gravel up to 1.2" long, medium density, wet	
210						

SHEET 7 of 8	PROJECT NUMBER: 326228.IM	BORING NUMBER: MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005	**DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		Box 42 Box 43	9.5	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - reddish brn 2.5YR5/3, 73% sand, 15% gravel, 12% silty fines, subang metamorphic sand and gravel up to 1.2" long, medium density, wet	collect 210ft sample @12:20 collect isoflow water sample
215					**CONGLOMERATE (BR)** - reddish brn 2.5YR5/3, 60% sand, 22% silty fines, 18% gravel, subang metamorphic, hard, moist, partially cemented	Top Miocene Conglomerate 213 ft bgs harder drilling, weathered fanglomerate, not wet below 213.5ft (moist)
220		Box 44 Box 45	9.5		- as above, cobbles at 218.5 ft, 58% sand, 22% gravel and cobbles, 20% fines	
					- more clay and stronger cementation observed below 222 ft, 55% sand, 25% silt and clay, 20% gravel	less weathering in fanglomerate
225				BR		
					- as above	relatively intact red fanglomerate
230		Box 46 Box 47	9.5		- as above	
					- sandy (SM) zone at 232 ft	
235						

Boring Terminated at 237 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained

CH2MHILL

SHEET 8 of 8	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-33

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 237.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 484.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,295.06	**EASTING (CCS NAD 27 Z 5):** 7,615,909.82	**DATE STARTED:** 02/12/2005	**DATE COMPLETED:** 02/15/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble	

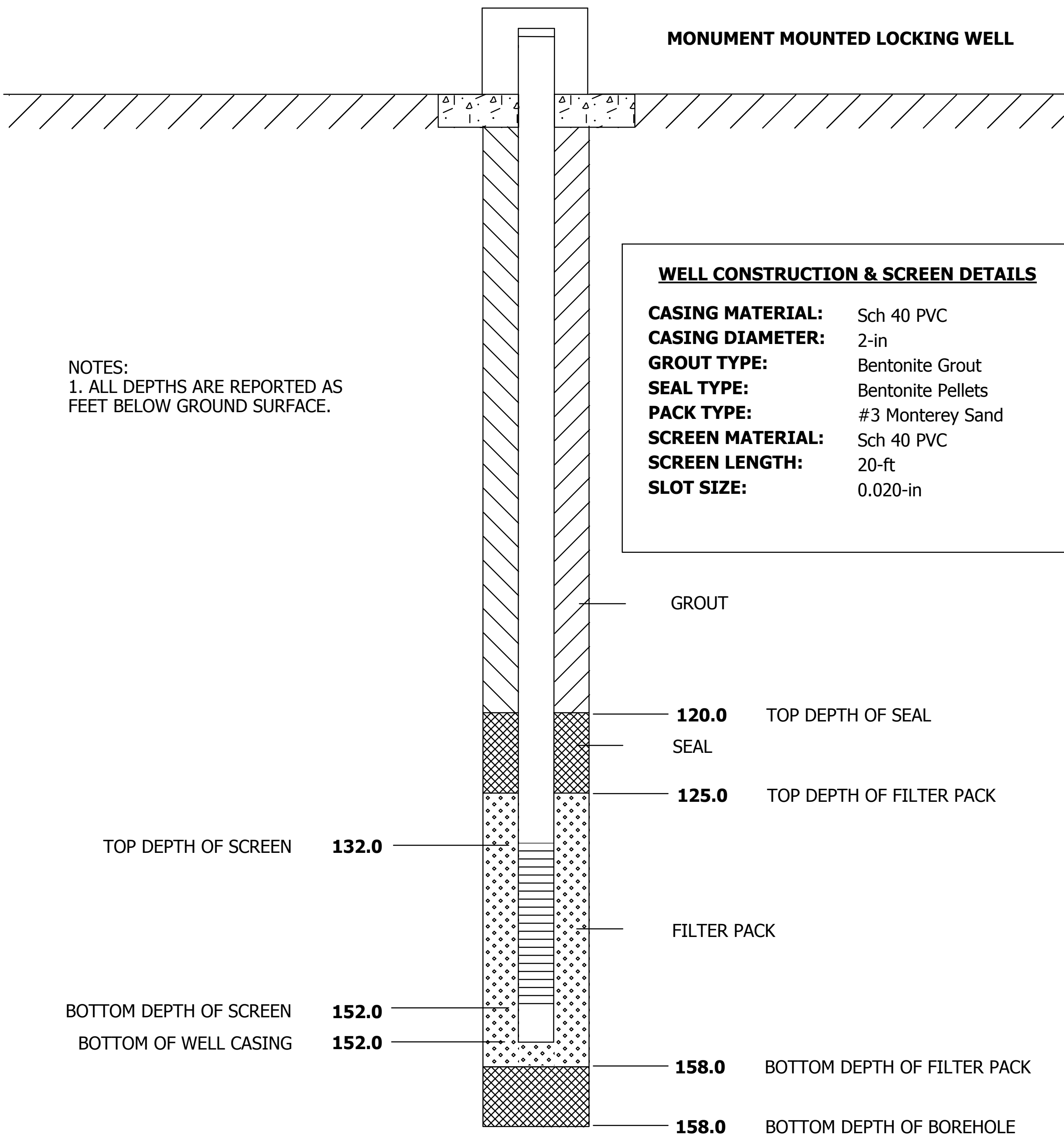
DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS SYMBOL, COLOR, PERCENT COMPOSITION, GRADING, GRAIN SHAPE, MINERALOGY, DENSITY/CONSISTENCY, STRUCTURE, MOISTURE.	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DAILY START AND END TIMES , DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
					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

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-33-150**

LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/21/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/22/2005
LOGGER: A. Erickson, T. Lae	**WELL COMPLETION DATE:** 02/24/2005
TOP OF WELL CASING (NGVD 29): 487.77	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2103302.58
GROUND SURFACE ELEVATION (NGVD 29): 485.00	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7615906.05



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

WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	20-ft
SLOT SIZE:	0.020-in

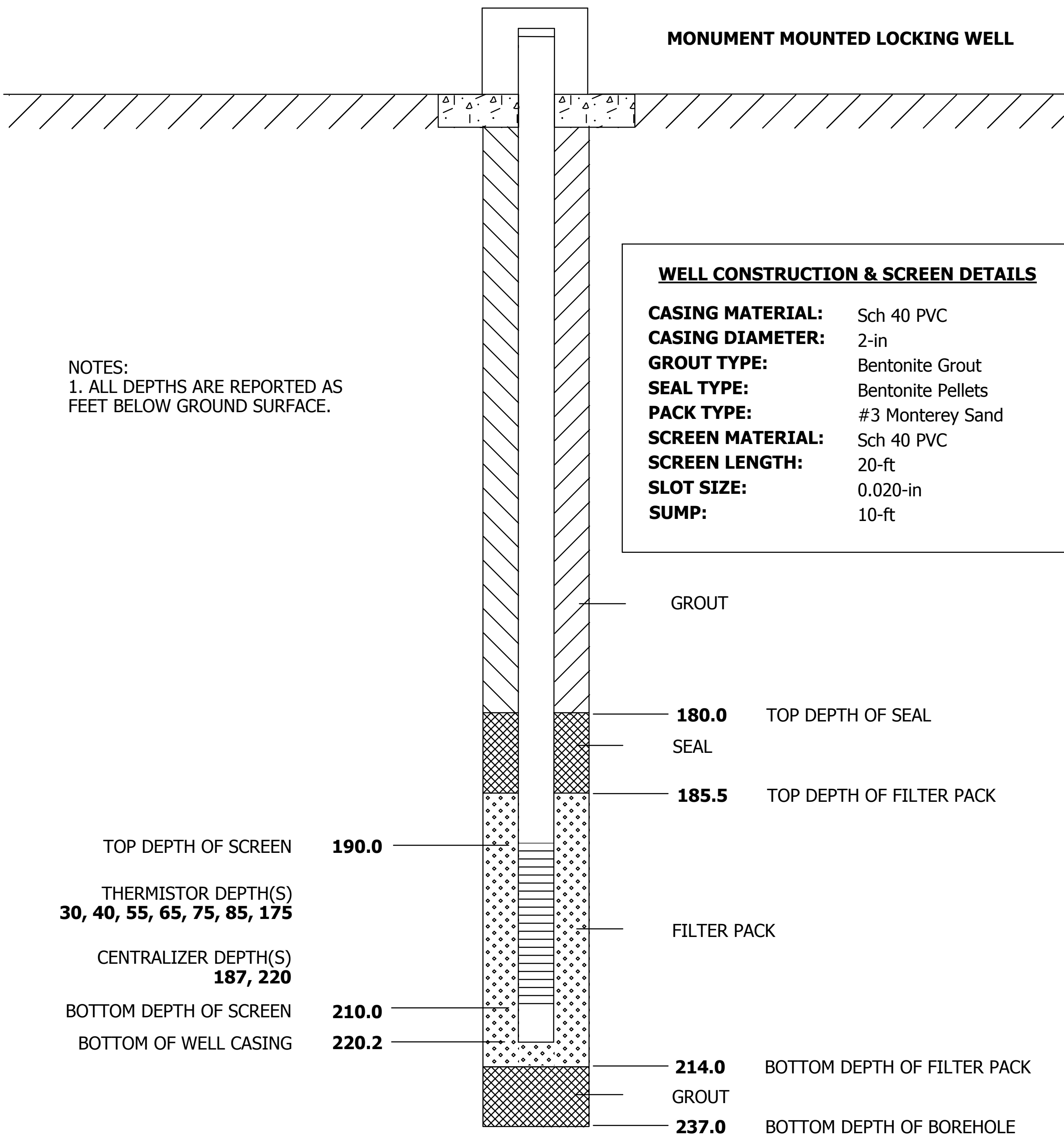
WELL DIAGRAM IS NOT TO SCALE

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-33-210**

LOCATION: 600 ft NE of TW-2D, Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/12/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/15/2005
LOGGER: B. Moayyad, B. Trebble	**WELL COMPLETION DATE:** 02/16/2005
TOP OF WELL CASING (NGVD 29): 487.25	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2103295.06
GROUND SURFACE ELEVATION (NGVD 29): 484.61	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7615909.82



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	20-ft
SLOT SIZE:	0.020-in
SUMP:	10-ft

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

THERMISTOR DEPTH(S)
30, 40, 55, 65, 75, 85, 175

CENTRALIZER DEPTH(S)
187, 220

WELL DIAGRAM IS NOT TO SCALE

ecology and environment, inc.

LITHOLOGIC LOG

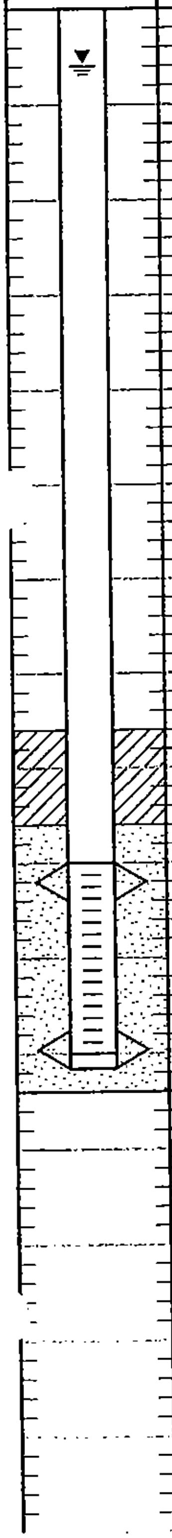
Well Number MW-34-55

Elevation of concrete pad 458.42 (in feet)
Drilling contractor / method Boart Longyear, Sonic

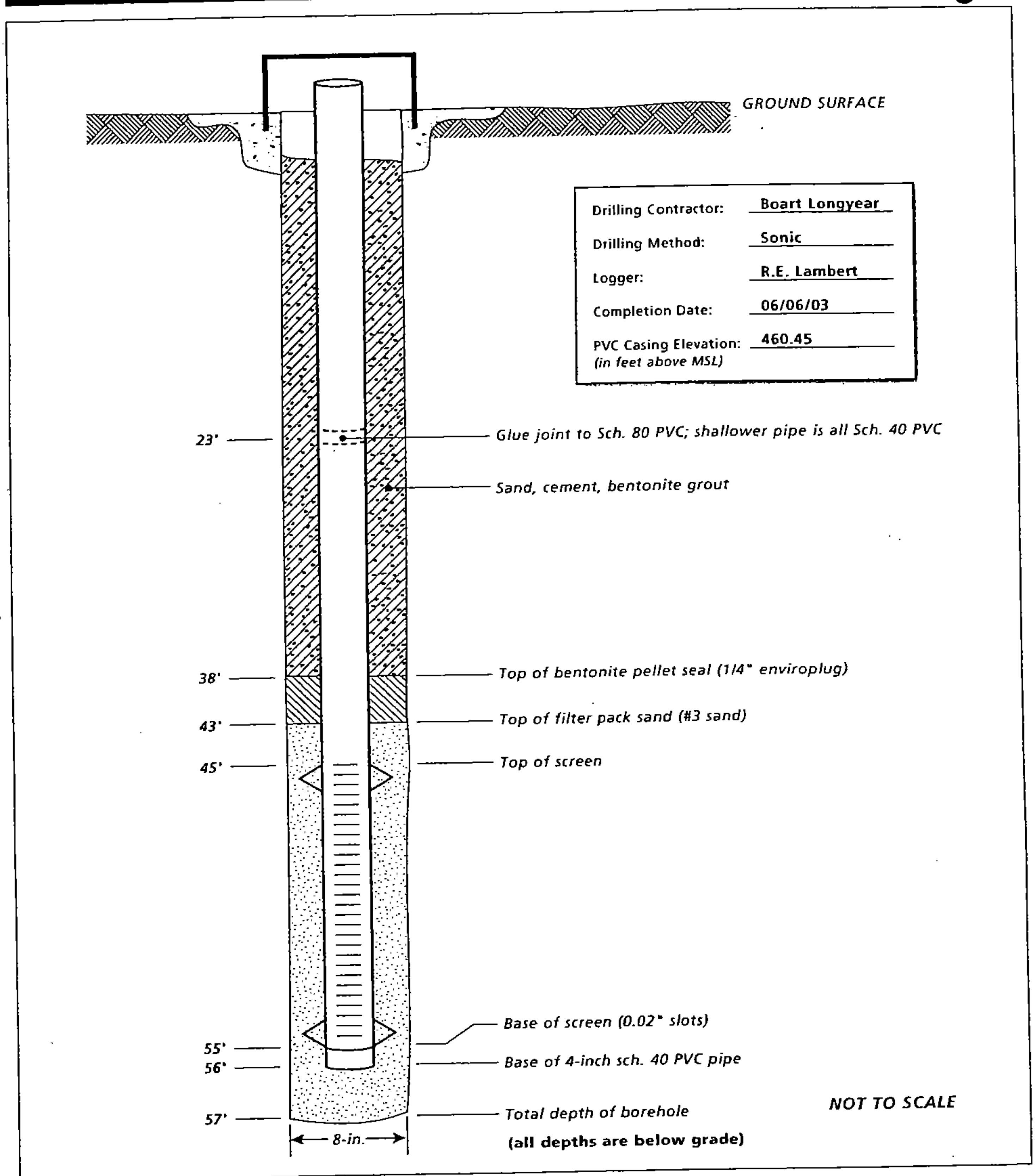
Completion date 6/6/03
Logger R. Lambert

Location 2,102,542 (northing); 7,616,444 (easting)
Borehole diameter 8 in., 4-inch PVC

COMPLETION DIAGRAM



DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
0	Sand, moderate brown, loose, fine-grained, loose, moist just below surface, twigs.	SP	*Spud 10:28 (Well located 7' NW of MW-34-80)*
	Silt to fine sand, dusky yellowish brown, organic rich, wet. ***Note: All reported colors are from wet samples.***	SP/ML	*(Adding water to keep flowing sands out of casing.)* (10YR 2/2)
	Sand, dark yellowish brown, medium- to coarse-grained.	SP	(10YR 4/2)
10			
	Sand, dusky yellowish brown, fine-grained, (10YR 2/2).	SP	
	Sand, moderate yellowish brown, medium- to coarse-grained (10YR 5/4)	SP	
20	Sand, tan, fine-grained.		*10:45 (Need to get more water and lunch)*
30	Sand, dark yellowish brown, medium- to coarse-grained, loose.		(10YR 4/2)
40	Gravelly, medium-grained sand with cobbles, 1/2- to 2-in. diameter, subrounded to rounded.	SW	
	Silty clay, dark yellowish brown, 1 foot thick, soft.	CL / ML	
	Coarse-grained sand to gravelly sand, <10% gravel, < 1-inch diameter, subangular to rounded.	SP/SW	*12:45*
50	Sand grades coarser, cobbles to 2.5 inches; sand is medium- to very coarse-grained.		
			TD 57' *(See adjacent MW-34-80 for grain size samples.)*
60			
70			
80			



ComplDiag_MW-34-55 (Z.68) 07/01/2003

Well Completion Diagram for MW-34-55
PG&E Topock

ecology and environment, inc.

LITHOLOGIC LOG

Well Number MW-34-80

Elevation of concrete pad 458.65 (in feet)

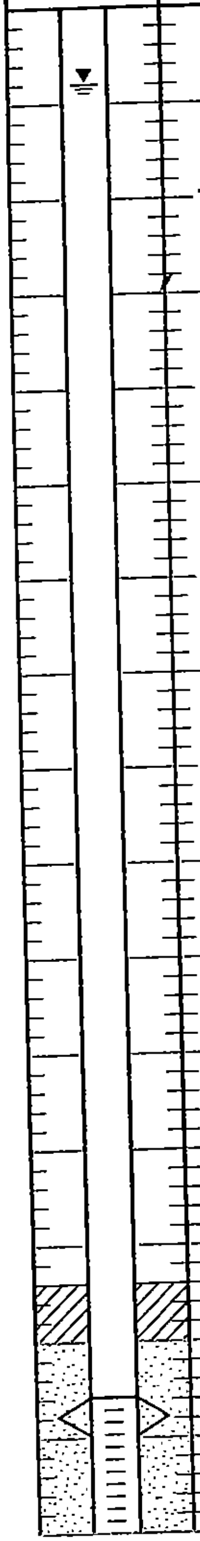
Completion date 6/6/03

Location 2,102,535 (northing); 7,616,445 (easting)

Drilling contractor / method Boart Longyear, Sonic

Logger R. Lambert

Borehole diameter 8 in. , 4-inch PVC



DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
	Sand, moderate brown, loose, fine-grained, moist just below surface, twigs.	SP	*Spud 10:36 on 6/5/03* (10YR 5/4)
	Silt to fine sand, dusky yellowish brown, organic rich, wet. ***Note: All reported colors are from wet samples.***	SP/ML	(10YR 2/2) MW-34-06 *(for grain size, 84.9% silt)*
		SP	*(Hole caving)*
	Sand, dark yellowish brown, medium- to coarse-grained.		*11:10* (10YR 4/2)
10		SP	*Adding water due to flowing sand.*
	Sand, dusky yellowish brown, fine-grained, (10YR 2/2). Sand, moderate yellowish brown, medium- to coarse-grained.	SP	(10YR 5/4)
			MW-34-20 *(97% fine- to medium-grained sand)*
20	Sand, tan, fine-grained.		*(Break for lunch, 11:45 – 13:07)*
			(10YR 4/2)
30	Sand, dark yellowish brown, medium- to coarse-grained, loose.		*13:28*
	Gravelly, medium-grained sand with cobbles, 1/2- to 2-in. diameter, subrounded to rounded.	SW	MW-34-41, *13:46 (33% gravel; 47% medium-grained sand; 6% silt)*
40	Silty clay, dark yellowish brown, 1foot thick, soft.	CL / ML	
	Coarse-grained sand to gravelly sand, <10% gravel, < 1-inch diameter, subangular to rounded.	SP/SW	
	Sand grades coarser, cobbles to 2.5 inches; sand is medium- to very coarse-grained.		MW-34-50 *(Lost much of the core; 83% fine- to medium-grained sand; 11% gravel)*
50			*14:20*
	Sand with cobbles, dark yellowish brown, medium- to fine-grained sand, subrounded cobbles to 3-inch diameter, 10 – 40% cobbles (of mixed lithology).	SP/SW	
60	Sand, dark yellowish brown, coarse- to very coarse-grained section above a section of medium- to coarse-grained sand.	SW/SP	MW-34-63 *(28% gravel, 70% fine- to medium-grained sand (14:35 to 15:40 down to get more pipe)*
70	4-inch piece of wood, olive gray; coarse-grained sand at top, medium- to coarse-grained below.	SP	*16:20* (5YR 3/2)
	Sand, moderate brown.	SP	(5YR 4/4)
	Gravelly sand, cobbles to 4-inch diameter, skip graded (which is typical here).	SW	
80			

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LITHOLOGIC LOG

Well Number **MW-34-80**

Elevation of concrete pad 458.65 (in feet)

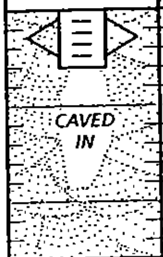
Completion date 6/6/03

Location 2,102,535 (northing); 7,616,445 (easting)

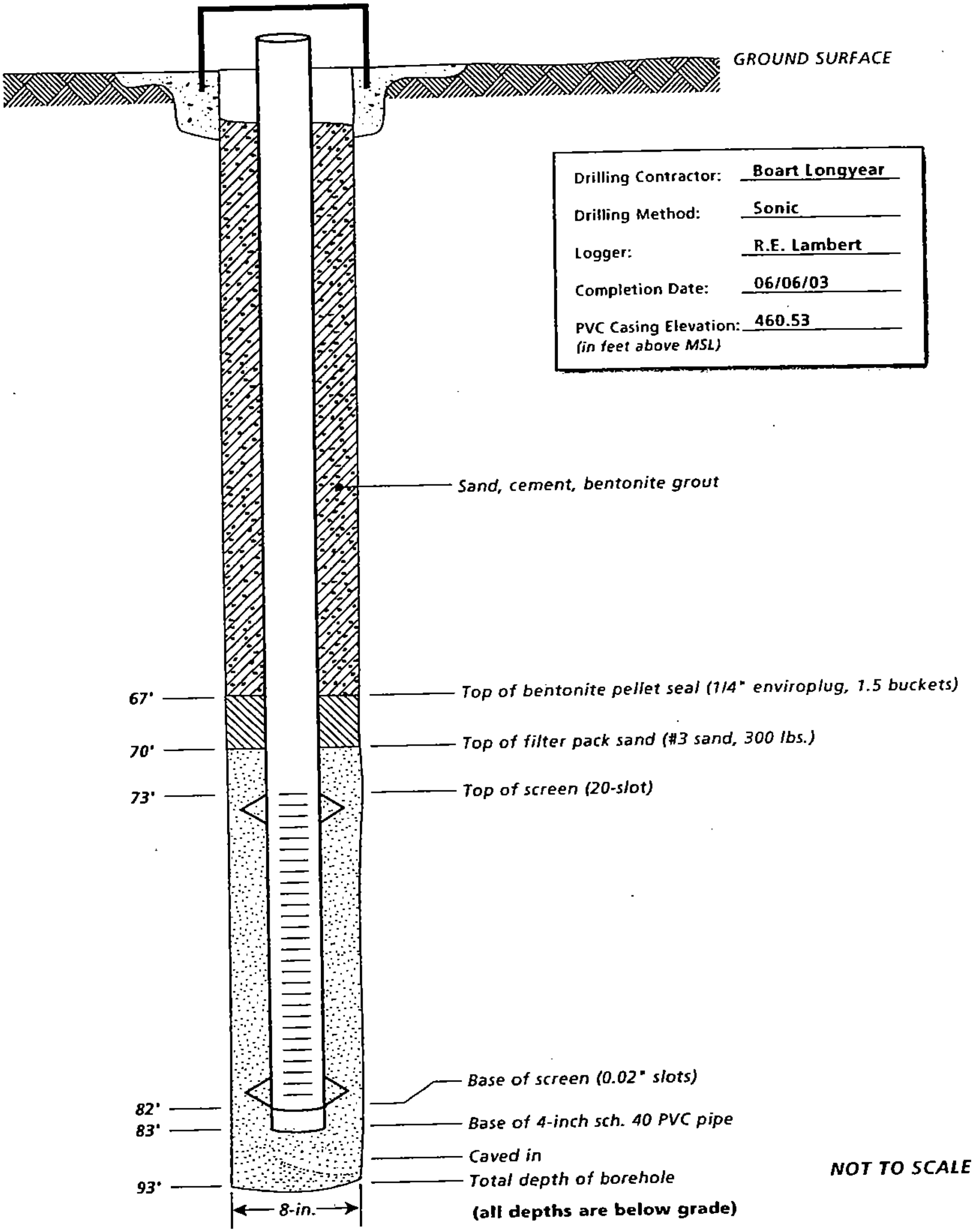
Drilling contractor / method Boart Longyear, Sonic

Logger R. Lambert

Borehole diameter 8 in., 4-inch PVC



COMPLETION DIAGRAM	DEPTH BELOW SURFACE (in feet)	SOIL DESCRIPTION (name, color, particle size, distribution, consistency (hard, soft, etc), moisture content; structure. etc.)	USCS	SAMPLE NUMBERS and COMMENTS
	80	Gravelly sand to sandy gravel, moderate yellowish brown, increasing cobbles.	SW/GW	(10YR 5/4) MW-34-82, *16:40 (74% gravel, 23% fine- to medium-grained sand*
		Cobbles in fine, silty, sand matrix, olive gray, very dense.	SM	(5Y 4/1) *Base of alluvial aquifer?*
		Gets drier, cobbles to 4-inch diameter in sand.	SW	(10R 3/4) *Wet.*
		Very coarse sand and gravel, dark reddish brown to very dusky red		(10R 2/2)
	90			**TD 93'** *17:15 (Very hard drilling)*
	100			
	110			
	120			
	130			
	140			
	150			
	160			



Drilling Contractor:	Boart Longyear
Drilling Method:	Sonic
Logger:	R.E. Lambert
Completion Date:	06/06/03
PVC Casing Elevation: (in feet above MSL)	460.53

ComplDiag_MW-34-80 (Z.68) 07/0

Well Completion Diagram for MW-34-80
PG&E Topock

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-34

SOIL BORING LOG

PROJECT NAME:		HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock, Interim Measures, Phase 2 (2005)		116.0	Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,530.55	**EASTING (CCS NAD 27 Z 5):** 7,616,452.40	**DATE STARTED:** 01/27/2005	**DATE COMPLETED:** 01/29/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Adjacent to MW-34-55 on Colorado River floodplain.			**LOGGED BY:** B. Moayyad, T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–7		Box 1	7	SP	**POORLY GRADED SAND (SP)** - dk grayish brn 10YR4/2, 98% sand, 2% fines with some organic matter and roots, loose, moist	collect bag samples for archive description and potential grain-size testing.
5					- pale brn 10YR6/3, 95% m sand, massive	collect bag sample: MW34-GS-4
7–17		Box 2 Box 3 Box 4	10		- yellowish brn 10YR5/4, moist to wet, bottom 8" transition with mottling with dark gray 10YR4/1 - dk grayish brn 10YR4/2, wet, massive - transition zone and mottling coincides with water tube at approx 8.5 to 9 ft bgs	collect bag sample: MW34-GS-8
10					- 99% f sand, 1% fines	
15					- color shift to yellowish brn 10YR5/4	
16				SP	**POORLY GRADED SAND (SP)** - dk grayish brn 10YR4/2, 99% f-m sand, 1% fines with some organic matter and roots, loose, moist - brn 10YR5/3	collect bag sample: MW34-GS-16
17–27		Box 4 Box 5 Box 6	10		- 99% vf sand, 1% fines	
20, 25						
27–35		Box 6 Box 7 Box 8	10			collect bag sample: MW34-GS-30
30, 35						

CH2MHILL

SHEET 2 of 4	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-34

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 116.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,530.55	**EASTING (CCS NAD 27 Z 5):** 7,616,452.40	**DATE STARTED:** 01/27/2005	**DATE COMPLETED:** 01/29/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Adjacent to MW-34-55 on Colorado River floodplain.			**LOGGED BY:** B. Moayyad, T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					POORLY GRADED SAND (SP) - dk grayish brn 10YR4/2, 99% f-m sand, 1% fines with some organic matter and roots, loose, moist	
					- 70-80% qtz, 20-30% mafic grains	
					- 96% sand, 3% gravel, 1% fines	
40				SP	**POORLY GRADED SAND WITH GRAVEL (SP)** - brn 10YR5/3, 87% sand, 15% rnd to well rnd gravel <1cm to 6cm, 4% silt, igneous, metamorphic, vesicular basalt, quartzite, soft, wet, massive, carbonate	
		Box 8 Box 9 Box 10	10		- dk gray 2.5YR2/1, 60% silt, 40% vf sand, soft, wet, massive	collect bag sample: MW34-GS-42.2
				SP	**POORLY GRADED SAND (SP)** - brn 10YR5/3, 95% rnd to well rnd sand, 5% fines, 3% rnd to well rnd gravel, igneous and metamorphic, soft, wet, gravel with vesicular basalt, carbonate, massive	collect bag sample: MW34-GS-43
45				ML	**SILTY CLAY (ML)** - brn 10YR5/3 - 7.5YR5/3, 98% fines, 2% sand, very abrupt boundary, sticky, plastic, fine grain layer	
			0	SP	**POORLY GRADED SAND (SP)** - brn 10YR4/3, 92% rnd sand, 5% subrnd gravel up to 1", 3% fines, qtz, some mafic, wet	
50						took sample at 13:05: MW34-GS-50
		Box 11	5		- 10YR5/3, 90% rnd sand, 10% subrnd f gravel up to 1 cm, qtzite, mafic, darker/coarser than above	
55					- 896% sand, 4% f gravel up to 1/2" subrnd to subang, less mafic	
					- 10YR5/3, subang to subrnd gravel	
					- 90% subrnd to rnd sand, coarsening, 10% rnd gravel up to 2 1/2", carbonate/granitic	
60					- 96% subrnd to rnd sand, 4% gravel up to 1", 5"mm cobble	
		Box 12 Box 13	10.45		- no gravel	
					- occasional silty clay lenses 2-4" thick	
65				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 80% rnd f sand, 15% fines, 5% subang to subrnd gravel up to 1"	took sample at 13:40: MW34-GS-65
					POORLY GRADED SAND (SP) - brn 7.5YR5/4, 90% f sand, 8% c sand, 2% fines, rnd, loose, wet	
70					- becomes more gray in color near wood	

CH2MHILL

SHEET 3 of 4	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-34

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 116.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ		
SURFACE ELEVATION: 458.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,530.55	**EASTING (CCS NAD 27 Z 5):** 7,616,452.40	**DATE STARTED:** 01/27/2005	**DATE COMPLETED:** 01/29/2005	
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track Mounted Sonic		
LOCATION: Adjacent to MW-34-55 on Colorado River floodplain.			**LOGGED BY:** B. Moayyad, T. McDonald		

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
70–75		Box 14 Box 15	9	SP	**POORLY GRADED SAND (SP)** - brn 7.5YR5/4, 90% f sand, 8% c sand, 2% fines, rnd, loose, wet - large wood fragments >6", no sediment, charcoal appearance - 98% sand, <2% fines, coarse, subrnd, f qtz sand	sample collected at 14:35: MW34-GS-73
75				GW	**WELL GRADED GRAVEL WITH SAND AND SILT (GW)** - brn 7.5YR5/3, 70% gravel up to 5", 20% sand, 10% fines, rnd to subrnd, medium, wet	
77		Box 16 Box 17	9.5	SP	**POORLY GRADED SAND (SP)** - brn 7.5YR5/2, 95% f rnd qtz sand, 5% silt, some mafics, loose, wet	
80				GW	**WELL GRADED GRAVEL WITH SAND AND COBBLES (GW)** - brn 7.5YR5/3, 60% rnd gravel up to 5", 35% subrnd qtz sand, 5% fines, igneous and metamorphic, wet - 60% gravel with 15% cobbles	sample collected at 15:00: MW-34P-GS-80
87		Box 18 Box 19	9	GW	**SILTY SANDY GRAVEL (GW)** - 55% sand, 43% gravel up to 6", 2% fines	drilling becomes much harder below 87 ft
89				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - very dk gray 7.5YR3/4, 70% sand, 15% rnd f-m gravel, 15% clay and silt, wet - dark gray/brn silty sand, becomes hard with 10-15% clay and silt fines - becomes reddish brn 5YR4/4 by 95 ft - 87% sand, 10% gravel, 3% fines	cobbles fall from core at 89, difficulty removing core barrel due to hard material
97		Box 20 Box 21	8.1	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - weak red 10YR4/4, 70% sand, 15% silt, 15% gravel, medium density	possible reworked Miocene Conglomerate
98–105					**CONGLOMERATE (BR)** - weak red 10YR4/4, conglomerate consists or 60% subang gravel up to 2.7", 25% subang sand, 15% silty fines, hard, dry.	Top Miocene Conglomerate 98 ft sample collected at 16:40: MW-34D-GS-102

CH2MHILL

PROJECT NUMBER: 326228.IM

BORING NUMBER: MW-34

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		HOLE DEPTH (ft): 116.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,530.55	EASTING (CCS NAD 27 Z 5): 7,616,452.40	DATE STARTED: 01/27/2005	DATE COMPLETED: 01/29/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft):	DRILLING EQUIPMENT: Track Mounted Sonic	
LOCATION: Adjacent to MW-34-55 on Colorado River floodplain.			LOGGED BY: B. Moayyad, T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				BR	**CONGLOMERATE (BR)** - weak red 10YR4/4, conglomerate consists or 60% subang gravel up to 2.7", 25% subang sand, 15% silty fines, hard, dry.	- core is shattered by vibration and is moist due to injected water, otherwise dry
					- carbonate cement evident, weak to moderate induration	
110		Box 22	9			no bag sample taken
115						

Boring Terminated at 116 ft

ABBREVIATIONS

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

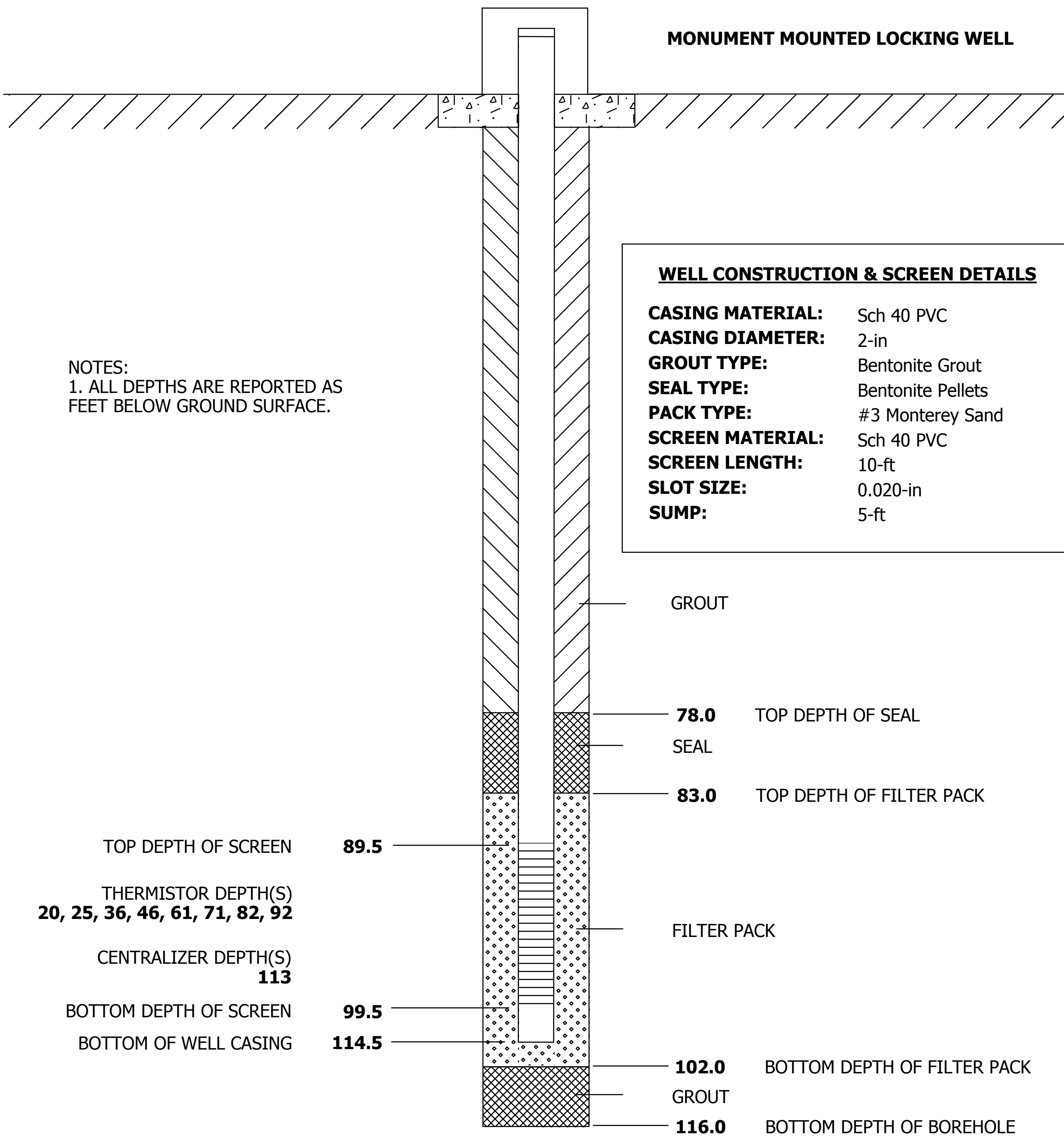
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-34-100**

LOCATION: Adjacent to MW-34-55 on Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 01/27/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 01/29/2005
LOGGER: B. Moayyad, T. McDonald	**WELL COMPLETION DATE:** 01/30/2005
TOP OF WELL CASING (NGVD 29): 460.97	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102530.55
GROUND SURFACE ELEVATION (NGVD 29): 458.93	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616452.40



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in
SUMP:	5-ft

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

WELL DIAGRAM IS NOT TO SCALE

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-35

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 168.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 481.2 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,104,045.82	**EASTING (CCS NAD 27 Z 5):** 7,615,329.76	**DATE AND TIME STARTED:** 03/28/2004 — **DATE AND TIME COMPLETED:** 03/30/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.			**LOGGED BY:** J. Piper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0						0-8' cobbles, boulders, hand dug 20min and set conductor casing
5						
8					**WELL GRADED SAND WITH SILT AND GRAVEL (SW/SM)** - gray 7.5YR4/2, f-c sand and gravel, subang, loose, moist.	
10						
11					- cemented zone	
12					- 50% gravel, loose, dry	
13		CC33	10			
15						
18					- few cobbles	
20						
21.5				SM/GM		
22					- zones of weak cement, ang to subang clasts	
25						
27					- 7.5YR4/2, some clay, silty, weakly cemented	
30						13:05-13:20 - hard drilling at 30', drill pipe broke trying 12' run.
33		CC34	10		- 7.5YR5/3, ang to subang, qtz and mm sand and clasts, slightly moist	
35						

CH2MHILL

SHEET 2 of 6	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-35

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 168.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 481.2 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,104,045.82	**EASTING (CCS NAD 27 Z 5):** 7,615,329.76	**DATE AND TIME STARTED:** 03/28/2004	**DATE AND TIME COMPLETED:** 03/30/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.			**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND WITH SILT AND GRAVEL (SW/SM) - gray 7.5YR4/2, f-c sand and gravel, subang, loose, moist.	water rises, flows from drill pipe >~35'
					- silty sand with gravel, little clay	
					- 7.5YR5/2, vf sand, increasing clay at depth, increasing gravel at depth, weakly cemented, moist	
40						
		CC35	10			
45						
					- weathered green mm clasts	
50						
					- green 7.5YR4/2, f-m sand, silt, some m-c gravel, subang to ang, mm, cemented	
				SM/GM		
		CC36	10			
55						
					- 7.5YR4/3, gravelly silty sand, moist	
60						
		CC37	10			
65						
				GW/GM	**WELL GRADED GRAVEL WITH SILT (GW/GM)** - 7.5YR4/3, silty coarse sand and gravel, wet.	
70						

CH2MHILL

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-35

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 168.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 481.2 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,104,045.82	**EASTING (CCS NAD 27 Z 5):** 7,615,329.76	**DATE AND TIME STARTED:** 03/28/2004 — **DATE AND TIME COMPLETED:** 03/30/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.			**LOGGED BY:** J. Piper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC38	10	GW/GM	**WELL GRADED GRAVEL WITH SILT (GW/GM)** - 7.5YR4/3, silty coarse sand and gravel, wet.	
75				GC	**CLAYEY GRAVEL (GC)** - 7.5YR4/3, wet.	
					- moist	much drier than 68-76
					- 7.5YR7/1, dry, gray	
80						wet core
				GW/GM	**WELL GRADED GRAVEL WITH SILT (GW/GM)** - well graded sand and pebbles with silt.	
85				GC	**CLAYEY GRAVEL WITH SAND (GC)** - clasts up to 3, ang, metamorphic.	
		CC39	20		- subang to ang clasts, slight plasticity	
					- 10YR4/3	
90					- subround qtz and mm sand	
95				GW/GM	**WELL GRADED GRAVEL WITH SILT AND SAND (GW/GM)** - f-c sand, silt, wet.	
100					- c sand	
105						

SHEET 4 of 6	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-35

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 168.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 481.2 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,104,045.82	**EASTING (CCS NAD 27 Z 5):** 7,615,329.76	**DATE AND TIME STARTED:** 03/28/2004	**DATE AND TIME COMPLETED:** 03/30/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.			**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC40	20	GW/GM	**WELL GRADED GRAVEL WITH SILT AND SAND (GW/GM)** - f-c sand, silt, wet.	
				GW/GC	**WELL GRADED GRAVEL WITH CLAY AND SAND (GW/GC)**	
110					- silty zone, ang, qtz and mm clasts, caliche cemented, moist	
115					- strong smell	
		CC41	12	SW/SM	**WELL GRADED SAND WITH SILT (SW/SM)** - 7.5YR5/3, well graded gravel and sand, ang MM clasts.	
120						wet core
125					- more silt and clay	
					- some gravel	
130					- reddish brn matrix 5YR4/4, weathered mm clasts	very dense>130'
		CC42	5	GC	**CLAYEY GRAVEL WITH SAND (GC)** - well graded gravel, f-c sand with silt, subang mm clasts, grading to sand.	
135						
				SW/SM	**WELL GRADED SAND WITH SILT (SW/SM)** - 7.5YR4/2, some f pebbles.	
140				SC	**CLAYEY SAND (SC)** - f-m sand with clay, pebbles, reddish brn.	

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PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-35

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 168.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 481.2 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,104,045.82	EASTING (CCS NAD 27 Z 5): 7,615,329.76	DATE AND TIME STARTED: 03/28/2004	DATE AND TIME COMPLETED: 03/30/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.			LOGGED BY: J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SC	**CLAYEY SAND (SC)** - f-m sand with clay, pebbles, brn.	vet core
145					**CLAYEY GRAVEL (GC)** - 7.5YR4/2, increasing gravel, more dense.	
		CC43	20			
150					- some f-c sand and clay	
155				GC		
					- 5YR4/2, angled bedding planes	angled bedding planes seen at 159,161 (photos), 163, 167 (dip ~20-30 at 159,163)
160						
		CC44	10			
165						
					Boring Terminated at 168 ft	

ABBREVIATIONS
cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-35

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 168.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 481.2 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,104,045.82	EASTING (CCS NAD 27 Z 5): 7,615,329.76	DATE AND TIME STARTED: 03/28/2004	DATE AND TIME COMPLETED: 03/30/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.			LOGGED BY: J. Piper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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	20' blank casing sump, sump 136-156

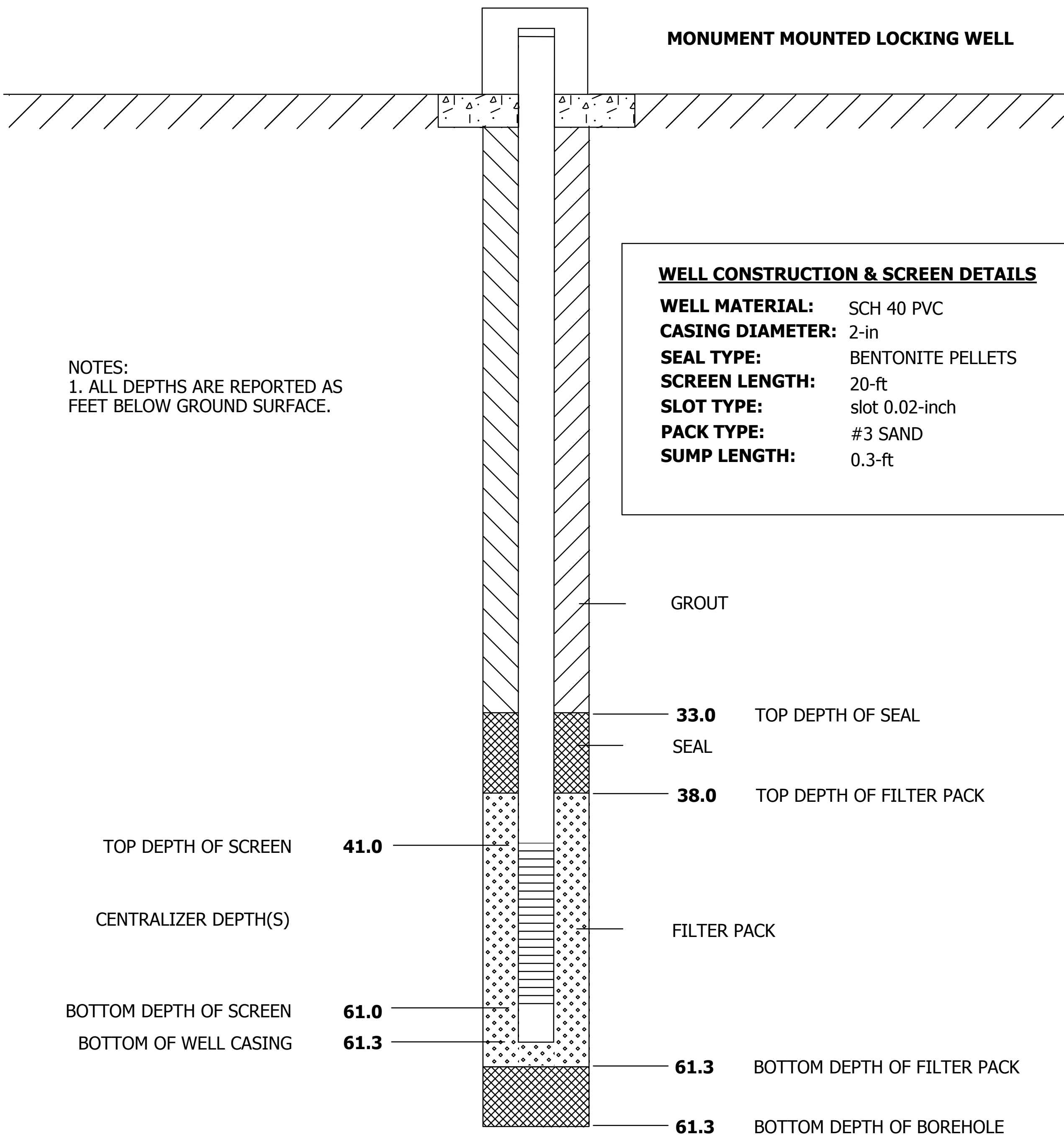
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 1 2004)	**WELL NO:** **MW-35-060**

LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 03/30/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 03/31/2004
LOGGER: J. Piper	**WELL COMPLETION DATE:** 03/30/2004
TOP OF WELL CASING (NGVD 29): 484.19	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2104058.80
GROUND SURFACE ELEVATION (NGVD 29): 481.10	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7615317.50



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

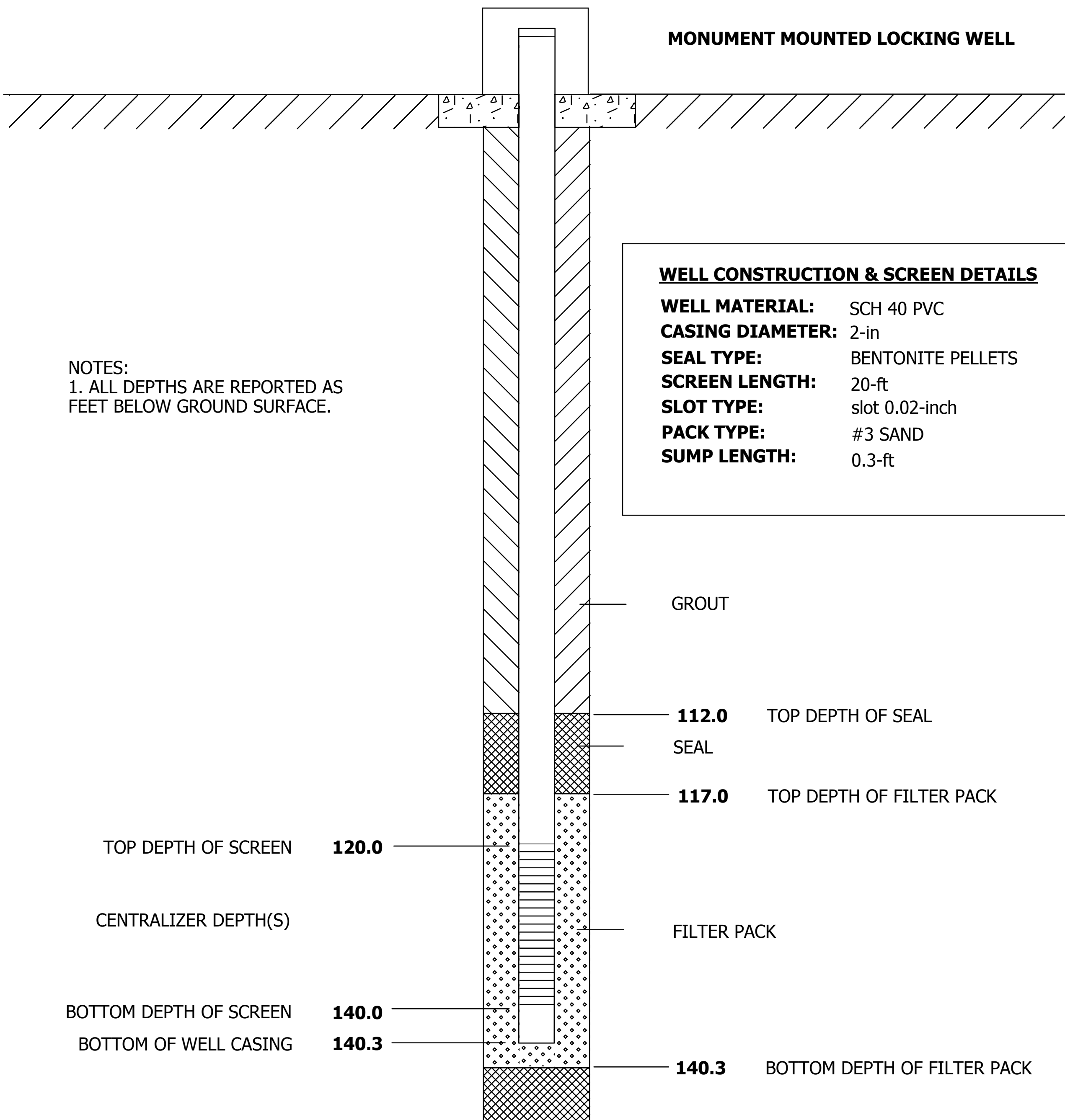
NOTES:
1. ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE.

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 1 2004) — **WELL NO:** **MW-35-135**
LOCATION: Old Route 66 Topock, CA. - Along east side of old Route 66 at dirt road turn-off, approximately 1000' north of extraction well structures.	
DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 03/28/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 03/30/2004
LOGGER: J. Piper	**WELL COMPLETION DATE:** 03/31/2004
TOP OF WELL CASING (NGVD 29): 483.57	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2104045.82
GROUND SURFACE ELEVATION (NGVD 29): 481.20	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7615329.76



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-36

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 108.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 466.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,532.37	**EASTING (CCS NAD 27 Z 5):** 7,616,267.51	**DATE AND TIME STARTED:** 04/30/2004 — **DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** All Terrain Sonic Rig with continuous 4 core, 6 casing
LOCATION: Floodplain area, approx. 400' east of MW-20 bench			**LOGGED BY:** J. Wellmeyer / PHX

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0					**POORLY GRADED SAND (SP)** - lt yellowish brn, 10YR6/4 f-m sand, well rnd, qtz dredge, loose, dry.	Start exploratory pilot hole 9:17 AM. Collect standard penetration tests (SPT) using 24 split-spoon sampler at 10 foot intervals at base of sonic-advance continuous core (CC) runs.
5	0-8	CC1 Box 1	5			9:20, heaving sands
					- slightly damp	
10					- saturated	water added
15	8-18	CC2 Box 2 Box 3 Box 4	10		- 10&R4/1 dk gray, f-m well rnd qtz sand, firm, moist, abundant fine-grained organic streaks and particulates	
20				SP		
25	18-28	CC3 Box 5 Box 6 Box 7	10			heaving sands, SPT washed
30					- gradational color change to dark grayish brn 10YR4/2	
35	28-35	CC4 Box 8 Box 9 Box 10	10		- brn 10YR4/3	

CH2MHILL

SHEET 2 of 4	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-36

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 108.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 466.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,532.37	EASTING (CCS NAD 27 Z 5): 7,616,267.51	DATE AND TIME STARTED: 04/30/2004	DATE AND TIME COMPLETED: 05/01/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: All Terrain Sonic Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain area, approx. 400' east of MW-20 bench			LOGGED BY: J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, f-m sand, well rnd, qtz dredge, loose, dry.	
40						
		CC5 Box 11 Box 12	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 95% f-vc sand, 5% gravel <0.5, trace fines, loose.	
45					- 50% c-vc sand, 30% f-m sand, 20% gravel up to 3, well rnd	
					- small pocket of red brn clay	
50						
		CC6 Box 13 Box 14 Box 15	10		- small pockets of light yellowish brn clay	
55					- sand content fining	
					- small pockets of light yellowish brn clay	
60				SW	**WELL GRADED SAND (SW)** - dk yellowish brn 10YR4/4, 70% m-c sand, 15% f sand, 10% vc sand, 5% clay, very well rnd qtz sand. - red brn clay sheet - iron staining	
		CC7 Box 15 Box 16 Box 17 Box 18	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 10YR4/4, 65% m-c sand, 15% gravel, 10% f sand, 10% vc sand, trace clay, well rnd, loose.	
65				SP	**POORLY GRADED SAND (SP)** - 10YR4/4, 70% m-sand, 20% c sand, 10% f sand, trace fines, loose.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 95% f-vc sand, 5% gravel < 1/2, trace fines, loose.	
70						

CH2MHILL

SHEET 3 of 4	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-36

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 108.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 466.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,532.37	**EASTING (CCS NAD 27 Z 5):** 7,616,267.51	**DATE AND TIME STARTED:** 04/30/2004	**DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** All Terrain Sonic Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain area, approx. 400' east of MW-20 bench			**LOGGED BY:** J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC8 Box 18 Box 19 Box 20	10	SM	**SILTY SAND (SM)** - 7.5YR4/4, 60% f sand, 30% silt, 10% clay, some CACO3 concretions, loose.	
				CH	**FAT CLAY (CH)** - brn 7.5YR4/4, some organics, CaCO3?, concretions.	
75				SM	**SILTY SAND (SM)** - 40% f sand, 20% m sand, 30% silt, 10% clay.	
				GC	**CLAYEY GRAVEL (GC)** - 7.5YR4/4, 35% clay, 30% gravel up to 3, 20% m-c sand, 10% f sand, 5% silt, matrix supported, heavily weathered.	drill chatter at 76' - 2 layer pure red clay
80		CC9 Box 21 Box 22	5	GW	**WELL GRADED GRAVEL (GW)** - 95% gravel up to 3 including pea gravel, 5% sands, trace fines, very well rnd, clast supported, fining upward, loose. - fluvial gravel zone	only 1/2 of core recovered
85						
90		CC10 Box 22 Box 23 Box 24	10	SP	**POORLY GRADED SAND (SP)** - brn 10YR4/4, 65% m sand, 15% f sand, 10% c-vc sand, 5% fines, trace gravel, loose.	hard drilling, lots of chatter on core pipe
95				GW	**WELL GRADED GRAVEL (GW)** - brn 10YR4/3, 70% gravel up to 2, 15% m-c sand, well rnd, clast supported, fining upward. - 70% gravel up to 4, 20% sand, 10% silt - dusky red 10YR3/4, ang lithic, consolidated	
100		CC11 Box 25 Box 26 Box 27	10	BR	**CONSOLIDATED CONGLOMERATE (BR)** 10R3/4 dusky red, ang lithics, consolidated.	top weathered Miocene conglomerate (Tmc unit) drill chatter, samples very hot very hard drilling
105						

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SHEET 4 of 4	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-36

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 108.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 466.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,532.37	EASTING (CCS NAD 27 Z 5): 7,616,267.51	DATE AND TIME STARTED: 04/30/2004	DATE AND TIME COMPLETED: 05/01/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: All Terrain Sonic Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain area, approx. 400' east of MW-20 bench			LOGGED BY: J. Wellmeyer / PHX	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
	X			BR	**CONSOLIDATED CONGLOMERATE (BR)** 10R3/4 dusky red, ang lithics, consolidated. - hard cemented red conglomerate	high vibrations on drill core barrel refusal
					Boring Terminated at 108 ft	stop at 8:35 AM

ABBREVIATIONS

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

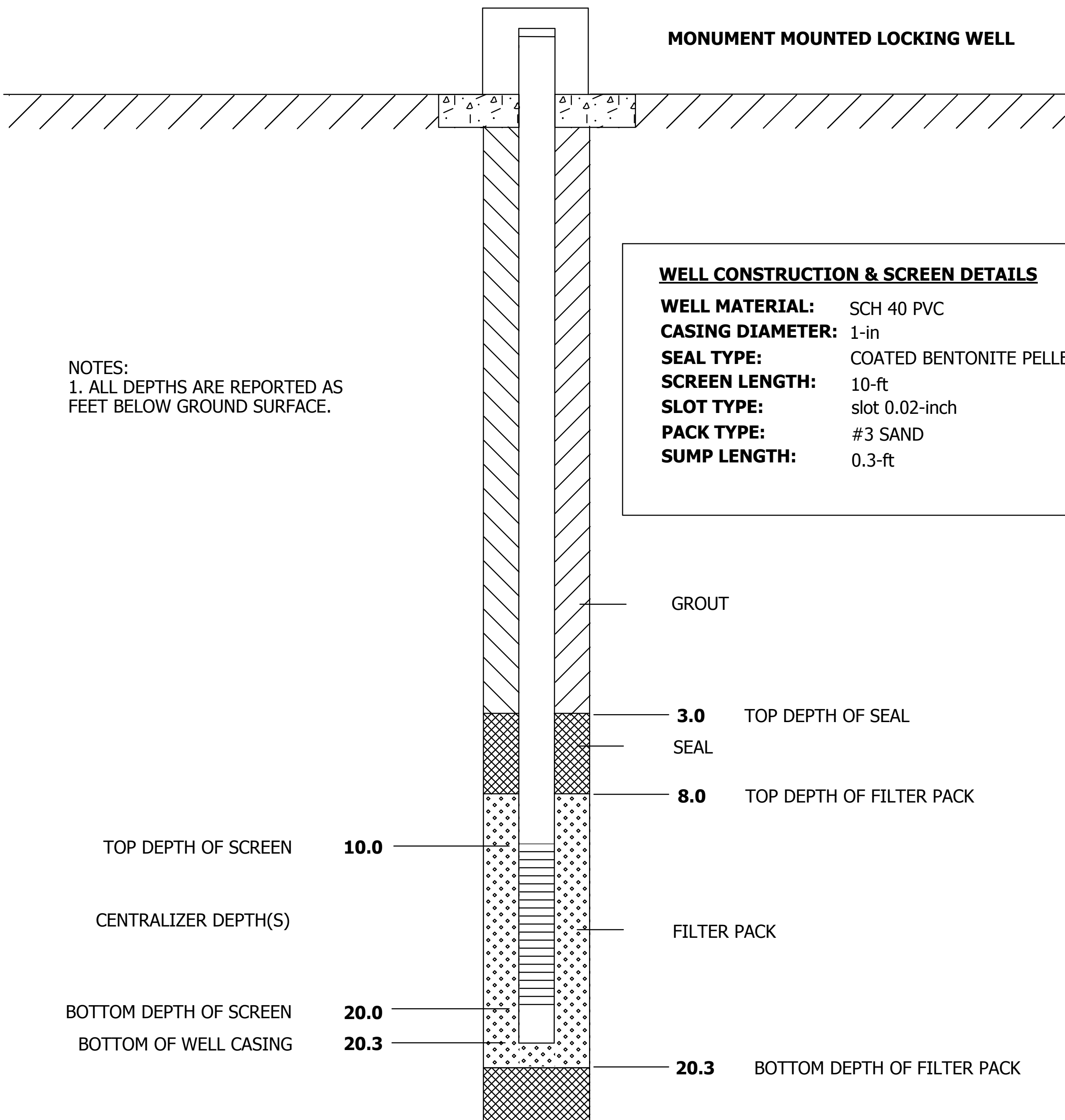
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-36-020**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 350' north of railroad, 400' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 05/03/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/03/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 05/03/2004
TOP OF WELL CASING (NGVD 29): 469.32	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102542.57
GROUND SURFACE ELEVATION (NGVD 29): 466.50	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616267.10



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

WELL DIAGRAM IS NOT TO SCALE

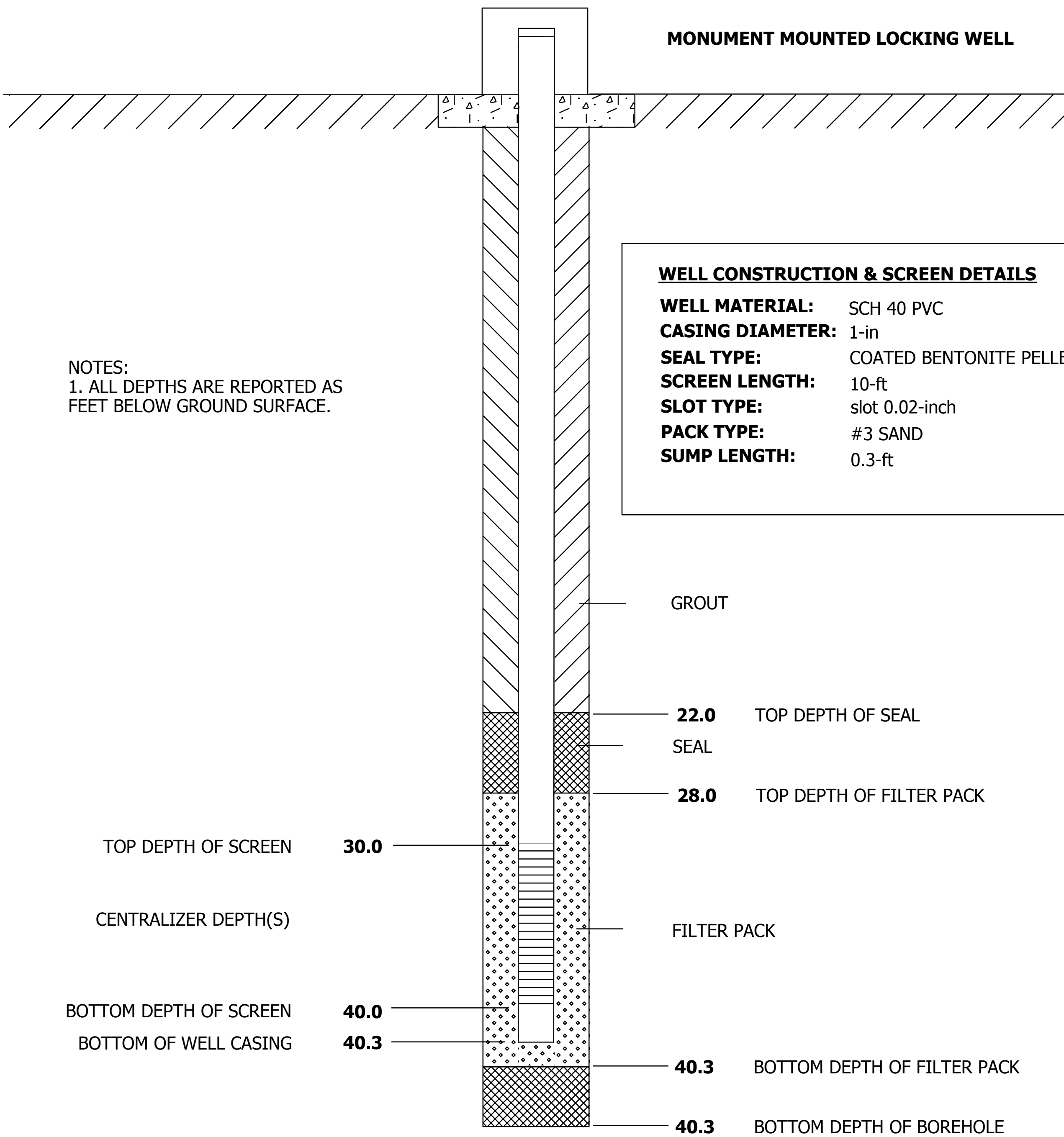
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-36-040**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 350' north of railroad, 400' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 05/02/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/03/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 05/03/2004
TOP OF WELL CASING (NGVD 29): 469.64	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102537.20
GROUND SURFACE ELEVATION (NGVD 29): 466.70	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616267.58



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

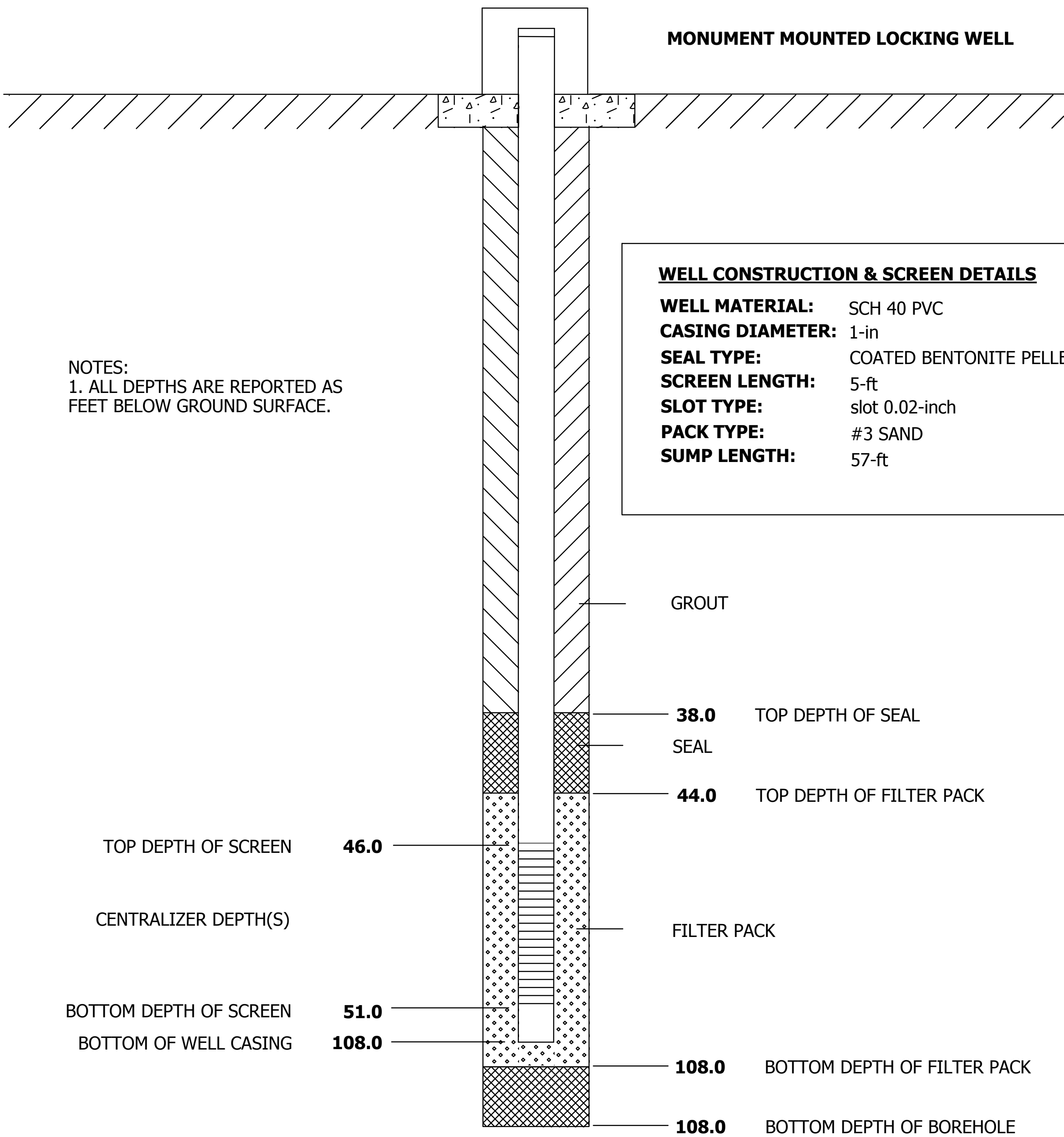
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-36-050**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 350' north of railroad, 400' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 05/01/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/01/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 05/01/2004
TOP OF WELL CASING (NGVD 29): 469.65	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102532.17
GROUND SURFACE ELEVATION (NGVD 29): 466.80	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616267.47



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	5-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	57-ft

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

WELL DIAGRAM IS NOT TO SCALE

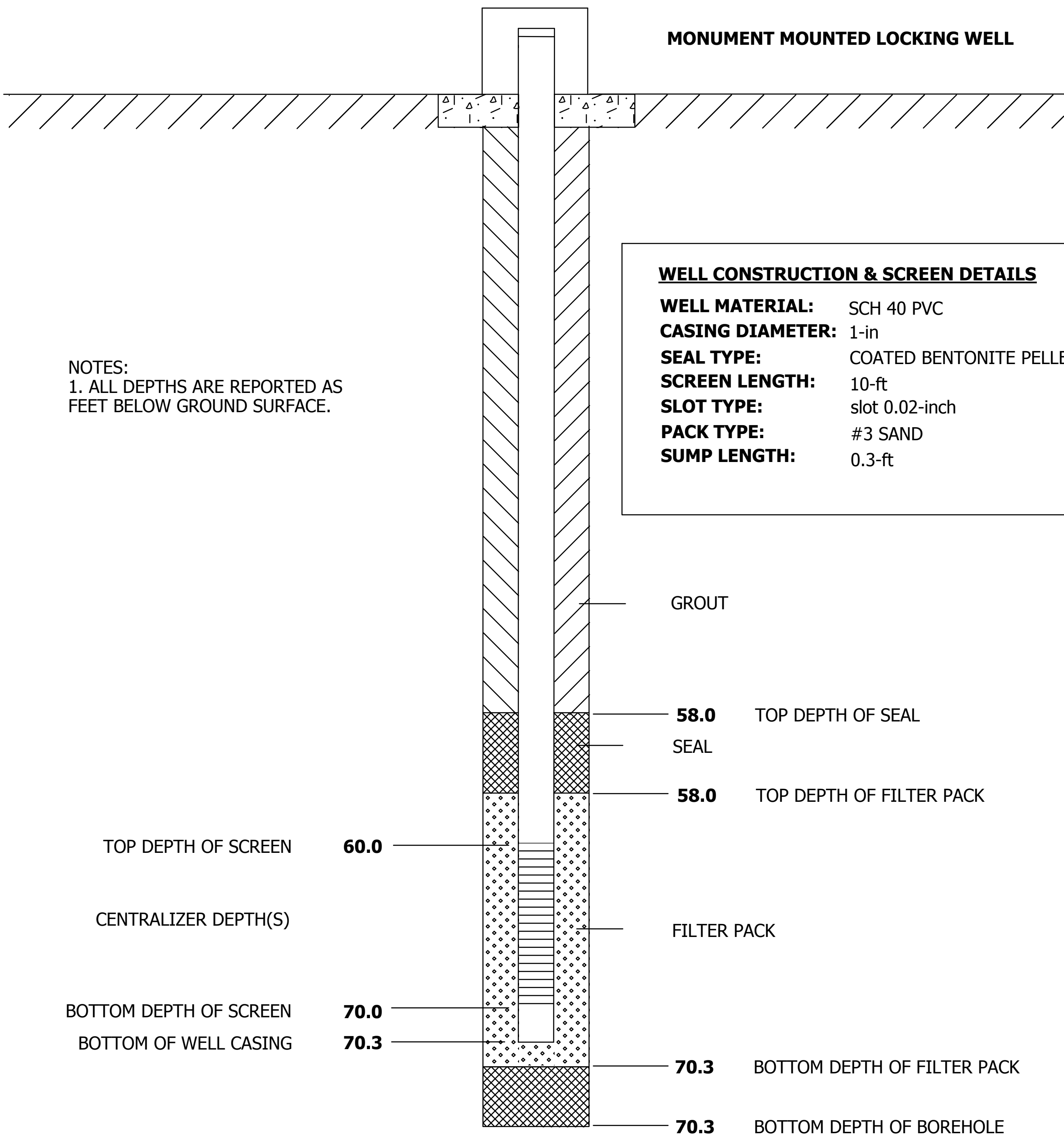
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-36-070**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 350' north of railroad, 400' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 05/03/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/03/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 05/03/2004
TOP OF WELL CASING (NGVD 29): 469.31	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102542.67
GROUND SURFACE ELEVATION (NGVD 29): 466.50	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616267.18



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

WELL DIAGRAM IS NOT TO SCALE

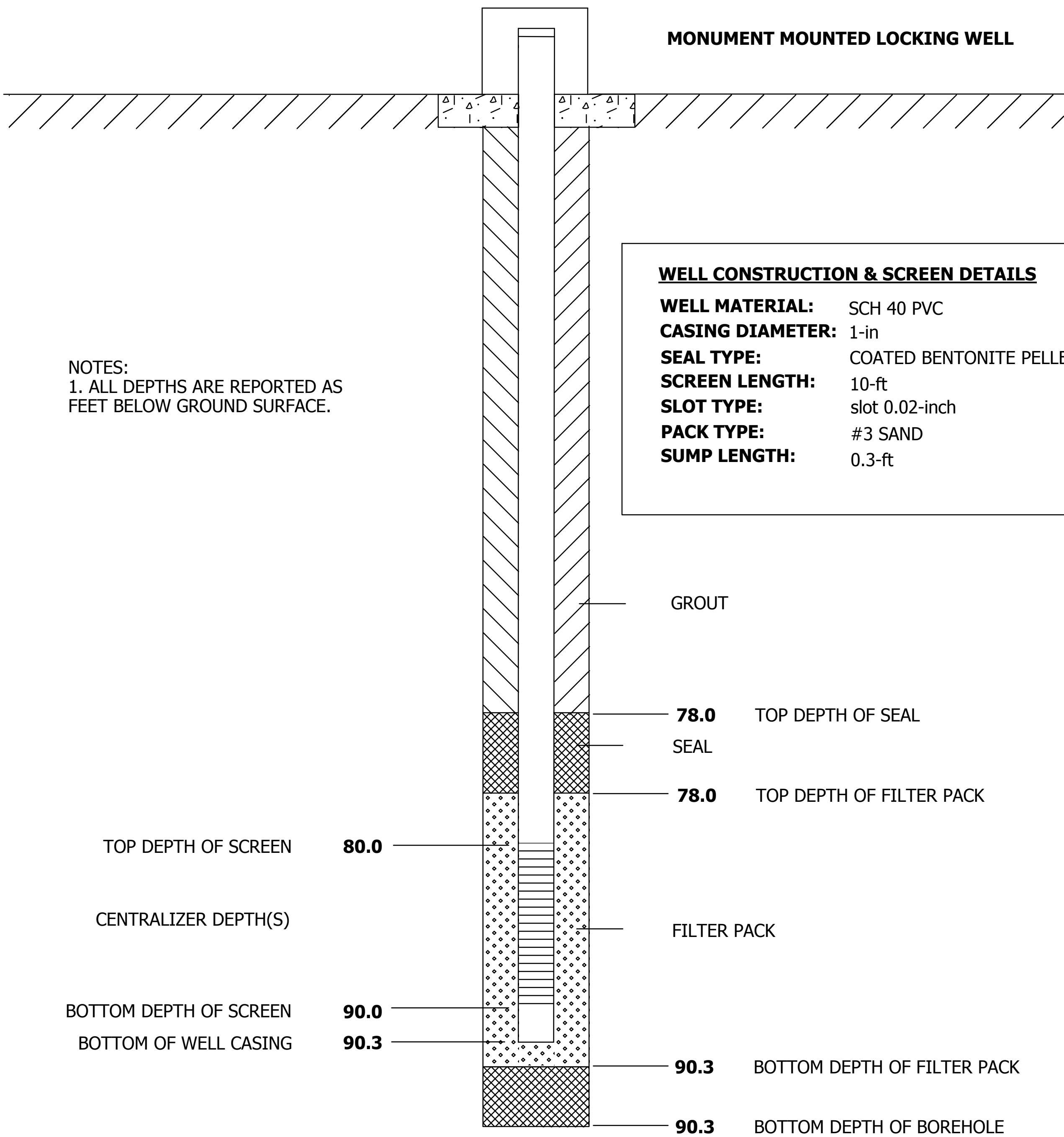
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-36-090**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 350' north of railroad, 400' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 05/02/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/03/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 05/03/2004
TOP OF WELL CASING (NGVD 29): 469.68	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102537.34
GROUND SURFACE ELEVATION (NGVD 29): 466.70	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616267.63



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

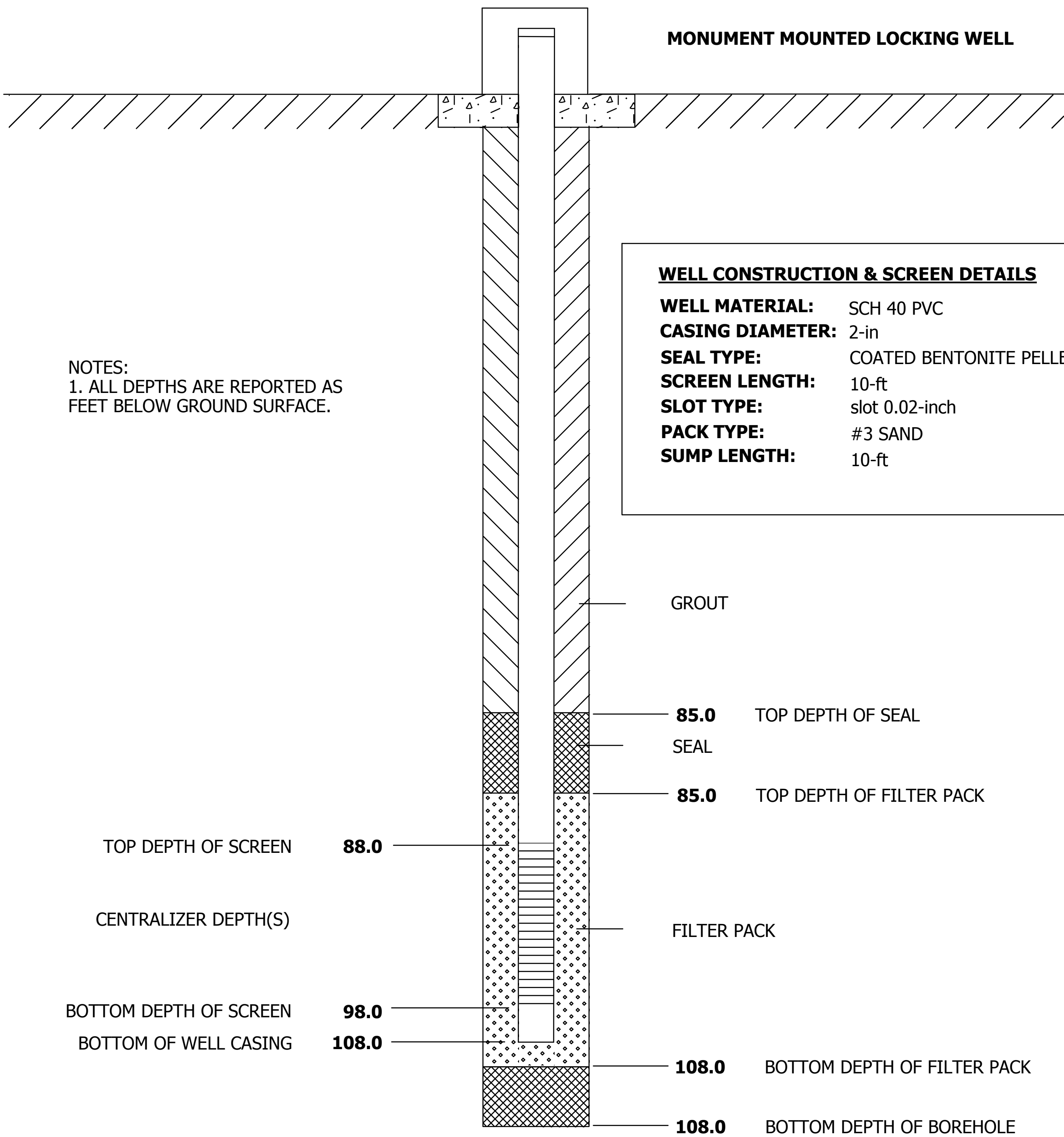
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-36-100**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 350' north of railroad, 400' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** 04/30/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/01/2004
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 05/01/2004
TOP OF WELL CASING (NGVD 29): 469.69	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102532.37
GROUND SURFACE ELEVATION (NGVD 29): 466.80	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616267.51



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	10-ft

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 228.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 483.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,882.18	EASTING (CCS NAD 27 Z 5): 7,614,825.33	DATE AND TIME STARTED: 04/13/2004 2:00:00 PM	DATE AND TIME COMPLETED: 04/21/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: North Bat Cave Wash Topock, CA			LOGGED BY: S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–8				NR	NO RECOVERY	0-8' lost in setting conductor pipe
8–16	8–18	CC56	5	GW/GC	**WELL GRADED GRAVEL WITH CLAY AND SAND (GW/GC)** - dk gray 2.5YR4/1, 50% well graded ang to subang gravel, 40% well graded sand, 10% fines, high dry strength, no plasticity, wet.	15:00 drillers lost 8'-13' dropped drilling is soft Cr 6+
16–22				SC	**CLAYEY SAND WITH GRAVEL (SC)** - 2.5YR5/2, 50% well graded subang sand, 30% well graded subang gravel, 20% fines, no plasticity, dry, grayish brn.	
22–23	18–35	CC57	20	GW	**WELL GRADED GRAVEL WITH SAND (GW)** - gray 2.5YR5/1, 70% gravel up to 3, 25% m-c sand, 5% f clay, gravel subrnd to subang, sand ang to subang, qtz, gneiss, dry.	
23–35				SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk gray 2.5YR4/1, 50% well graded subang sand, 30% well graded subang f-c gravel, 20% f clay, high dry strength, moist. - becomes more sandy - dark grayish brn 10YR4/2, 40% well graded subang sand, 40% clay fines, 20% well graded subround gravel, high dry strength, medium plasticity	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 228.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 483.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,882.18	EASTING (CCS NAD 27 Z 5): 7,614,825.33	DATE AND TIME STARTED: 04/13/2004 2:00:00 PM	DATE AND TIME COMPLETED: 04/21/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: North Bat Cave Wash Topock, CA			LOGGED BY: S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					CLAYEY SAND WITH GRAVEL (SC) - dk gray 2.5YR4/1, 50% well graded subang sand, 30% well graded subang f-c gravel, 20% f clay, high dry strength, moist.	
40						
		CC58	10			
45					- 40% well graded subround to rnd sand, 30% clay fines, low plasticity	
50				SC	- dark grayish brn 10YR4/2, 40% clay fines, 30% well graded subround to subang sand, 30% well graded subang gravel, medium plasticity	8:14, Cr6+
		CC59	10			
55					- drier	
					- brn 7.5YR4/3, 45% well graded subang to subround c-m sand, 40% well graded ang gravel, 15% fines, grades consolidated to unconsolidated at depth.	8:16, Cr6+
60						8:45 drilling is hard, Cr6+ at 9:30
		CC60	10			
65				GW/GC	**WELL GRADED GRAVEL WITH CLAY AND SAND (GW/GC)** - dk brn 10YR3/3, 60% well graded ang to subang gravel, 30% ang to subang sand, 10% fines, gneiss, qtz, no plasticity, moist.	9:35, Cr6+
				SC	**CLAYEY SAND WITH GRAVEL (SC)** - high dry strength, moist.	
70						

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SHEET 3 of 7	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 228.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 483.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,882.18	**EASTING (CCS NAD 27 Z 5):** 7,614,825.33	**DATE AND TIME STARTED:** 04/13/2004 2:00:00 PM / **DATE AND TIME COMPLETED:** 04/21/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: North Bat Cave Wash Topock, CA			**LOGGED BY:** S. Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC61	10	SC	**CLAYEY SAND WITH GRAVEL (SC)** - high dry strength, moist. - slightly more clay, less gravel, still very sandy	10:30, Cr6+
75				GC	**CLAYEY GRAVEL WITH SAND (GC)** - lt yellowish brn 2.5YR6/3, 50% well graded subang gravel up to 3, 20% well graded subang c-m sand, 20% clay fines, qtz, gneiss, unconsolidated, medium plasticity, dry.	10:35, Cr6+
80		CC62	15	CL	**SANDY LEAN CLAY WITH GRAVEL (CL)** - olive brn 2.5YR4/3, 55% clay fines, 30% well graded subrnd sand, 15% well graded subrnd f-m gravel, high dry strength, high plasticity, moist.	
85				GC	**CLAYEY GRAVEL WITH SAND (GC)** - olive brn 2.5YR4/3, 50% well graded mm subang to subrnd gravel, 30% well graded subang to subrnd sand, 20% clay fines, unconsolidated, low dry strength, low plasticity, dry to moist.	14:05, Cr6+ 14:10, Cr6+
90				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 10YR4/3, 40% well graded subang to subrnd f-m sand, 35% clay fines, 25% well graded subang to subrnd gravel, medium dry strength, moist.	
95 100 105		CC63	15	CL	**SANDY LEAN CLAY (CL)** - grayish brn 2.5YR5/2, 70% clay fines, 20% m-c sand, 10% well graded subang gravel up to 1, low dry strength, medium plasticity, wet.	16:35, Cr6+

CH2MHILL

SHEET 4 of 7	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 228.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 483.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,882.18	**EASTING (CCS NAD 27 Z 5):** 7,614,825.33	**DATE AND TIME STARTED:** 04/13/2004 2:00:00 PM	**DATE AND TIME COMPLETED:** 04/21/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: North Bat Cave Wash Topock, CA			**LOGGED BY:** S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					CLAYEY SAND WITH GRAVEL (SC) - brn 7.5YR4/2 with some reddish mottles and clasts, 40% well graded subang m-c sand, 40% f gravel, 20% clayey fines, qtz, gneiss, green minerals, thin layers of clay.	hard drilling, 16:40 CR6+
					- dark grayish brn 10YR4/2, metamorphic, gneiss, unconsolidated	
110						8:45 CR6+
		CC64	10			
115						8:50 CR6+
					- some red staining, increasing gravel	
					- brn 10YR4/3, 60% well graded subang sand, 20% well graded ang to subang gravel up to 3, 20% clay fines, qtz, green mm minerals, medium plasticity, wet	
120						11:45 CR6+
				SC		
125						11:45 CR6+
		CC65	20			
130						11:50 CR6+
135						11:55 CR6+
					- brn 10YR4/3, 60% subang sand, 25% well graded subang gravel up to 2, 15% clay fines, low plasticity, moist	
				SW/SC	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW/SC)** - brn 10YR4/3, 50% well graded ang to subang sand, 40% well graded subang gravel, 10% clay fines, low plasticity, wet.	some heaving gravels
140						

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 228.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 483.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,882.18	**EASTING (CCS NAD 27 Z 5):** 7,614,825.33	**DATE AND TIME STARTED:** 04/13/2004 2:00:00 PM; **DATE AND TIME COMPLETED:** 04/21/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: North Bat Cave Wash Topock, CA		**LOGGED BY:** S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
				SW/SC	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW/SC)** - brn 10YR4/3, 50% well graded ang to subang sand, 40% well graded subang gravel, 10% clay fines, low plasticity, wet.	14:45 CR6+
145				CL	**SANDY LEAN CLAY (CL)** - brn 10YR5/3, 50% clay fines, 40% well graded subang sand, 10% well graded subang gravel, medium plasticity, wet.	14:50 CR6+
		CC66	20			
150				SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk grayish brn 10YR4/2, 60% well graded subang sand, 30% clay fines, 10% well graded subang gravel, medium plasticity, wet.	
155						wet, Drilling becomes harder, reworked red fanglomerate
				GC	**CLAYEY GRAVEL WITH SAND (GC)** - dk grayish brn 10YR4/2, reddish staining, 40% well graded ang to subang sand, 20% clay fines, unconsolidated, low plasticity, moist.	
				CL	**SANDY LEAN CLAY WITH GRAVEL (CL)** - dk grayish brn 10YR4/2, 50% clay fines, 30% well graded subang gravel, 20% well graded subang sand, green mineralogy, medium plasticity, moist.	
160						fairly hard drilling
165						16:35 CR6+
		CC67	20	SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk grayish brn 10YR4/2, 50% well graded subang sand, 25% well graded ang to subang gravel, 25% clay fines, medium plasticity, wet.	
170						16:40 Cr6+
					- increasing fines	
175						

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SHEET 6 of 7	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 228.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 483.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,882.18	**EASTING (CCS NAD 27 Z 5):** 7,614,825.33	**DATE AND TIME STARTED:** 04/13/2004 2:00:00 PM / **DATE AND TIME COMPLETED:** 04/21/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: North Bat Cave Wash Topock, CA			**LOGGED BY:** S. Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
				GC	**CLAYEY GRAVEL WITH SAND (GC)** - dk grayish brn 10YR4/2, 50% well graded subang gravel, 30% well graded subang sand, 20% clay fines, medium plasticity, moist to dry.	16:45 Cr6+
180		CC68	20	SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 7.5YR4/3, 40% well graded subang sand, 30% well graded subang gravel, 30% clay fines, sand qtz, gneiss, amphiboles, gravel gneiss, medium plasticity, matrix supported, moist, reddish stains.	
					- gravels up to 3	
185						
190					- wetter, more sand and gravel	
195					- moist, reddish brn	
					- brn 7.5YR4/4, 60% well graded subang to ang f-c sand, 25% well graded subang to ang gravel, 15% clay fines, low plasticity, high dry strength, matrix supported, moist	
200		CC69	20		**BEDROCK (BR)** - Rock material, miocene conglomerate	13:00 Cr6+, fractures obliquely
					- increasing gravel up to 3 with depth	
205						13:05 Cr6+
					- decreasing gravel	
210						

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SHEET 7 of 7	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-37

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 228.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 483.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,882.18	**EASTING (CCS NAD 27 Z 5):** 7,614,825.33	**DATE AND TIME STARTED:** 04/13/2004 2:00:00 PM	**DATE AND TIME COMPLETED:** 04/21/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: North Bat Cave Wash Topock, CA			**LOGGED BY:** S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					BEDROCK (BR) - Rock material, miocene conglomerate	13:10 Cr6+, still fractures obliquely
				BR	- reddish brn, 30% gravel, consolidated, high dry strength, moist	
215						13:15 Cr6+
					- brn 7.5YR4/3, gravelly sand and clay, gravels up to 2, low plasticity, moist.	
220						
					- brick red color	
		CC70	10			
225						
					- more consolidated	digital photo of oblique fracture in red fanglomerate, photo #4

Boring Terminated at 228 ft

ABBREVIATIONS

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

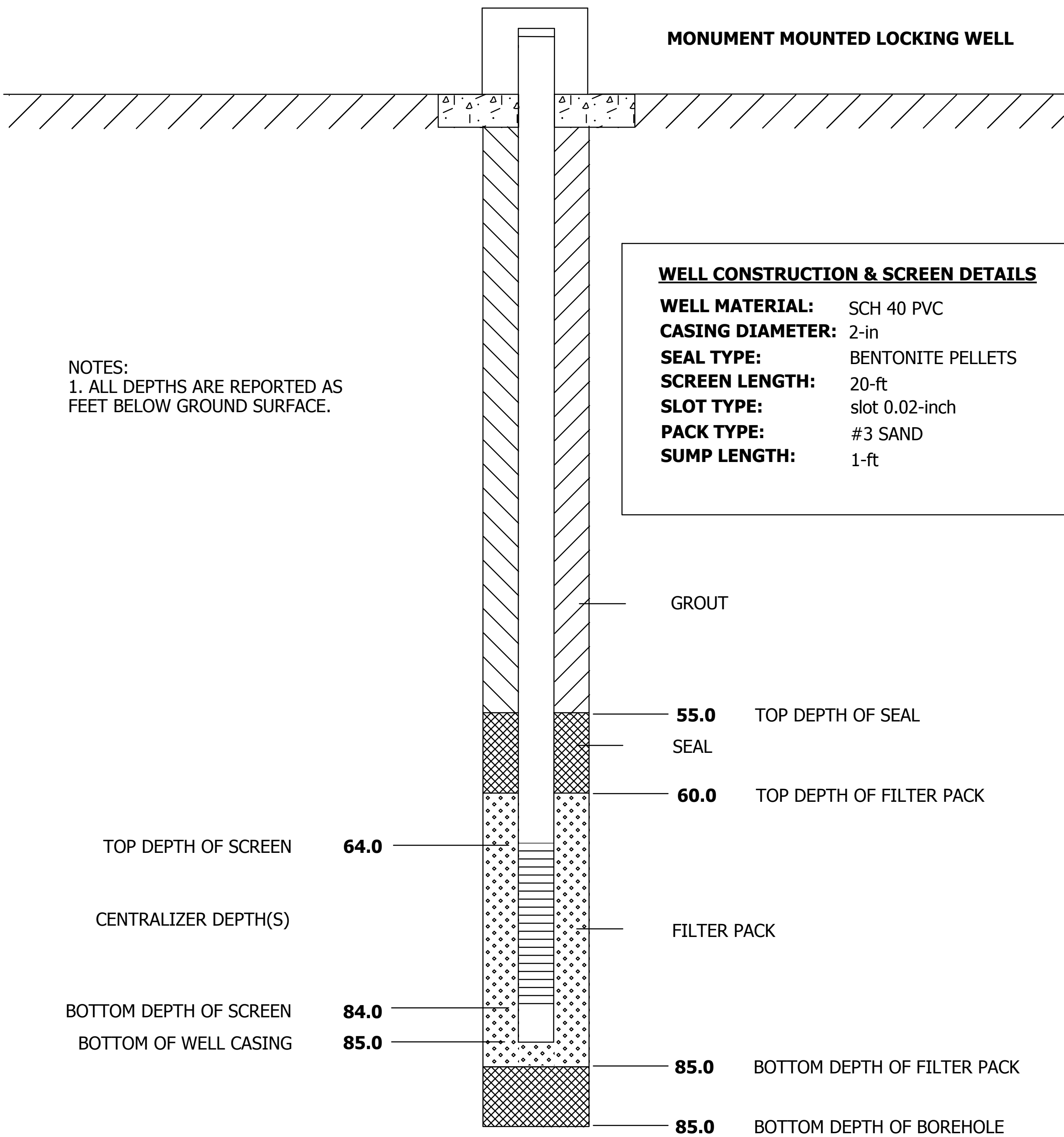
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-37S**

LOCATION: North Bat Cave Wash Topock, CA. - From extraction well bench head 500' to north, exit east to dirt road, 700' up steep slope to southeast, at crest of hill turn northeast and head 1000' down into wash.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 04/13/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 04/21/2004
LOGGER: S. Cooper	**WELL COMPLETION DATE:** 04/23/2004
TOP OF WELL CASING (NGVD 29): 485.97	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102869.45
GROUND SURFACE ELEVATION (NGVD 29): 483.50	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614827.87



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	1-ft

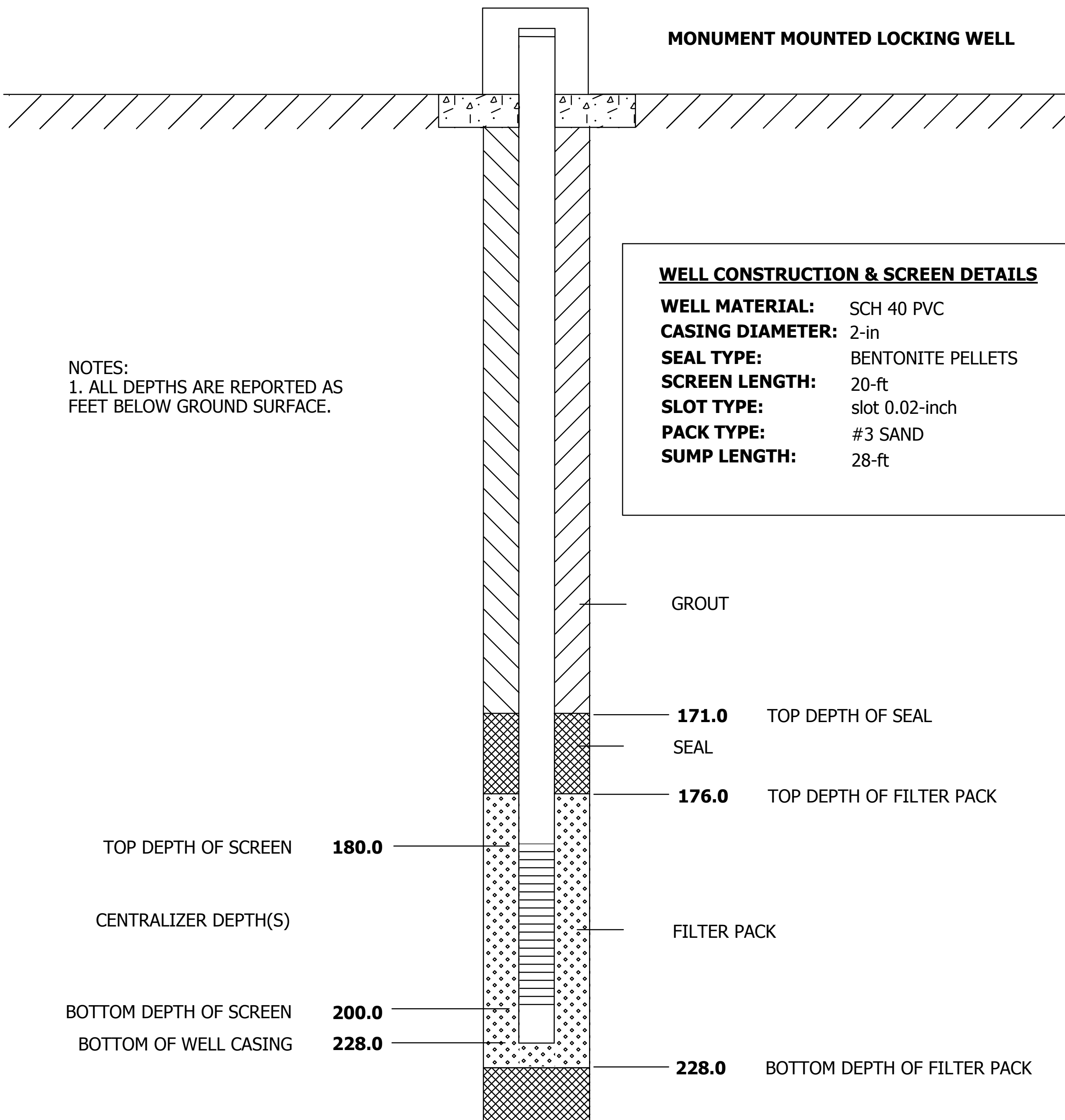
WELL DIAGRAM IS NOT TO SCALE

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-37D**

LOCATION: North Bat Cave Wash Topock, CA. - From extraction well bench head 500' to north, exit east to dirt road, 700' up steep slope to southeast, at crest of hill turn northeast and head 1000' down into wash.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 04/13/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 04/21/2004
LOGGER: S. Cooper	**WELL COMPLETION DATE:** 04/22/2004
TOP OF WELL CASING (NGVD 29): 486.19	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102882.18
GROUND SURFACE ELEVATION (NGVD 29): 483.70	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614825.33



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	28-ft

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

SHEET 1 of 5	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-38S

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)		HOLE DEPTH (ft): 130.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 522.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,279.65	EASTING (CCS NAD 27 Z 5): 7,614,918.75	DATE AND TIME STARTED: 04/11/2004	DATE AND TIME COMPLETED: 04/11/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: 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.			LOGGED BY: S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
5						
10						
15						
20						
25						
30						
35						

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-38S

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)		HOLE DEPTH (ft): 130.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 522.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,279.65	EASTING (CCS NAD 27 Z 5): 7,614,918.75	DATE AND TIME STARTED: 04/11/2004	DATE AND TIME COMPLETED: 04/11/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: 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.			LOGGED BY: S. Cooper	

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						
45						
50						
55						
60						
65						
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-38S

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)		HOLE DEPTH (ft): 130.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 522.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,279.65	EASTING (CCS NAD 27 Z 5): 7,614,918.75	DATE AND TIME STARTED: 04/11/2004	DATE AND TIME COMPLETED: 04/11/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: 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.			LOGGED BY: S. Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
75						
80		CC86	10	SC	**CLAYEY SAND (SC)** - lt olive brn 2.5YR5/3, 50% fines, 40% ang to subang c-f sand, 10% subang gravel up to 1, medium plasticity, wet.	hard drilling
85				GC	**CLAYEY GRAVEL (GC)** - 2.5YR5/3, 50% subang to subrnd gravel up to 0.5, 30% well graded subang f-c sand, 20% clayey fines, qtz, feldspar, amphiboles, high dry strength, medium plasticity, wet, multicolored mineralogy.	lots of gravel, hard drilling
90		CC87	12	SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk grayish brn 2.5YR4/2, 70% subrnd gravel up to 1, 20% well graded subang to subrnd c-f sand, 10% fines, gneiss, schist, high dry strength, no plasticity, moist.	
95				GC	**CLAYEY GRAVEL WITH SAND(GC)** - brn 10YR4/3, 40% well graded subang sand, 40% well graded subang to ang gravel, 20% fines, high dry strength, low plasticity, moist.	
100				GW/GC	**WELL GRADED GRAVEL WITH CLAY (GW/GC)** - dk grayish brn 10YR4/2, 40% well graded subang gravel up to 2, 10% well graded subang sand, 10% clay fines, high dry strength, no plasticity, moist.	no recovery
105						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-38S

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)		**HOLE DEPTH (ft):** 130.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 522.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,279.65	**EASTING (CCS NAD 27 Z 5):** 7,614,918.75	**DATE AND TIME STARTED:** 04/11/2004 — **DATE AND TIME COMPLETED:** 04/11/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: 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.			**LOGGED BY:** S. Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
110		CC88	8	GW/GC	**WELL GRADED GRAVEL WITH CLAY (GW/GC)** - dk grayish brn 10YR4/2, 40% well graded subang gravel up to 2, 10% well graded subang sand, 10% clay fines, high dry strength, no plasticity, moist.	core lost
115				GC	**CLAYEY GRAVEL WITH SAND (GC)** - brn 10YR4/3, 40% well graded subang to subrnd gravel, 30% fines, 20% well graded sand, high dry strength, low plasticity, moist.	
120				SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk grayish brn 10YR4/2, 40% well graded subang sand, 30% clay fines, 30% well graded subang gravel, high dry strength, medium plasticity, wet.	
125		CC89	11	GW/GC	**WELL GRADED GRAVEL WITH CLAY (GW/GC)** - dk grayish brn 10YR4/2, 40% well graded subang gravel up to 2, 10% well graded subang sand, 10% clay fines, high dry strength, no plasticity, moist.	
130	+				- 70% well graded ang to subang gravel up to 2, 20% well graded ang to subang c-f sand, 10% clay fines, qtz, feldspar, green mm, gneiss, m plasticity, dry, light gray 7.5YR7/1	

Boring Terminated at 130 ft

ABBREVIATIONS

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

CH2MHILL

SHEET 5 of 5	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-38S

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 5 2004)		**HOLE DEPTH (ft):** 130.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 522.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,279.65	**EASTING (CCS NAD 27 Z 5):** 7,614,918.75	**DATE AND TIME STARTED:** 04/11/2004 / **DATE AND TIME COMPLETED:** 04/11/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: 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.			**LOGGED BY:** S. Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

CH2MHILL

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
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.	
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						grain size
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.	lost all but top 2' of core. Broke drill pipe when attempting to retrieve logging based on mixed material
35						

CH2MHILL

SHEET 2 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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SC	**CLAYEY SAND (SC)** - 7.5YR6/1, 60% well graded ang to subang sand, 30% fines, 10% subang gravel up to 1.4, dry.	
					- 7.5YR5/3, 70% well graded ang sand, 30% fines, trace ang gravel, decreasing clay, cohesive, dry	9:15 lost bottom 2' of core to heat blowout
40						
					- increasing cementation	
45						grain size
				GC	**CLAYEY GRAVEL (GC)** - 50% well graded ang gravel to 3, 30% well graded ang sand, 20% fines, moderate cementation, dry.	
50						
				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.	
55						
60						
					- cobble layer	
					- 7.5YR7/2, 60% well graded ang sand, 30% fines, 10% well graded ang gravel, moist	
65						grain size (preserved core)
					- dry	
70						

CH2MHILL

SHEET 3 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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				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	
75						
				CL	**LEAN CLAY WITH SAND (CL)** - 10YR7/1, 80% fines, 20% well graded subang to ang sand, medium plasticity, dry.	casing ~173' @12:30
80						
				SC	**CLAYEY SAND (SC)** - 7.5YR5/2, 50% well graded ang sand, 30% ang f gravel, 20% clay, wet. - less gravel	
85						
				GC	**CLAYEY GRAVEL (GC)** - 50% f ang gravel, 30% well graded ang sand, 20% fines, high dry strength.	preserved core
90				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.	
				CL	**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.	
95				SC	**CLAYEY SAND (SC)** - 7.5YR5/3, decreasing clay.	
				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.	
100						preserved core', chromium jar qtz, green mineral with bonding
105						

CH2MHILL

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				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
110				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
115						chromium jar
				NR	No Recovery	preserved core
120						chromium jar
				GC	**CLAYEY GRAVEL (GC)** - 35% subang vf-f gravel, 35% fines, 30% well graded ang fines, m stiff, medium plasticity, wet, 7.5YR4/3.	
125				SC	**CLAYEY SAND (SC)** - slightly moist, not as cohesive, crumbly.	chromium jar
130				CL	**LEAN CLAY WITH SAND (CL)** - 80% silty clay, 20% f-m sand, soft, wet, 7.5YR5/3.	chromium jar
				GC	**CLAYEY GRAVEL (GC)** - increasing sand, increasing gravel, m stiff, wet, white, orange and bright green deposits of heavily weathered minerals, 10YR4/2.	
135						chromium jar
140						

SHEET 5 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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				GC	**CLAYEY GRAVEL (GC)** - 10YR4/2, white orange and bright green deposits of heavily weathered minerals, increasing sand, increasing gravel, m stiff, wet.	preserved core, chromium jar
				SC	**CLAYEY SAND (SC)** - grading into clayey sand	
145				GC	**CLAYEY GRAVEL (GC)** - ang f gravel, clay, uniform core, 10YR4/2.	grain size, chromium jar
150						preserved core, chromium jar
155						chromium jar
160				GP	**POORLY GRADED GRAVEL (GP)** - 75% ang vf-f gravel, 15% well graded ang sand, 10% fines, loose, very wet.	
165				GW/GC	**WELL GRADED GRAVEL WITH CLAY (GW/GC)** - 60% well graded ang f-c gravel up to 2, 30% well graded ang sand, 10% clay.	grain size
170				GC	**CLAYEY GRAVEL (GC)** - 7.5YR3/2, 25% clay, subrnd to ang gravel. - layer of heavily weathered rock with clay	
175				SC/GC	**CLAYEY SAND WITH GRAVEL (SC/GC)** - some reddish areas but mostly medium brn, very firm, slightly moist.	

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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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SC/GC	**CLAYEY SAND WITH GRAVEL (SC/GC)** - some reddish areas but mostly medium brn, very firm, slightly moist.	
				SC	**CLAYEY SAND (SC)** - 50% well graded sand, 30% fines, 20% f gravel, soft, wet, soft.	
180					- 65% well graded subang sand, 25% fines, 10% subang vf gravel, soft, very wet	
185					- loosely consolidated bedrock, f sand, multicolored, moist	
					- very stiff and moist	
190						
						refusal, broken bit
195					Boring Terminated at 195 ft	refusal, no core

ABBREVIATIONS

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

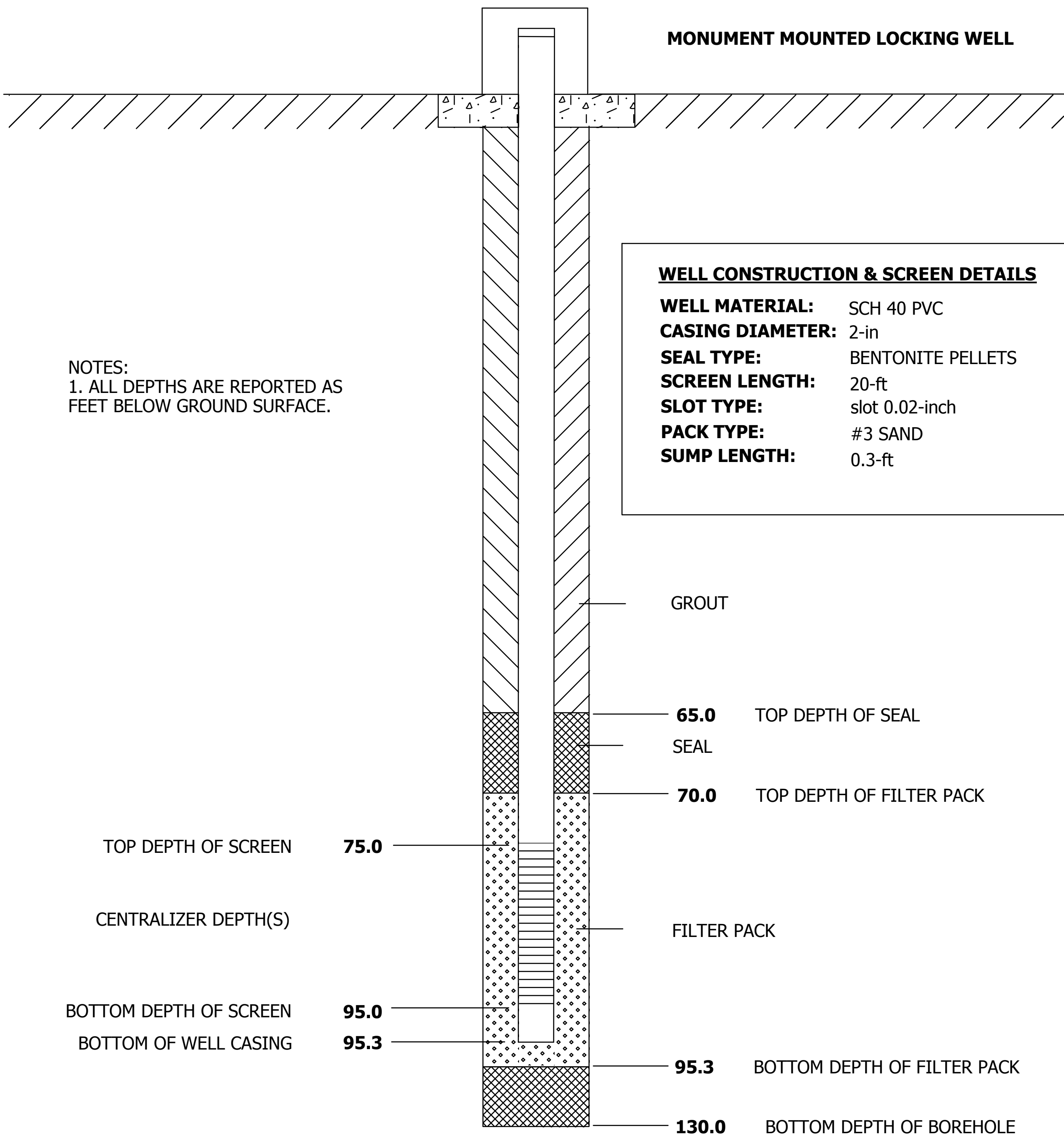
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-38S**

LOCATION: 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.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 04/11/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 04/11/2004
LOGGER: S. Cooper	**WELL COMPLETION DATE:** 04/12/2004
TOP OF WELL CASING (NGVD 29): 525.51	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101279.65
GROUND SURFACE ELEVATION (NGVD 29): 522.80	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614918.75



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

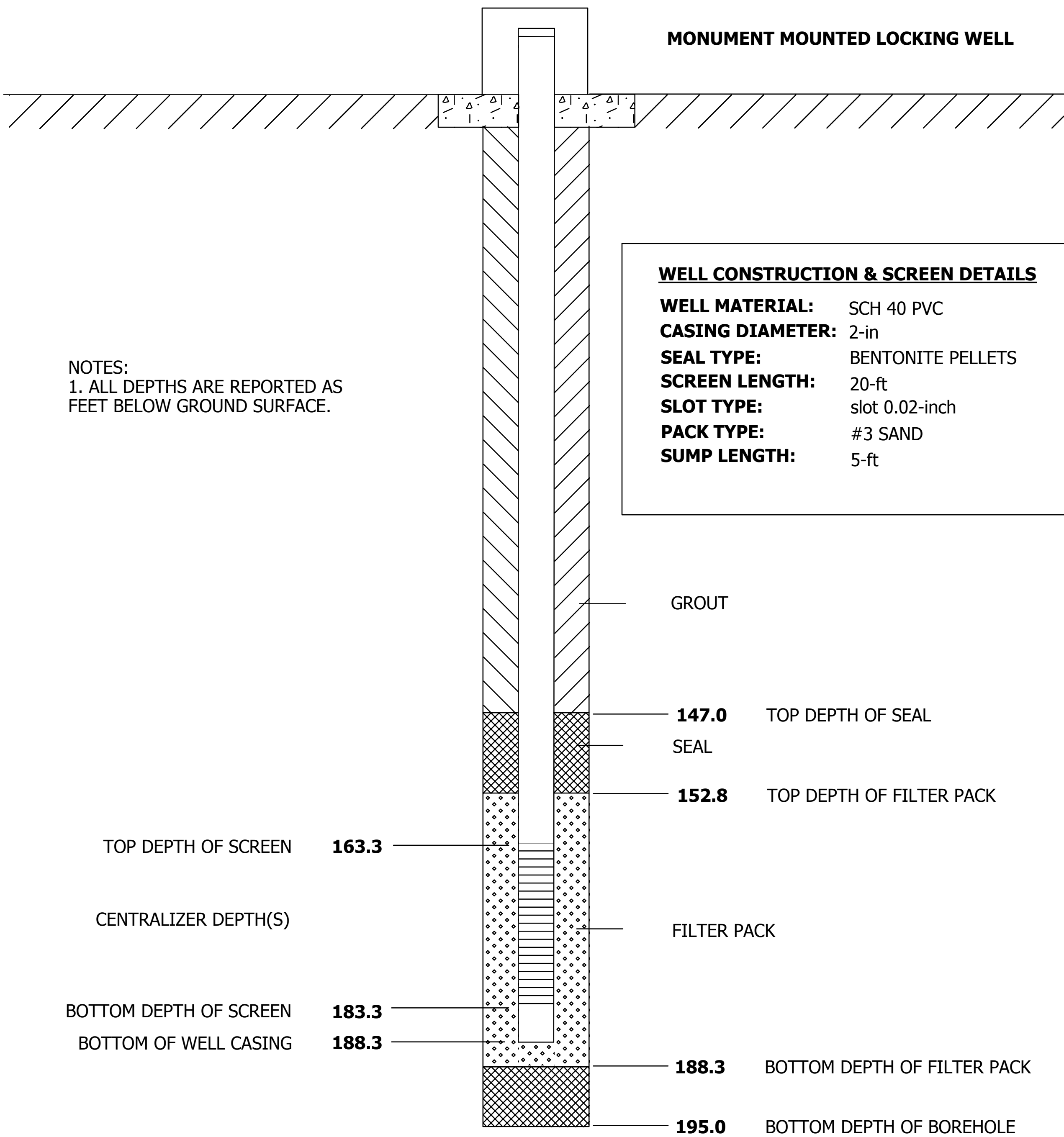
NOTES:
1. ALL DEPTHS ARE REPORTED AS FEET BELOW GROUND SURFACE.

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)
WELL NO: **MW-38D**	
LOCATION: 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.	
DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 04/06/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 04/11/2004
LOGGER: R. Edwards / S. Cooper	**WELL COMPLETION DATE:** 04/10/2004
TOP OF WELL CASING (NGVD 29): 525.31	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101264.32
GROUND SURFACE ELEVATION (NGVD 29): 523.00	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614918.79



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	5-ft

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-39

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 118.3	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 465.3 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,494.95	**EASTING (CCS NAD 27 Z 5):** 7,616,099.30	**DATE AND TIME STARTED:** 04/19/2004 — **DATE AND TIME COMPLETED:** 04/20/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Limited Access Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.		**LOGGED BY:** J. Wellmeyer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, f-m sand, well rnd, qtz, loose, some moisture-dry.	4/19/04, 13:15 begin drilling pilot hole
5		CC90	8			
10						
		CC91	10		- f-m sand, some organic material, well rnd, qtz, loose	saturated
15						
				SC	**CLAYEY SAND (SC)** - dk brn sand with dk gray clay 7.5YR3/2, f-m sand, well rnd, loose.	
20				CL	**CLAY WITH SAND (CL)** - dk brn 7.5YR3/2, 10% f sand, some organic material, soft, f black laminations.	
		CC92	10	SC	**CLAYEY SAND (SC)** - dk brn sand with dk gray clay 7.5YR3/2, f-m sand, well rnd, loose. - organic mat	
25				CL	**CLAY WITH SAND (CL)** - dk brn 7.5YR3/2, 10% f sand, some organic material, soft, f black laminations.	
				SP	**POORLY GRADED SAND (SP)** - yellowish brn, 70% m sand, 30% f sand, fining upward, well rnd, loose, wet.	
				SP/SC	**POORLY GRADED SAND WITH CLAY (SP/SC)** - dk grayish brn 7.5YR3/2, 20% clay, m sand, fining upward, well rnd.	
30				SP	**POORLY GRADED SAND (SP)** - dk brn 7.5YR3/2, f-m sand, trace fines, well rnd, qtz, loose, wet.	
		CC93	10	SW	**WELL GRADED SAND (SW)** - yellowish brn, f-c sand, well rnd, qtz, soft, wet. - firming	
35						

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SHEET 2 of 4	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-39

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 118.3	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 465.3 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,494.95	**EASTING (CCS NAD 27 Z 5):** 7,616,099.30	**DATE AND TIME STARTED:** 04/19/2004 / **DATE AND TIME COMPLETED:** 04/20/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Limited Access Rig with continuous 4 core, 6 casing
LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.			**LOGGED BY:** J. Wellmeyer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND (SW)** - yellowish brn, f-c sand, well rnd, qtz, soft, wet. - thin black organic laminations, loose - dark gray brn, f-c sand, fining upwards, well rnd, loose, wet	
40		CC94	10			
				CH	**FAT CLAY (CH)** - dk grayish brn 10YR4/2, f black organic lamination, soft-firm, greasy.	
				SP	**POORLY GRADED SAND (SP)** - dk grayish brn, mostly rnd qtz c sand, 5% subang mm gravel up to 0.25, clay pockets, some organics, fining upwards, loose.	
45				GW	**WELL GRADED GRAVEL (GW)** - brn, f gravel, cobbles, sand, trace fines, very well rnd, clast supported.	
				CL	**CLAY WITH COBBLES (CL)** - brn 10YR4/3, orange iron staining, 10% sand, trace silt, large cobbles, some laminated organics.	
				SP	**POORLY GRADED SAND (SP)** - dk grayish brn, m sand, thin clay pockets, well rnd, soft, wet.	
50		CC95	10			
				ML	**SILT WITH GRAVEL (ML)** - brn, 40% ang gravel up to 1.75, silt supported, partially cemented, soft, wet at depth.	
55						
				SP	**POORLY GRADED SAND (SP)** - brn, f sand, 5% silt, cobbles up to 2, subrnd, soft, loose, wet. - sparse gravel, 4 basalt cobble	
60		CC96	10			refusal, hard drilling chatter
				GW	**WELL GRADED GRAVEL (GW)** - dk brn 7.5YR3/4, gravels up to 2.5, m-c sand, 5% fines, subrnd to ang, mm and volcanic clasts, loose, clast supported, musky odor, wet.	
65						
					- dark reddish brn 5YR3/3, subround to ang gravels up to 1.5, 10% fines, metamorphic clasts, clast supported.	hard drilling
70						

CH2MHILL

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-39

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 118.3	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 465.3 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,494.95	**EASTING (CCS NAD 27 Z 5):** 7,616,099.30	**DATE AND TIME STARTED:** 04/19/2004	**DATE AND TIME COMPLETED:** 04/20/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Limited Access Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.		**LOGGED BY:** J. Wellmeyer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
		CC97	10	GW	**WELL GRADED GRAVEL (GW)** - dk brn 7.5YR3/4, gravels up to 2.5, m-c sand, 5% fines, subrnd to ang, mm and volcanic clasts, loose, clast supported, musky odor, wet.	
					- cemented sands & gravels up to 2 fining upwards, silt increasing to 15%, green mm	
75						
80		CC98	9			hard drilling
					- brn 7.5YR4/3	
85						hard drilling
				GM	**SILTY GRAVEL WITH SAND (GM)** - dk reddish brn 5YR3/2, 25% silt, 5% sand, subang gravels, soft to firm, gravel supported.	
90		CC99	9			
				GW	**WELL GRADED GRAVEL (GW)** - dk reddish brn 5YR3/2, pea gravel up to 1 1/2, 5% clay, rnd to ang, loose, wet.	
95				GW/GC	**WELL GRADED GRAVELS WITH CLAY (GW/GC)** - dk reddish brn, 30% clay, ang clasts, compacted, dry.	hard drilling
					- 25% clay, shattered gravels, green mm, clast supported, compacted, dry, dark reddish brn	
					- 20% clay, subround to ang, fining upwards, slightly loose, moist, dark reddish brn	
100		CC100	10			stop drilling @ 17:15, resume 4/20/04, 8:20, hard drilling
105						

CH2MHILL

SHEET 4 of 4	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-39

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 118.3	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 465.3 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,494.95	**EASTING (CCS NAD 27 Z 5):** 7,616,099.30	**DATE AND TIME STARTED:** 04/19/2004	**DATE AND TIME COMPLETED:** 04/20/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Limited Access Rig with continuous 4 core, 6 casing	
LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.			**LOGGED BY:** J. Wellmeyer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED GRAVELS WITH CLAY (GW/GC) - dk reddish brn, 35% clay, some silt, subang clasts, tight and compacted, clast supported, dry.	hard drilling
110						hard drilling, drill chatter
				GW/GC		chatter refusal
		CC101	10			
115						
					- 60% clay, 35% f sand to f gravel, 5% silt, shattered, dry	stop 4/20/04, 10:15, bottom of boring
					Boring Terminated at 118.3 ft	

ABBREVIATIONS

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

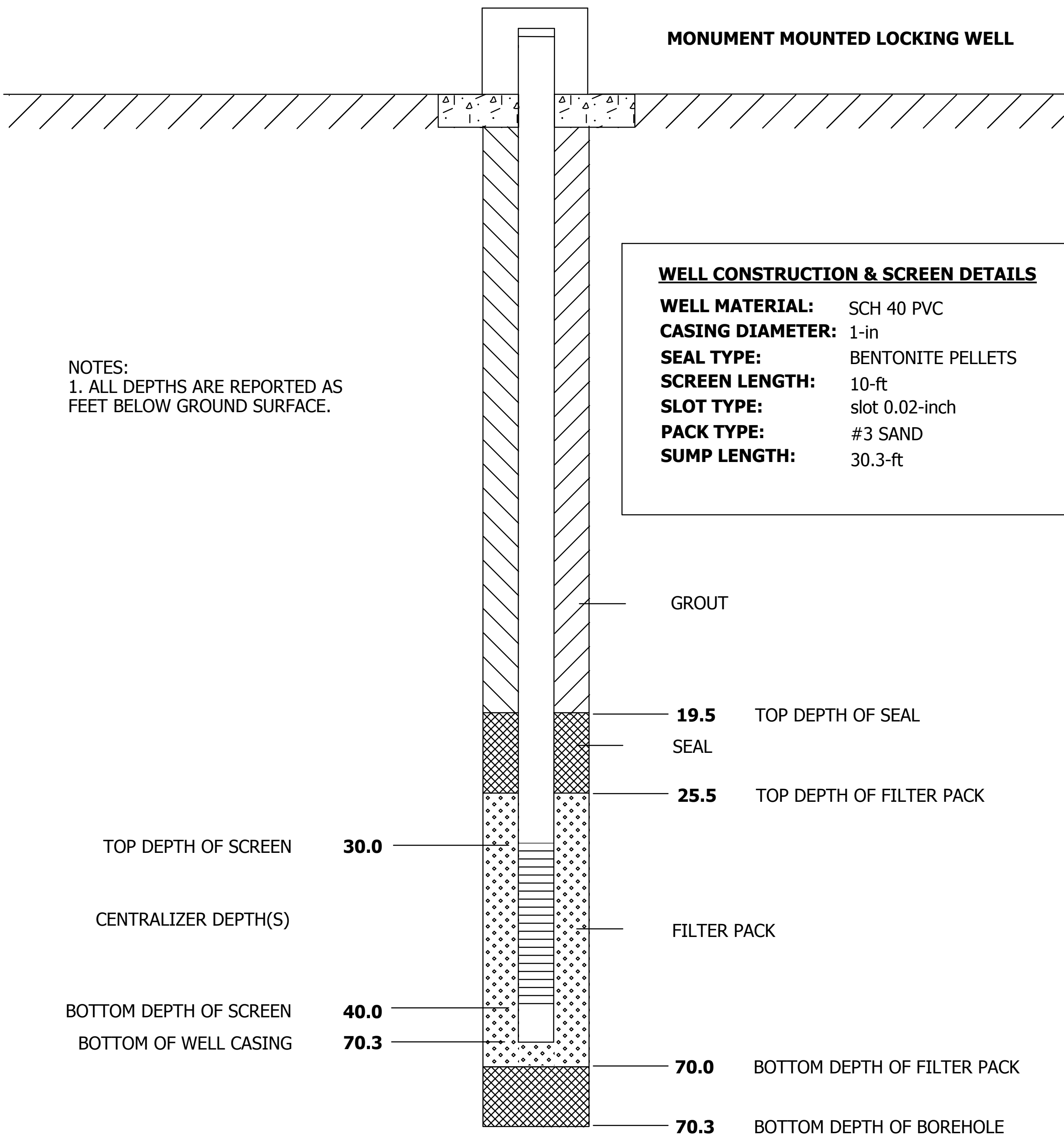
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-39-040**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** ---
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** ---
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/29/2004
TOP OF WELL CASING (NGVD 29): 468.02	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102506.22
GROUND SURFACE ELEVATION (NGVD 29): 465.20	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616091.44



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	30.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

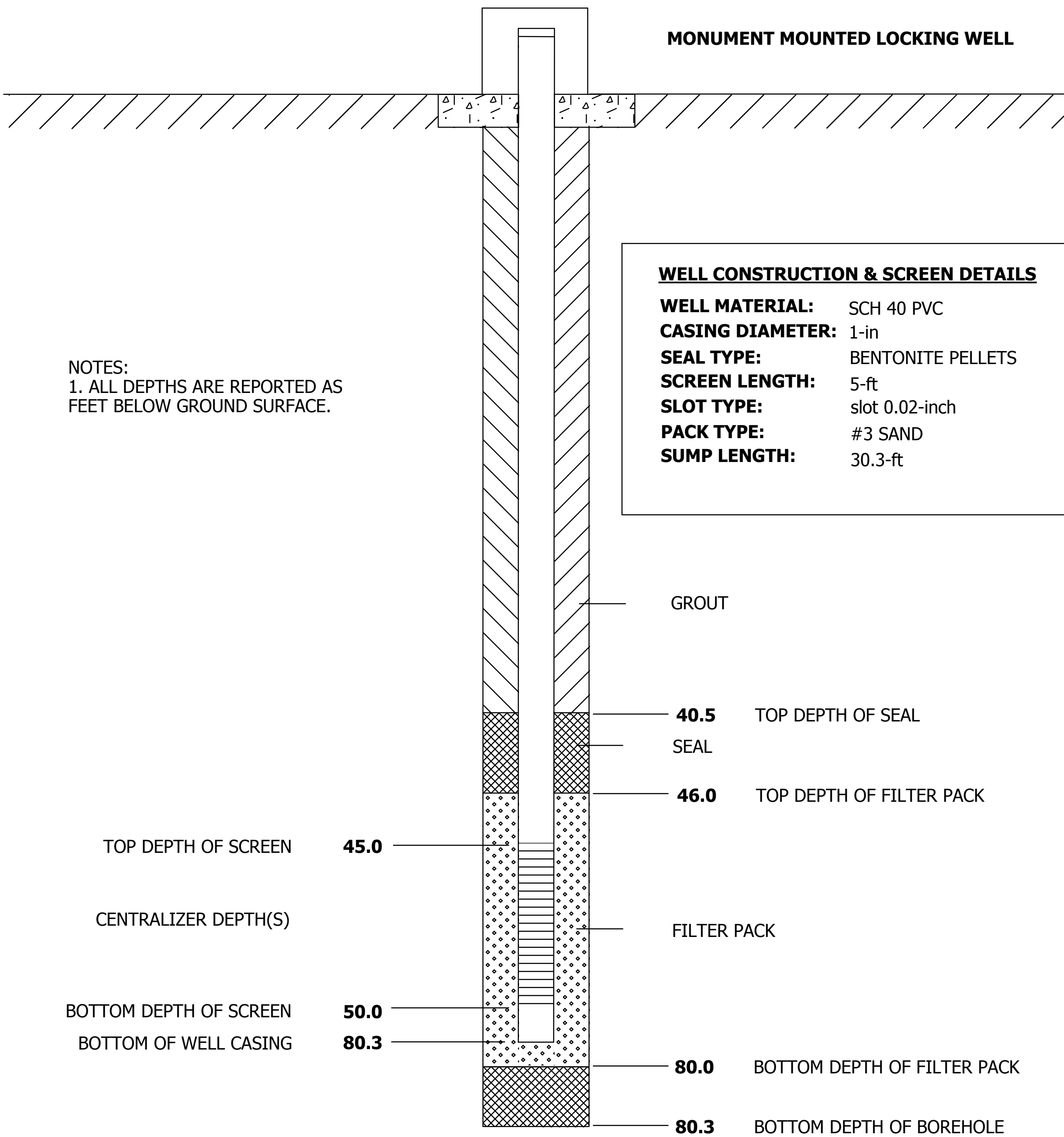
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-39-050**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** ---
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** ---
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/28/2004
TOP OF WELL CASING (NGVD 29): 467.93	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102498.75
GROUND SURFACE ELEVATION (NGVD 29): 465.10	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616095.96



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	5-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	30.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

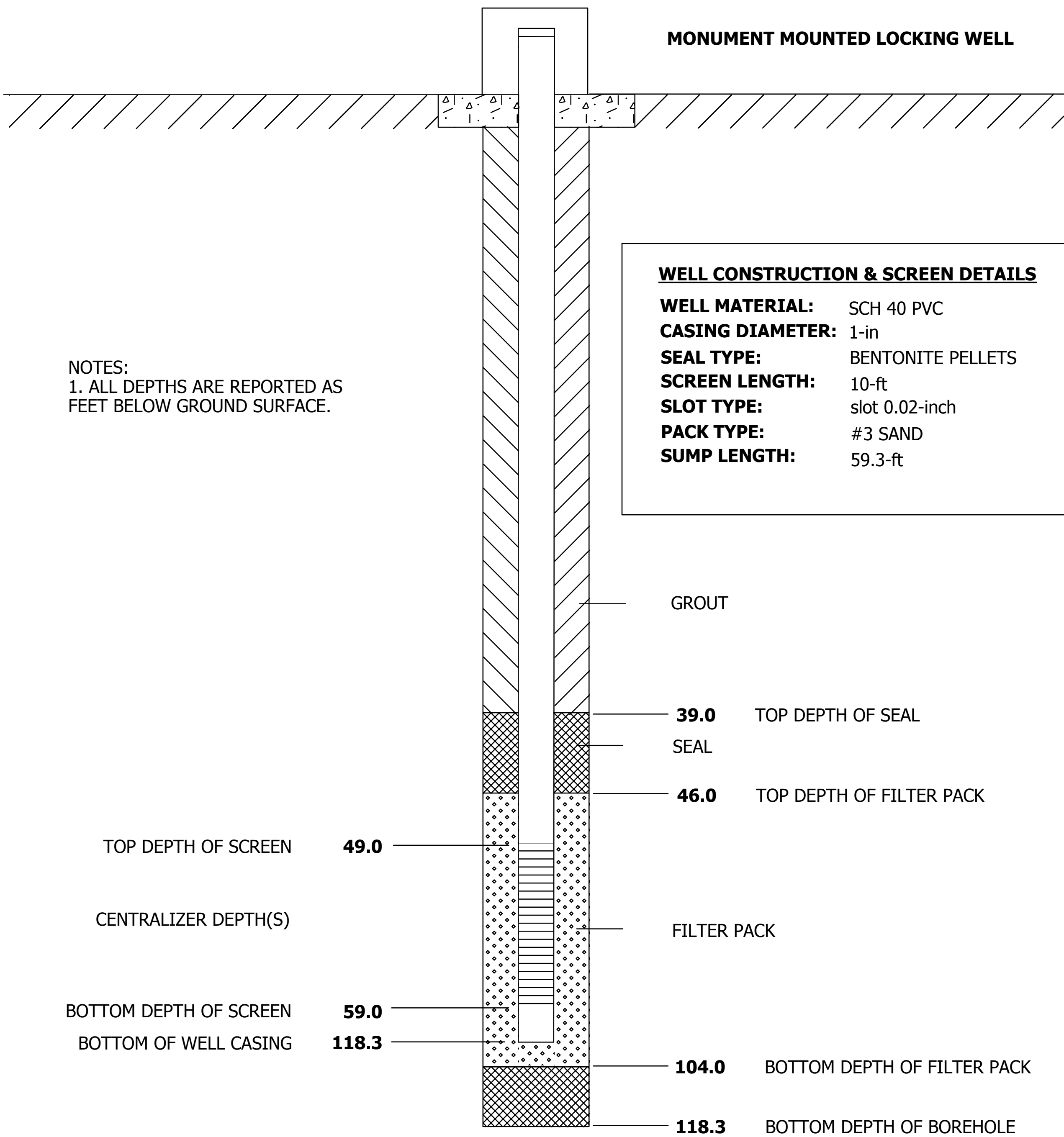
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-39-060**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** ---
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** ---
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/22/2004
TOP OF WELL CASING (NGVD 29): 468.00	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102495.05
GROUND SURFACE ELEVATION (NGVD 29): 465.30	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616099.45



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	59.3-ft

WELL DIAGRAM IS NOT TO SCALE

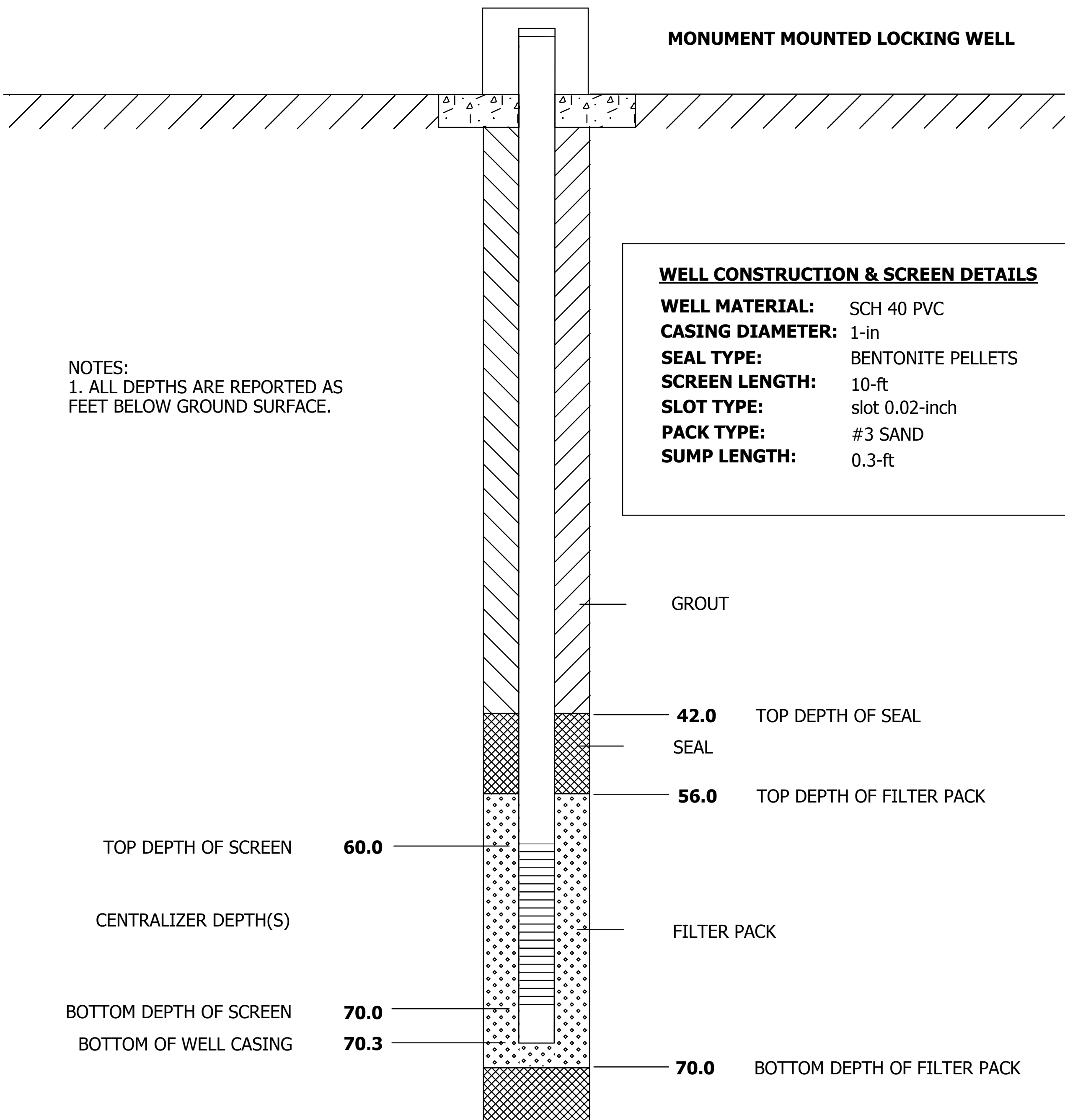
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-39-070**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** ---
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** ---
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/29/2004
TOP OF WELL CASING (NGVD 29): 468.02	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102506.30
GROUND SURFACE ELEVATION (NGVD 29): 465.20	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616091.38



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

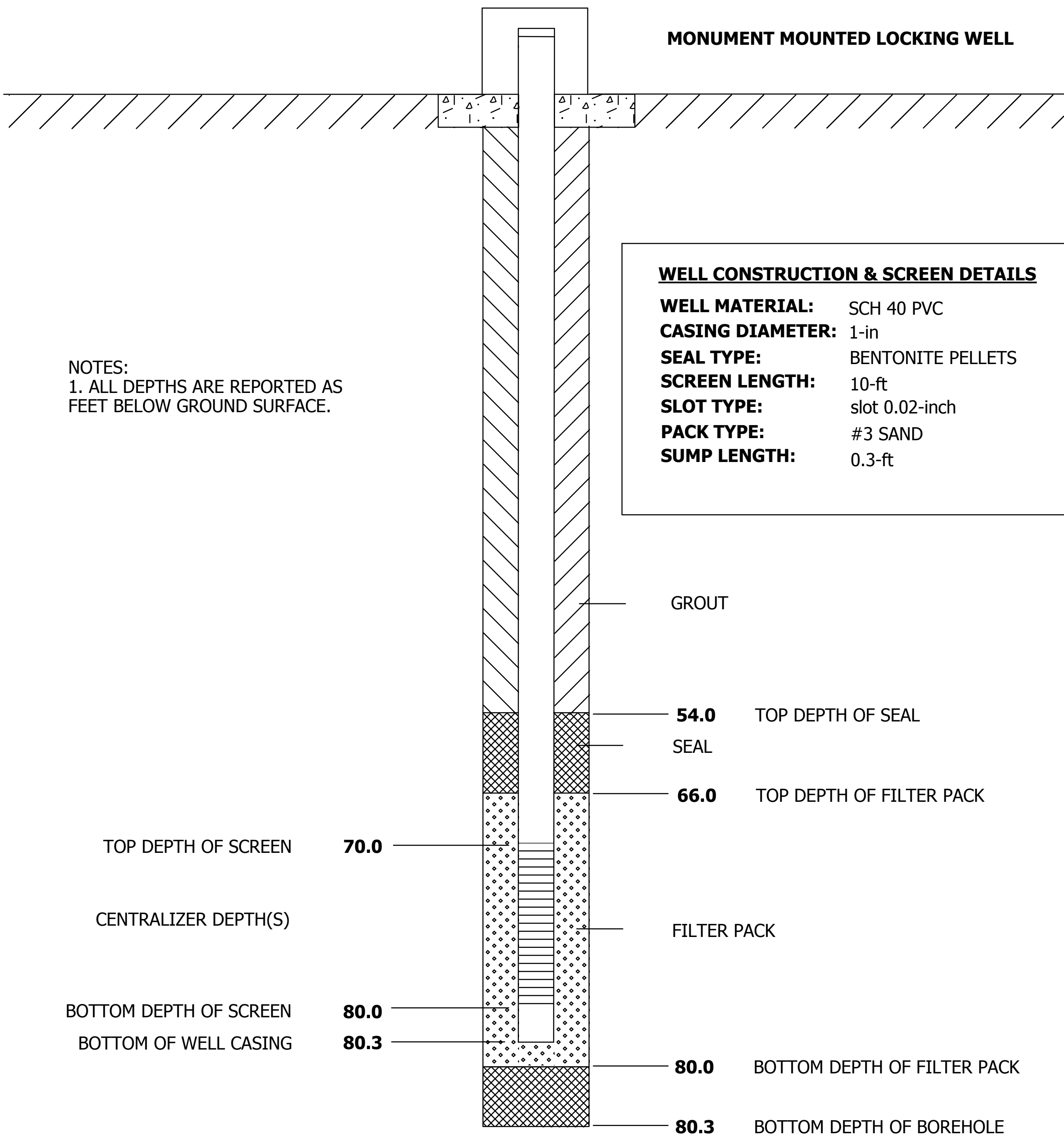
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-39-080**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** ---
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** ---
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/28/2004
TOP OF WELL CASING (NGVD 29): 467.92	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102498.83
GROUND SURFACE ELEVATION (NGVD 29): 465.10	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616095.86



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	1-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	10-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

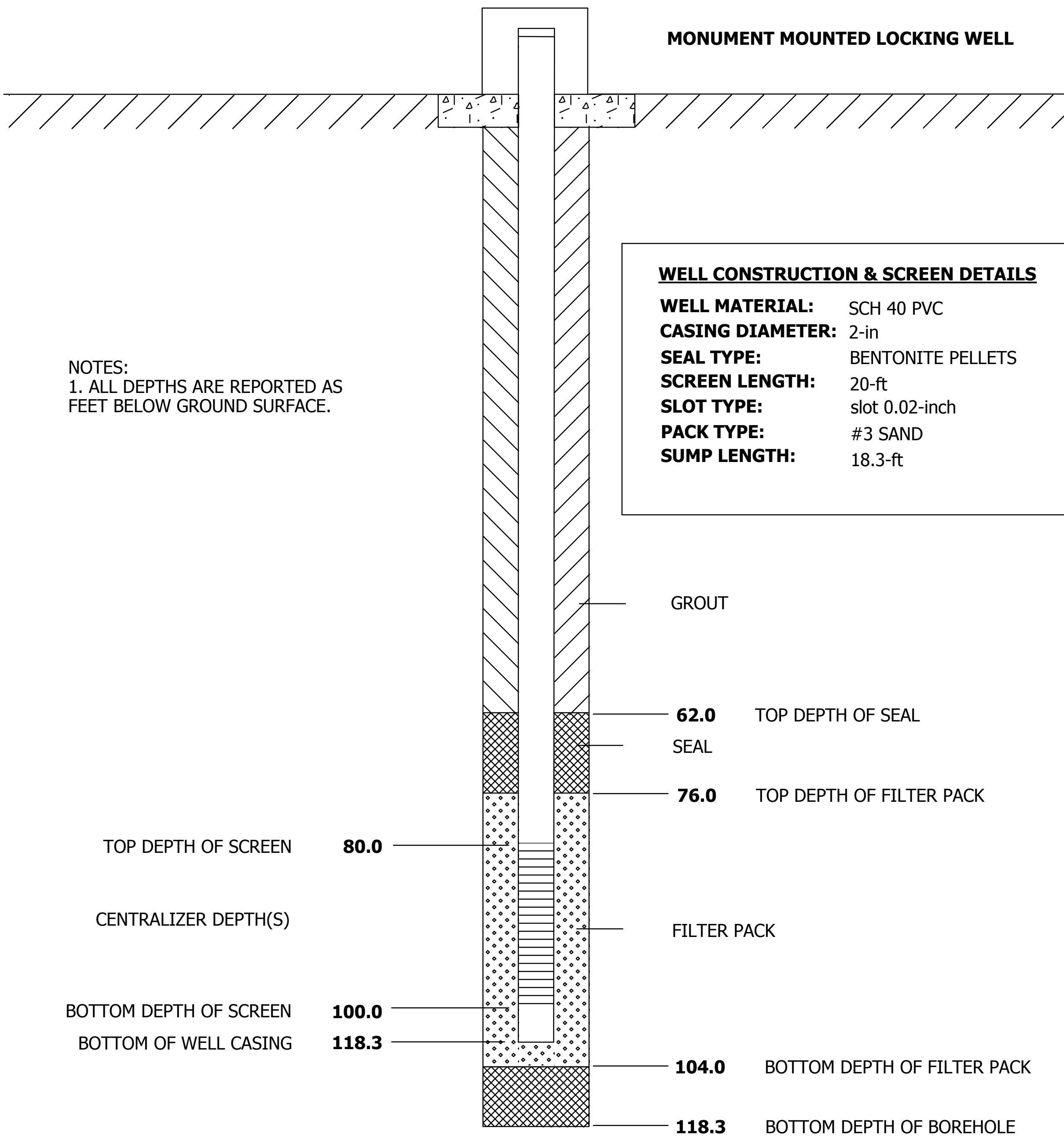
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-39-100**

LOCATION: Floodplain well field Topock, CA. - Central dune area, approximately 300' north of railroad, 150' east of extraction well bench.

DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	**DRILLING START DATE:** ---
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** ---
LOGGER: J. Wellmeyer	**WELL COMPLETION DATE:** 04/22/2004
TOP OF WELL CASING (NGVD 29): 468.01	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102494.95
GROUND SURFACE ELEVATION (NGVD 29): 465.30	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616099.30



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	18.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 268.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 566.5 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,101,864.35	**EASTING (CCS NAD 27 Z 5):** 7,614,370.53	**DATE AND TIME STARTED:** 04/26/2004 4:30:00 PM / **DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.		**LOGGED BY:** T. Henderson, S.Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
0–8					Lost setting conductor pipe	lost setting conductor pipe
8–18	8–18	CC102	10	SW/SC	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW/SC)** - dk grayish brn 2.5YR4/2, 60% well graded subang sand, 30% well graded subang to subrnd gravel up to 3, 10% fines, schist, gneiss, qtz, no plasticity, wet.	water added to push core out
18–28	18–28	CC103	10	SW/SC	- dark grayish brn 10YR4/2, gravel up to 2, moist - dry - dark yellowish brn 10YR4/4, 70% well graded subang sand, 20% well graded subang f gravel up to 0.5, 10% clay fines, slightly consolidated, matrix supported, dry - light gray 10YR7/1, more gravel, cobbles up to 1.5	
28–35	28–35	CC104	10	SW/SC		

CH2MHILL

SHEET 2 of 9	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 268.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 566.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,864.35	**EASTING (CCS NAD 27 Z 5):** 7,614,370.53	**DATE AND TIME STARTED:** 04/26/2004 4:30:00 PM	**DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			**LOGGED BY:** T. Henderson, S.Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND WITH CLAY AND GRAVEL (SW/SC) - dk grayish brn 2.5YR4/2, 60% well graded subang sand, 30% well graded subang to subrnd gravel up to 3, 10% fines, schist, gneiss, qtz, no plasticity, wet.	
40						
		CC105	10			
45						
50					- light brnish gray 10YR6/2, gravel up to 1, unconsolidated, dry	
		CC106	10	SW/SC		
55					- slightly more gravel, ang clasts of qtz, amphiboles, green mineralogy, more consolidated	
					- brn 10YR4/3, dry to moist	
60						driller reports drilling's been hard all the way through
		CC107	10			
65					- cobbles up to 2	
					- less gravel, dry	
70						

CH2MHILL

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 268.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 566.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,864.35	**EASTING (CCS NAD 27 Z 5):** 7,614,370.53	**DATE AND TIME STARTED:** 04/26/2004 4:30:00 PM; **DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			**LOGGED BY:** T. Henderson, S.Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC108	10	SW/SC	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW/SC)** - dk grayish brn 2.5YR4/2, 60% well graded subang sand, 30% well graded subang to subrnd gravel up to 3, 10% fines, schist, gneiss, qtz, no plasticity, wet.	
					-30% gravel, ang mineralogy, gneiss, qtz, feldspar, green mm	
75						
					- moist	
80		CC109	10			
85				GW/GM	**WELL GRADED GRAVEL WITH SILT AND SAND (GW/GM)** - gray 10YR6/1, 50% well graded subang gravel up to 3.5, 40% well graded subang sand, 10% fines, no plasticity, unconsolidated, dry.	
		CC110	10	SC	**CLAYEY GRAVEL WITH SAND (SC)** - dk grayish brn 10YR4/2, 60% well graded ang to subang sand, 20% well graded subang gravel up to 0.5, 20% fines, medium plasticity, matrix supported, wet.	drillers added water to get core out.
90						
95						
					- light brnish gray 10YR6/2, 20% f sand, unconsolidated, dry	
		CC111	10		- grayish brn 2.5YR5/2, 40% well graded subang sand, 40% fines, 20% well graded subround to subang gravel up to 0.5, high plasticity, wet	
100					- sandier	began Cr6+ sampling here. MW-40D-100
					- brn 7.5YR4/3, reddish staining, 60% well graded subang sand, 20% well graded subang gravel up to 1, 20% clay fines, medium plasticity	
105						

CH2MHILL

SHEET 4 of 9	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 268.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 566.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,864.35	**EASTING (CCS NAD 27 Z 5):** 7,614,370.53	**DATE AND TIME STARTED:** 04/26/2004 4:30:00 PM	**DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			**LOGGED BY:** T. Henderson, S.Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					CLAYEY GRAVEL WITH SAND (SC) - dk grayish brn 10YR4/2, 60% well graded ang to subang sand, 20% well graded subang gravel up to 0.5, 20% fines, matrix supported, medium plasticity, wet.	
					- more gravel	
110					- low plasticity, moist	
		CC112	*			
115					- slightly coarser grained sand	
						very wet, drillers lost 2'
120					- clayey sand with gravel, wet	
		CC113	8	SC		
125					- brn 7.5YR4/3	
					- dark grayish brn 10YR4/2, m-c sand, gneiss, feldspar, green mm, matrix supported, low plasticity, wet	
130						
		CC114	10			
135					- more clay, moist	
					- wet	
					- dry	
140						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 268.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 566.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,864.35	EASTING (CCS NAD 27 Z 5): 7,614,370.53	DATE AND TIME STARTED: 04/26/2004 4:30:00 PM	DATE AND TIME COMPLETED: 05/01/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			LOGGED BY: T. Henderson, S.Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
145		CC115	20	SC	**CLAYEY GRAVEL WITH SAND (SC)** - dk grayish brn 10YR4/2, 60% well graded ang to subang sand, 20% well graded subang gravel up to 0.5, 20% fines, matrix supported, medium plasticity, wet.	9:05 Cr6+ and clazone
150				SM	**SILTY SAND WITH GRAVEL (SM)** - lt gray 10YR7/2, 60% well graded f-c sand, 20% f silt, 15% well graded subang to subrnd gravel, unconsolidated, dry.	9:15 Cr6+
155				SC	**CLAYEY GRAVEL WITH SAND (SC)** - brn 10YR4/3, 60% well graded subang f-c sand, 20% well graded subang gravel up to 0.5, 20% fines, consolidated, low plasticity, matrix supported, moist.	Cr6+
160		CC116	10	SP/SM	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP/SM)** - dk grayish brn 2.5YR4/2, 60% poorly graded m sand, 30% well graded subrnd to subang gravel, 10% fines, no plasticity, matrix supported, moist.	
165				SC	**CLAYEY GRAVEL WITH SAND (SC)** - dk grayish brn 10YR4/2, 45% well graded subang sand, 30% clay fines, 25% well graded subang gravel up to 1, qtz, feldspar, green mm, gneiss, matrix supported, moist.	
					- 55% sand	
170					- increased gravel up to 1	
		CC117	*			
175					- poorly graded m sand	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 268.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 566.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,864.35	**EASTING (CCS NAD 27 Z 5):** 7,614,370.53	**DATE AND TIME STARTED:** 04/26/2004 4:30:00 PM / **DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			**LOGGED BY:** T. Henderson, S.Cooper

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SC	**CLAYEY GRAVEL WITH SAND (SC)** - dk grayish brn 10YR4/2, 45% well graded subang sand, 30% clay fines, 25% well graded subang gravel up to 1, qtz, feldspar, green mm, gneiss, matrix supported, moist.	
					- 70% poorly graded ang to subang m-c sand, 15% well graded subang gravel, 15% fines, no plasticity, wet	
180					- 50% well graded subang sand, 40% fines, 10% well graded subang gravel up to 1, medium dry strength, m plasticity, moist, brn 10YR4/3	
					- red staining, more gravel, more cohesive, harder	
185					- coarser sand	
		CC118	20			
190				ML	**SANDY SILT WITH GRAVEL (ML)** - brn 10YR4/3, 60% fines, 30% well graded sand and gravel, matrix supported, very high dry strength, low plasticity, moist.	
				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 10YR4/3, 50% well graded subang sand, 40% fines, 10% well graded subang gravel up to 0.5, low plasticity, moist.	
195					- broken up	
200					- gravel up to 2	
		CC119	7			
205					- small brick-red colored lens	only recovered to 205' on this run. However 205-208' was recovered on next run
210						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 268.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 566.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,864.35	EASTING (CCS NAD 27 Z 5): 7,614,370.53	DATE AND TIME STARTED: 04/26/2004 4:30:00 PM	DATE AND TIME COMPLETED: 05/01/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			LOGGED BY: T. Henderson, S.Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC120	13	SP/SM	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP/SM)** - dk grayish brn 10YR4/2, 70% poorly graded subang m-c sand, 20% well graded gravel up to 1, 10% fines, qtz, feldspar, mm, unconsolidated, no plasticity, wet.	
215					**CLAYEY GRAVEL WITH SAND (SC)** - brn 7.5YR4/4, reddish staining, 50% well graded subang sand, 30% well graded subang gravel, 20% fines, matrix supported, high dry strength, medium plasticity, moist.	
220					- dark grayish brn 10YR4/2, 60% well graded subang sand, 30% well graded subang gravel, 20% clay fines.	
225					- more clay	
		CC121	20	SC		
230					- red stains, drier	
235						
240					- dark grayish brn 10YR4/2	
					- rnd gravels	
245						

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 268.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 566.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,864.35	EASTING (CCS NAD 27 Z 5): 7,614,370.53	DATE AND TIME STARTED: 04/26/2004 4:30:00 PM	DATE AND TIME COMPLETED: 05/01/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			LOGGED BY: T. Henderson, S.Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC122	*	SC	**CLAYEY GRAVEL WITH SAND (SC)** - brn 7.5YR4/4, reddish staining, 60% well graded subang sand, 30% well graded subang gravel, 10% fines, high dry strength, medium plasticity, matrix supported, moist. - ang gravels	
250						
				CL	**LEAN CLAY (CL)** - brn 10YR4/3, 80% clay fines, 10% well graded sand, 10% well graded subang gravel up to 0.5, high plasticity, moist.	
		CC123	15	SP	**POORLY GRADED SAND WITH GRAVEL (SP)** - brn 7.5YR4/3, 80% poorly graded subang f-m sand, 15% silt fines, 5% well graded subang gravel up to 2, igneous and mm minerals, m density, no plasticity, wet. igneous and metamorphic minerals	
255						
				SM	**SILTY SAND WITH GRAVEL (SM)** - 15% gravel, 15% fines.	
260						
				SC	**CLAYEY GRAVEL WITH SAND (SC)** - brn 7.5YR4/3, 25% fines, no plasticity, slightly sticky, wet.	
				GC	**CLAYEY GRAVEL (GC)** - lt greenish gray (10YR7/1) and brn (7.5YR4/2), 60% ang gravel up to 2, 25% fines, 15% well graded fines, very stiff, moist to dry.	
265						
				BR	**SILTY SAND** - 20% ang gravel up to 1, 15% fines, moist to dry, reddish brn 2.5YR4/4.	
					Boring Terminated at 268 ft	pipe breaks at 268' bgs, becomes very difficult to drill

ABBREVIATIONS

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

CH2MHILL

SHEET 9 of 9	**PROJECT NUMBER:** 315024.IM.02	**BORING NUMBER:** MW-40

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 268.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 566.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,864.35	**EASTING (CCS NAD 27 Z 5):** 7,614,370.53	**DATE AND TIME STARTED:** 04/26/2004 4:30:00 PM	**DATE AND TIME COMPLETED:** 05/01/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Access Rig with continuous 4 core, 6 casing	
LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.			**LOGGED BY:** T. Henderson, S.Cooper	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

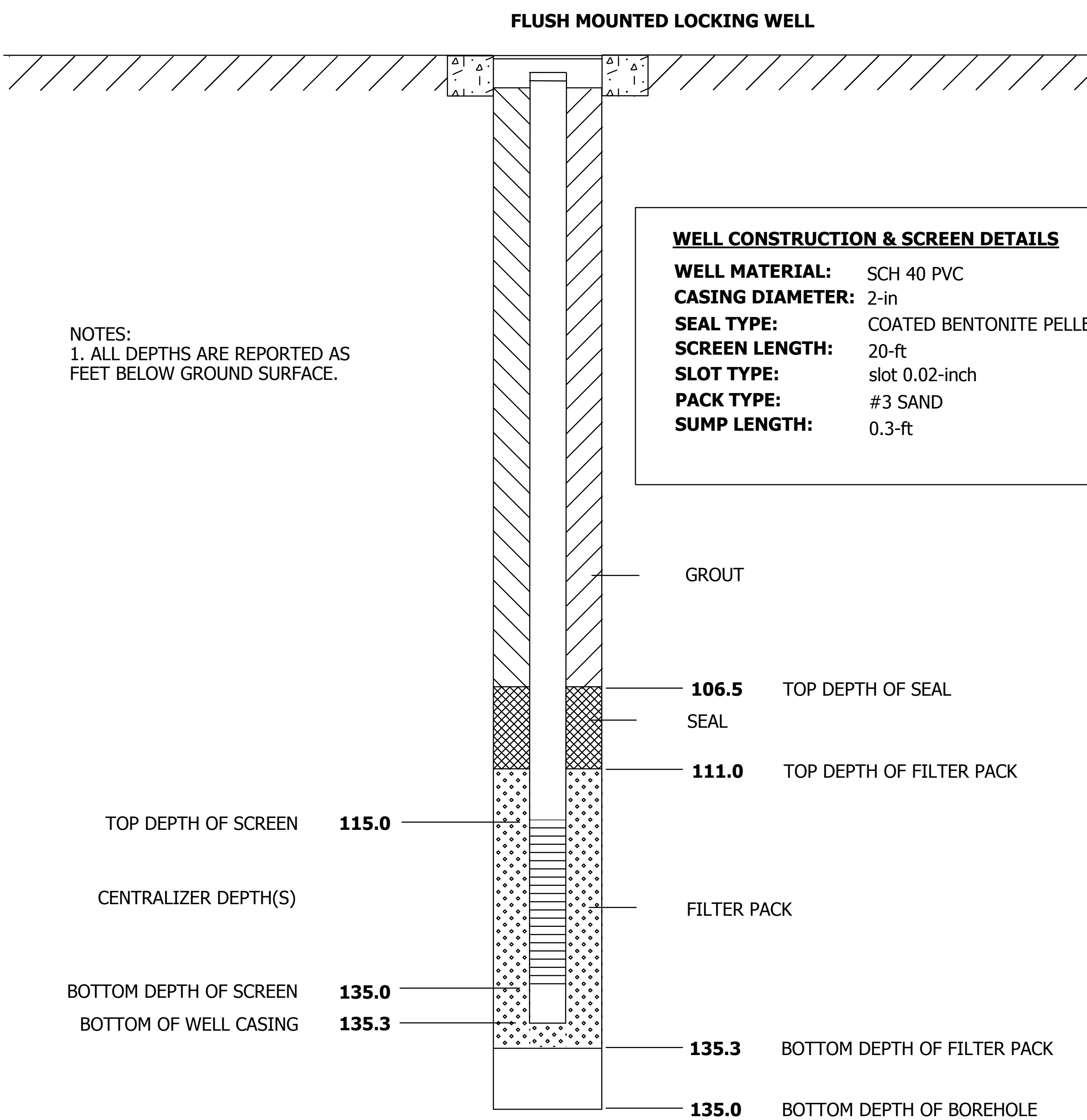
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-40S**

LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 05/02/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/03/2004
LOGGER: B. Moayyad, R. Crotty	**WELL COMPLETION DATE:** 05/03/2004
TOP OF WELL CASING (NGVD 29): 566.04	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101861.86
GROUND SURFACE ELEVATION (NGVD 29): 566.30	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614386.85



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	COATED BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	0.3-ft

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

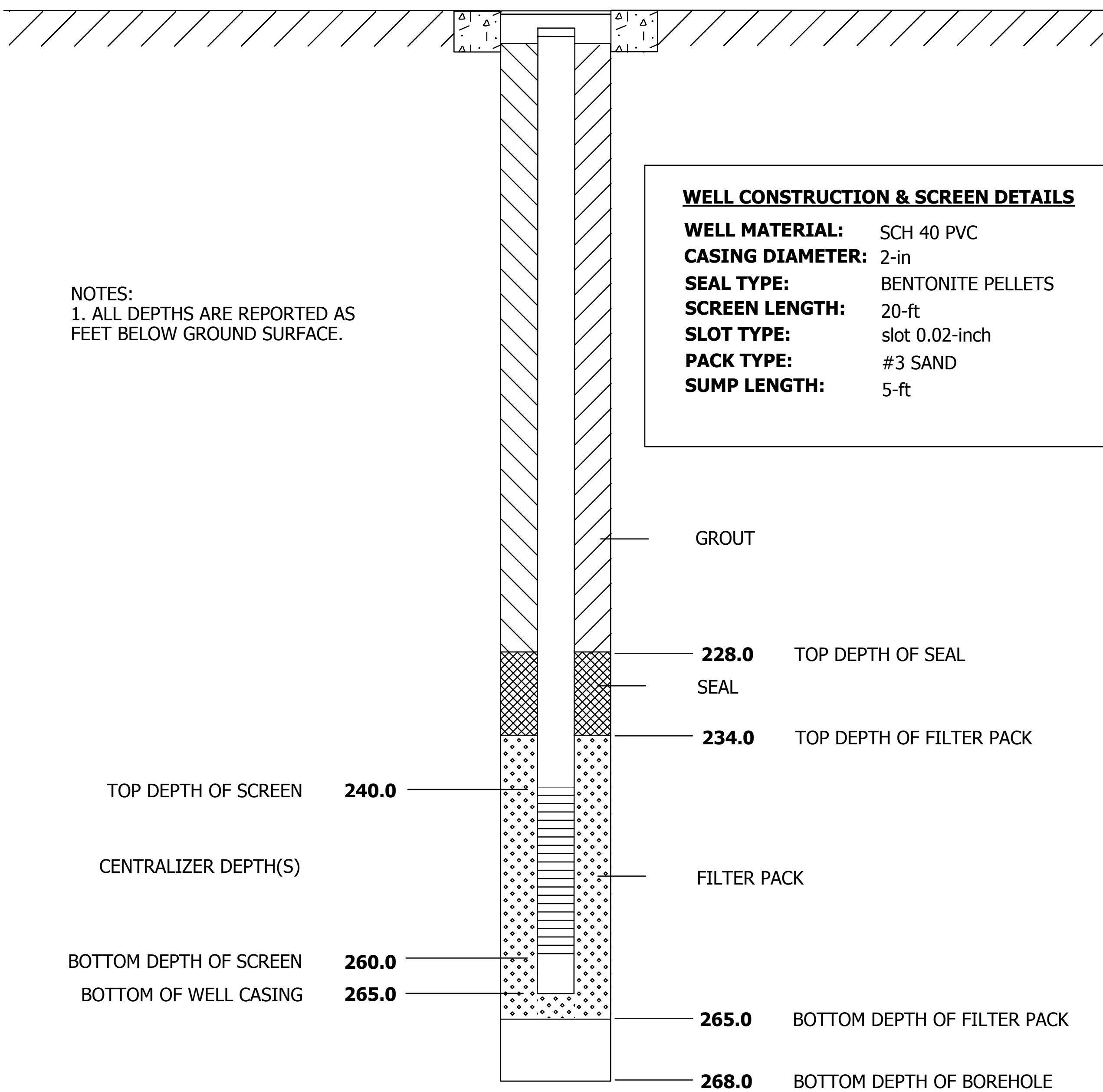
WELL COMPLETION DIAGRAM

PROJECT NO: 315024.IM.02	**PROJECT:** PG&E Topock IM Investigation (Phase 5 2004)	**WELL NO:** **MW-40D**

LOCATION: I-40 median Topock, CA. - 1.5 miles east of Park Moabi exit, west of Bat Cave Wash crossing.

DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	**DRILLING START DATE:** 04/26/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 05/01/2004
LOGGER: T. Henderson, S.Cooper, B. Moayyad, R. Crotty	**WELL COMPLETION DATE:** 05/02/2004
TOP OF WELL CASING (NGVD 29): 566.08	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101864.35
GROUND SURFACE ELEVATION (NGVD 29): 566.50	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614370.53

FLUSH MOUNTED LOCKING WELL



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	SCH 40 PVC
CASING DIAMETER:	2-in
SEAL TYPE:	BENTONITE PELLETS
SCREEN LENGTH:	20-ft
SLOT TYPE:	slot 0.02-inch
PACK TYPE:	#3 SAND
SUMP LENGTH:	5-ft

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

SHEET 1 of 10	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 476.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004	**DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–20				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 45% rnd to ang gravel/cobbles up to 0.75", 40% f-m sand, 10% coarse sand, 5% silty clay.	0 to 20 ft not collected in core barrel during conductor casing set. Description is from homogenized cuttings
20–31	20–31	CC1	11	SW		Box 1 - 20 to 23 ft Box 2: 23 to 27 ft Box 3: 27 to 31 ft
29–31				GW-GM	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM)** - 65% f-c gravel avg 2.5" up to 3", 20% c sand, 10% silt/clay, 5% f-m sand, sand and gravel ang to subang, metamorphic, 50% of gravels are highly weathered, moist, abrupt lower boundary.	
31–35	31–			SC	**SILTY SAND WITH GRAVEL (SC)** - olive brn (2.5Y 4/3), 30% c sand, 25-30% silt, 20% m sand, 10% f gravel (0.2" to 0.75"), 10% f sand, sand and gravel ang to subang, metamorphic, moist.	Box 4: 31 to 34 ft Appears to be fining upward from to 31 to __ ft bgs Box 5: 34 to 38 ft

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 476.9 ft. MSL **NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004	**DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: Bat Cave Wash, Parcel No. 650-151-06		**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC2	8.5	SW-SC	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SC)** - olive brn (2.5Y 4/3), 40% f sand, 30% m sand, 10-15% silt, 10% c sand, 5-10% f gravel, sand and gravel ang to subang, metamorphic, moist, abrupt lower boundary.	
40				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn (7.5YR 4/4), 50% m sand, 20% f sand, 15% c sand, 10% f gravel coarsening with depth, 5% silt, moderate caliche development, sand and gravel ang to subang, metamorphic, moist.	Box 6: 38 to 42 ft
				SW-SM	**SAND WITH SILT AND GRAVEL (SW-SM)** - brn (10YR 4/4), 40% m sand, 25% c sand, 10-15% f gravel, 10-15% silt, 10% f sand well graded, sand and gravel ang to subang, metamorphic. - lt to moderate caliche	Box 7: 42 to 46 ft Appears to encounter water table at 45 to 46 ft bgs
45		CC3	9.5			
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - dark grayish brn to brn (10YR 4/2-4/3), 60% m sand, 15% f sand, 15% f-m gravel, 10% f sand, ang to subang, metamorphic, wet. - 20% f gravel	Box 8: 46 to 50 ft
50					- 5% gravel, 15% silt	Box 9: 50 to 54 ft
55		CC4	10		- 30% f gravel, 25% vf sand, 15% silt, 15% f sand, 5% m sand, 10% c sand	Box 10: 54 to 58 ft
					- brn (10YR 4/3), 40% c sand , 15% f sand, 15% m sand, 15% f gravel, 10% c gravel, 5% silt, ang to subang, metamorphic, wet	Box 11: 58 to 62 ft
60						Box 12: 62 to 66 ft Collect grain size sample at 62 to 64 ft, ID: MW-41D-63
65		CC5	10		- 5% silt, 10% f sand, 10% m sand, 60% c sand, 5-10% f gravel	Collect grain size sample at 65 to 66 ft, ID: MW-41D-66 Box 13: 66 to 70 ft
70					- increasing silt content, 10% silt at 70 ft bgs, 15% silt at 71 ft bgs	Collect groundwater grab sample, ID: MW-41D-70

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 476.9 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004	**DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: Bat Cave Wash, Parcel No. 650-151-06		**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
70–80		CC6	9.5		**WELL GRADED SAND WITH GRAVEL (SW)** - dark grayish brn to brn (10YR 4/2-4/3), 60% m sand, 15% f sand, 15% f-m gravel, 10% f sand, ang to subang, metamorphic, wet.	Box 14: 70 to 74 ft Box 15: 74 to 78 ft Box 16: 78 to 82 ft
75						
~79.5					- 10-15% silt	Stop drilling at 80 ft bgs on 10/22/04, continue drilling on 10/23/04
80–90		CC7	10		- 5-10% silt	Box 17: 82 to 86 ft
85				ML	**SANDY SILT WITH GRAVEL (ML)** - greenish gray (GLEY1 5/5GY), 50% silt, 20% vf sand, 10% f sand, 10% m sand, 10% f gravel, sand and gravel ang to subang, metamorphic, silty plastic, silty sticky to not sticky, moist to wet. Abrupt lower boundary (< 2 cm).	Box 18: 86 to 90 ft
86				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn (7.5YR 4/4), 40% f sand, 20% m sand, 20% c sand, 10% silt, 10% f gravel, sand and gravel ang to subang, metamorphic, moist, distinct layers of 15-20% silt < 2 cm thick.	
90–100		CC8	10	SM	**SILTY SAND WITH GRAVEL (SM)** - brn (10YR 5/3-4/3), 35% f sand, 20% silt, 15% f gravel 0.2" to 1", 10% vf sand, 10% m sand, 10% c sand, sand and gravel dominantly ang to subang, v few subrnd, metamorphic and v few conglomerate, moist.	Box 19: 90 to 94 ft Collect grain size sample at 93 ft, ID: MW-41D-93
95						Box 20: 94 to 98 ft
					- silt caliche	
97				SW-SM	**SAND WITH SILT AND GRAVEL (SW-SM)** - brn (7.5YR 4/3), 30% m sand, 20% f sand, 20% c sand, 20% f-m gravel, 10% silt, sand and gravel ang to subang, metamorphic, moist to wet, silt caliche.	Box 21: 98 to 102 ft Drilled 100 to 110 ft but dropped core during retrieval and recovered on next run
100–105		CC9	5		- 15% silt, 5% f-m gravel	Box 22: 102 to 106 ft
105						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 320.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 476.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,536.66	EASTING (CCS NAD 27 Z 5): 7,614,578.85	DATE STARTED: 10/22/2004	DATE COMPLETED: 11/05/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Gefco SS-15K-HL	
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			LOGGED BY: T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn (7.5YR 4/4), 30% m sand, 30% c sand, 20% f sand, 15% f-m gravel, 5% silt, sand and gravel ang to subang, metamorphic, moist. Moderate caliche development, silty cemented throughout. Distinct 1/8" silt layers are dark gray (5Y4/1), 90% silt, 10% vf sand.	Box 23: 106 to 110 ft
				SW	**WELL GRADED SAND (SW)** - brn (10YR 4/3), 30% f sand, 30% m sand, 15% silt, 15% c sand, 10% f gravel, ang to subang, metamorphic, wet.	
110						
		CC10	14	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn (10YR 4/3 at top, 7.5YR 4/3 at bottom), 30% m sand, 30% c sand, 25% f-c gravel, 10% f sand, 5% silt, sand ang to subang and fining downwards, gravel ang to subrnd, metamorphic, wet.	Box 24: 110 to 114 ft
115						Box 25: 114 to 118 ft
					- 20% silt	Box 26: 118 to 122 ft
120						
		CC11	10	MH	**SILT WITH GRAVEL (MH)** - dark brn (2.5Y 4/3 or 4/4), 65% silt, 30% f-m ang to subang gravel up to 2.75", 5% clay, 5% c sand, metamorphic, med-high elasticity, sticky, plastic, dry, caliche on gravels, abrupt lower boundary.	Box 27: 122 to 126 ft Collect grain size sample at 122 to 124 ft, ID: MW-14D-123
125					- interbedded sand with gravels, brn (7.5YR 4/3), 30% c sand, 20% f gravel, 20% m sand, 20% f gravel, 10% silt, well graded	Box 28: 126 to 130 ft
				SW	**SILTY SAND (SW)** - dark greenish gray (Y2 4/10G), 30% vf sand, 30% f sand, 20% silt, 10% m-c sand, 10% ang to subang gravel, metamorphic, moist. Moderate caliche development. Mottled brn (7.5YR 4/4) over 10% of surface, mottling increases to 50% of surface at bottom 3".	
130						Box 29: 130 to 134 ft
		CC12	10		- 80% silt, 10% f sand, 10% c sand	Box 30: 134 to 138 ft
135						
					WELL GRADED SAND WITH GRAVEL (SW) - 40% m sand, 25% f-c gravel (1/5" to 1"), 20% c sand, 10% f sand, 5% silt, ang to subang, metamorphic, wet.	Collect grain size sample at 136.5 to 137.5 ft, ID: MW-14D-137 Box 31: 138 to 142 ft
					- 10% silt, slit horizontal fabric in gravels	Collect groundwater sample at 139 ft
140						

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR | **BORING NUMBER:** MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 476.9 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004	**DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: Bat Cave Wash, Parcel No. 650-151-06		**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND WITH GRAVEL (SW) - 40% m sand, 25% f-c gravel (1/5" to 1"), 20% c sand, 10% f sand, 5% silt, ang to subang, metamorphic, wet.	bgs, ID: MW-41D-139 Appears to be reworked due to drilling
					- dark grayish brn (10YR 4/2), 40% f sand, 20% f-c gravel 1/5" up to 3", 10% m sand, 5-10% silt, moist. Mottling in blocks of brn (7.5YR 4/3)	Box 32: 142 to 146 ft
145						
					- 35% m sand, 25% c sand, 25% f sand, 15% gravel, 5-10% silt, well graded, caliche development throughout and increased cementation with depth	Box 33: 146 to 150 ft
150		CC13	15	SW		Box 34: 150 to 154 ft
155						Box 35: 154 to 158 ft
						Reworking at 140 to 176 indicated by lack of fabric, no silt layers around gravels, color, and blocks of mottled brown
160					- brn (10YR 4/3 to 7.5YR 4/3), 5% silt, 10% f sand, 40% m sand, 35% c sand, 10% f gravel, well graded, sand and gravel ang to subang - metamorphic. Gravels less than 2 cm	
165		CC14	10			
					WELL GRADED SAND WITH SILT (SW-SM) - brn (7.5YR 4/2 to 4/3), 35% m sand, 30% f sand, 15% c sand, 10-15% silt, 5-10% f-c gravel (0.2" avg, up to 2"), ang to subang with v few subang gravel, moist to wet.	
170						
				SW-SM		Collect grain size sample at 172.5 to 173.5 ft, ID: MW-41D-173
175						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 476.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004 **DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC15	10		**WELL GRADED SAND WITH SILT (SW-SM)** - brn (7.5YR 4/2 to 4/3), 35% m sand, 30% f sand, 15% c sand, 10-15% silt, 5-10% f-c gravel (0.2" avg, up to 2"), ang to subang with v few subang gravel, moist to wet. - < 5% red mottling (2.5YR 4/6), < 5% silt, 20% f sand, 50% m sand, 20% c sand, 5% gravel	
180				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn (10YR 5/3), 50% m sand, 20% c sand, 20% f sand, 5% silt, 5% gravel avg 0.5", ang to subang, metamorphic, wet.	
				SP	**POORLY GRADED SAND (SP)** - grayish brn (10YR 5/2), 85% m sand, 10% f sand, < 5% silt, ang to subang, metamorphic, wet.	
185				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn (10YR 5/3), 50% m sand, 20% f sand, 20% c sand, 5% silt, 5% gravel avg 0.5", ang to subang, metamorphic, wet.	
190		CC16	18	SM	**SILTY SAND WITH GRAVEL (SM)** - brn (7.5YR 4/3) with 15% dark greenish gray (GLEY1 4/10Y) and 10% red (10R 4/6) mottling, 25% m sand, 25% c sand, 20% silt, 15% f sand, 15% gravel 0.5" - 2.5", ang to subang with v few subrnd, metamorphic. Silty caliche development, faint fabric with aligned gravels.	
195						
200				SW-SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** - brn (7.5YR 4/3) with 10% dark greenish gray (GLEY1 4/10Y) mottling, 30% m sand, 25% c sand, 20% f sand, 15% gravel from 0.5" - 2.5", 10% silt, sand and gravel ang to subang, metamorphic, silt caliche development, abrupt lower boundary.	
205						
210						

CH2MHILL

SHEET 7 of 10	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 476.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004	**DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC17	18	GW-GM	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM)** - brn (7.5YR 4/2), 50% gravel up to 2" , 20% m sand, 20% c sand, 5% silt, 5% f sand, sand and gravel ang to subang, metamorphic.	Appears to be coarsening upward sequence 210 to 213 ft bgs
215				SW-SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** - brn (7.5YR 4/3) with 10% dark greenish gray (GLEY1 4/10Y) mottling, 30% m sand, 25% c sand, 20% f sand, 15% gravel from 0.5" to 2", 10% silt, ang to subang, metamorphic with lt caliche development.	
				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn (7.5YR 4/3), 40% m sand, 30% f sand, 20% c sand, 5% silt, 5% gravel, sand and gravel ang to subang, metamorphic, wet, moderate to strong caliche development, silt fabric with horizontally aligned gravels and c sand.	
220				SP	**POORLY GRADED SAND (SP)** - dark grayish brn (2.5Y 4/2), 50% m sand, 50% c sand, subang, metamorphic, wet.	Core from 220 to 233 appears to be washed out from drilling process
225					**WELL GRADED SAND (SW)** - brn (7.5YR 5/3), 40% m sand, 30% c sand, 15% f sand, 10% gravel, 5% silt, sand and gravel ang to subang, metamorphic, wet, silt cementation. - 10% silt - reddish brn (5YR 4/3), 45% m sand, 5-10% silt, 10% f sand, 5-10% gravel .5 to 8 cm, moderate caliche development	
230		CC18	17			
235					- 60-70% m sand, 20% c sand, 5% silt, 5% gravel 0.5 - 2 cm - 45% m sand, 30% c sand, 5-10% silt, 10% f sand, 5-10% gravel 0.5 to 8 cm	
240					- 30% m sand, 30% c sand, 10-15% silt, 15% f sand, 10-15% gravel, some caliche, wet	
245						

SHEET 8 of 10	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 476.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004 **DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC19	10		**WELL GRADED SAND (SW)** - brn (7.5YR 5/3), 40% m sand, 30% c sand, 15% f sand, 10% gravel, 5% silt, sand and gravel ang to subang, metamorphic, wet, silt cementation.	
					- reddish brn (5YR 4/4), 5% red (10R 4/8), 5% grayish green (GLEY1 4/5G) mottled, 60-70% m sand, 10-15% silt, 15% f sand, 5% gravel, some caliche, silty consolidated	
250				SW	- 40% f sand, 40% m sand, 10% c sand, 5% silt, 5% f gravel, very few c gravel of 4 to 5 cm, silty indurated, slit fabric with horizontal gravel, strongest at base	
255		CC20	9		- brn (10YR 5/3) matrix, 60% yellowish red (5YR 4/6), 20% v dark greenish gray GLEY2 3/5BG mottling, 30% f sand, 20% vf sand, 20% m sand, 15-20% silt, 5% c sand, 5% c gravel, few thin layers of 25-30% silt, abrupt lower boundary	
					- reddish brn (5YR 4/4), 40% f sand, 35% c sand, 10% m sand, 10% f gravel up to 2 cm, 5% silt, gravel ang to subang, c sand ang to subround, metamorphic, wet, slit clay films on gravels	
260						
265		CC21	9		- red (2.5YR 4/4 to 4/6), 5-10% silt/clay, 30% f sand, 30% c sand, 20% m sand, 15% gravel, increased induration, v few weak clay films around gravels	
					- strong caliche	
					- 2 to 6 cm gravels from 267 to 268 ft bgs	
270					- brn (5YR 4/4), 50% c sand, 25% f gravel up to 0.5", 10% f sand, 10% m sand, 5% clay/silt	
275		CC22	5		- v few spots of dk greenish gray (GLEY2 4/5BG) mottling, 40% f sand, 20% m sand, 20% c sand, 10% silt, 10% f gravel, well graded, silty indurated, moderate caliche, strongest in top 6 inches	
280					**SILTY SAND WITH GRAVEL (SM)** - dark reddish brn (2.5YR 3/3), 30% f sand, 25% silt, 20% c sand, 15% gravel, 10% m sand, subang, little metamorphic, wet, silty indurated, weathered.	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 476.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004 **DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
280–285		CC23	5	SM	**SILTY SAND WITH GRAVEL (SM)** - dark reddish brn (2.5YR 3/3), 30% f sand, 25% silt, 20% c sand, 15% gravel, 10% m sand, subang, little metamorphic, wet, silty indurated, weathered.	
285		CC24	15	SW	**WELL GRADED SAND (SW)** - grayish brn (10YR 5/2), 40% m sand, 25% c sand, 15% f sand, 10% fines, 10% gravel to 0.5", sand and gravel ang to subang, some metamorphic, wet, silty indurated, trace caliche.	
290				SM	**SILTY SAND (SM)** - grayish brn (10YR 5/2), 30% m sand, 25% fines, 25% gravel, 20% c sand, 10% f sand, ang to subang, some metamorphic, wet, moderately indurated.	
295				SW	**SAND (SW)** - dark red (2.5YR 3/6) with brn (7.5YR4/3 clay layer, 30% m sand, 25% gravel up to 1.5", 20% c sand, 15% fines, 10% f sand, weathered bedrock, moderately indurated, wet.	Angled bedding plane seen at 301' (photo)
300		CC25	15	BR	**CONGLOMERATE (BR)** - dark reddish brn (2.5YR 3/3), 30% m sand, 30% c sand, 20% f sand, 10% fines, 10% gravel up to 1.5", ang to subang, dry, strongly indurated.	
				BR	**CONGLOMERATE (BR)** - reddish brn (2.5YR 4/4), 30% m sand, 30% c sand, 20% f sand, 10% fines, 10% gravel, gravel subrnd, dry.	
305				BR	**CONGLOMERATE (BR)** - reddish brn (2.5YR 4/3), 30% f sand, 20% fines, 20% c sand, 20% subang gravel up to 1", 10% m sand, wet.	
310					**CONGLOMERATE (BR)** - dark reddish brn (2.5YR 3/3), 30% m sand, 30% subang gravel to 1.5", 20% f sand, 10% fines, 10% c sand, dry, silty indurated, weathered.	
315						

PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: MW-41

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 320.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 476.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,536.66	**EASTING (CCS NAD 27 Z 5):** 7,614,578.85	**DATE STARTED:** 10/22/2004 **DATE COMPLETED:** 11/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: Bat Cave Wash, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
320		CC26	5	BR	**CONGLOMERATE (BR)** - dark reddish brn (2.5YR 3/3), 30% m sand, 30% subang gravel to 1.5", 20% f sand, 10% fines, 10% c sand, dry, silty indurated, weathered. - silty more indurated, moist	Well Completion: TD = 311.5' bgs; Screen Interval = 271 to 291 ft bgs; Filter Pack = 299 - 261 ft bgs; Stick-up Approx = 2.6 ft; Sump = 291 to 311 bgs

Boring Terminated at 320 ft

ABBREVIATIONS

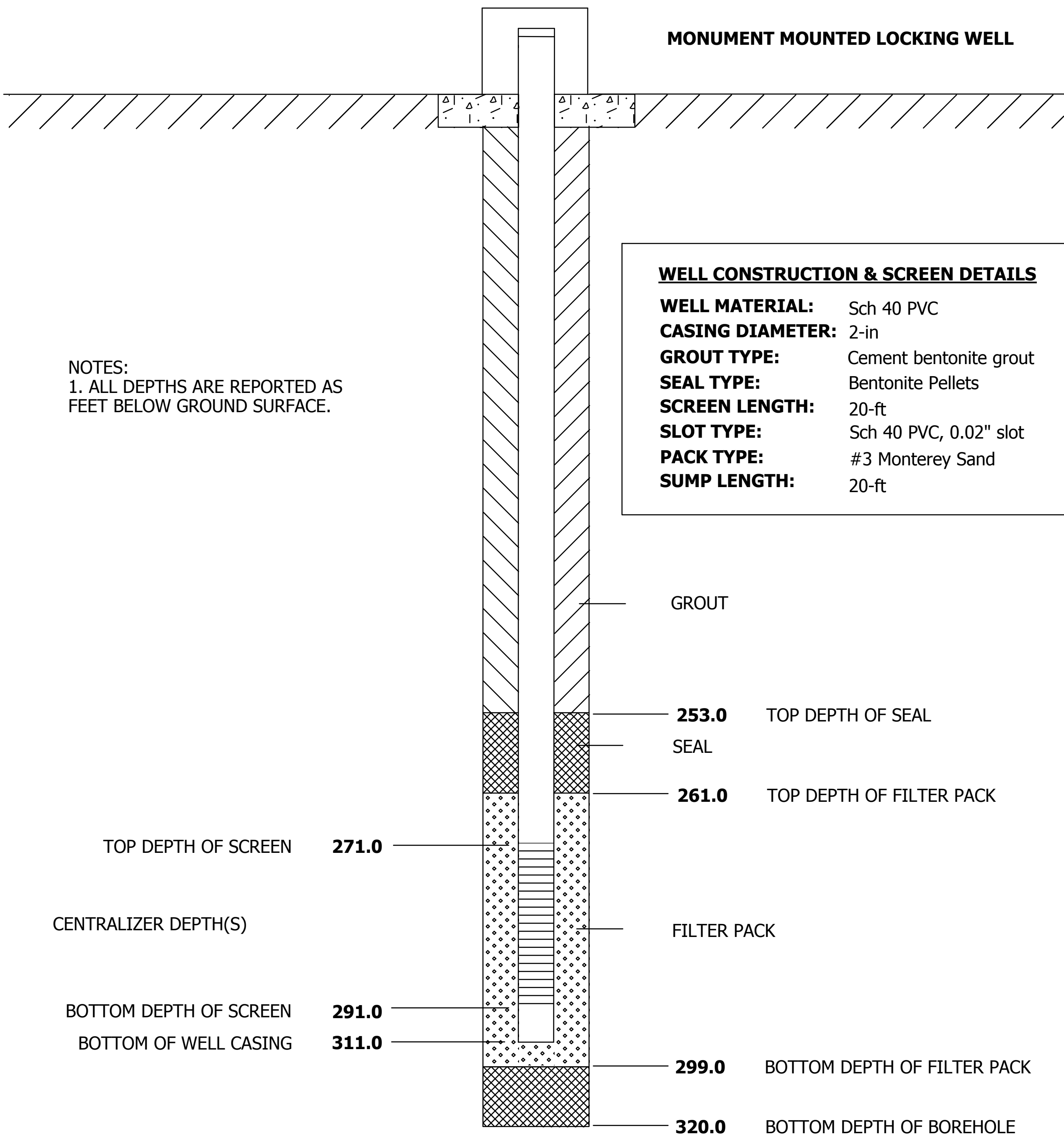
cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz

WELL COMPLETION DIAGRAM

PROJECT NO: 326128.01.07.AR	**PROJECT:** IM-3 Hydrogeologic Investigation, PG&E Topock	**WELL NO:** **MW-41D**

LOCATION: Bat Cave Wash, Parcel No. 650-151-06

DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	**DRILLING START DATE:** 10/22/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 11/05/2004
LOGGER: T. McDonald	**WELL COMPLETION DATE:** 11/05/2004
TOP OF WELL CASING (NGVD 29): 479.42	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2103536.66
GROUND SURFACE ELEVATION (NGVD 29): 476.88	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614578.85



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Cement bentonite grout
SEAL TYPE:	Bentonite Pellets
SCREEN LENGTH:	20-ft
SLOT TYPE:	Sch 40 PVC, 0.02" slot
PACK TYPE:	#3 Monterey Sand
SUMP LENGTH:	20-ft

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

WELL DIAGRAM IS NOT TO SCALE

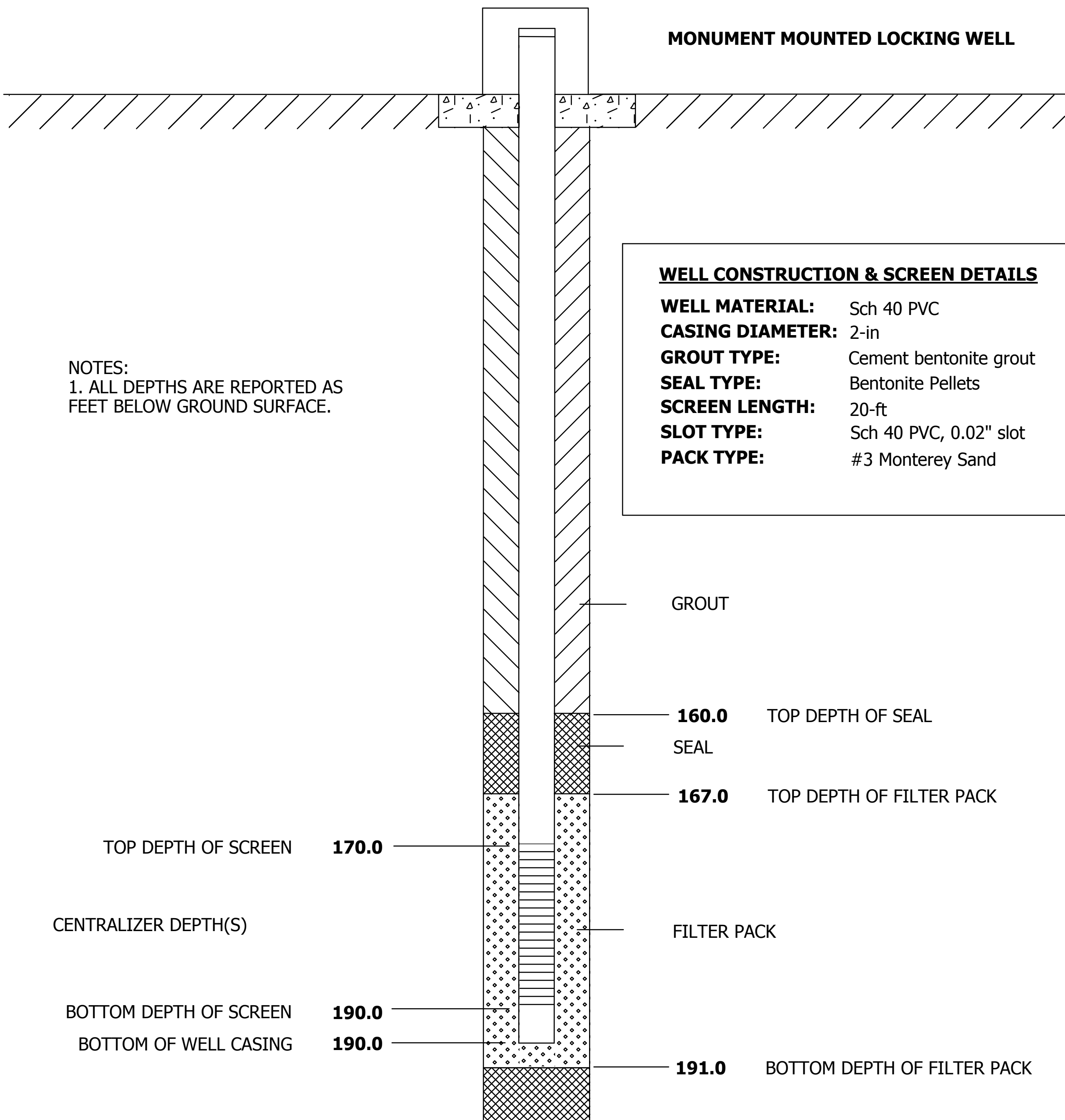
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326128.01.07.AR	**PROJECT:** IM-3 Hydrogeologic Investigation, PG&E Topock	**WELL NO:** **MW-41M**

LOCATION: Bat Cave Wash, Parcel No. 650-151-06

DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	**DRILLING START DATE:** 11/01/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 11/01/2004
LOGGER: T. McDonald	**WELL COMPLETION DATE:** 11/07/2004
TOP OF WELL CASING (NGVD 29): 479.84	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2103527.41
GROUND SURFACE ELEVATION (NGVD 29): 477.06	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614583.19



WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Cement bentonite grout
SEAL TYPE:	Bentonite Pellets
SCREEN LENGTH:	20-ft
SLOT TYPE:	Sch 40 PVC, 0.02" slot
PACK TYPE:	#3 Monterey Sand

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

WELL DIAGRAM IS NOT TO SCALE

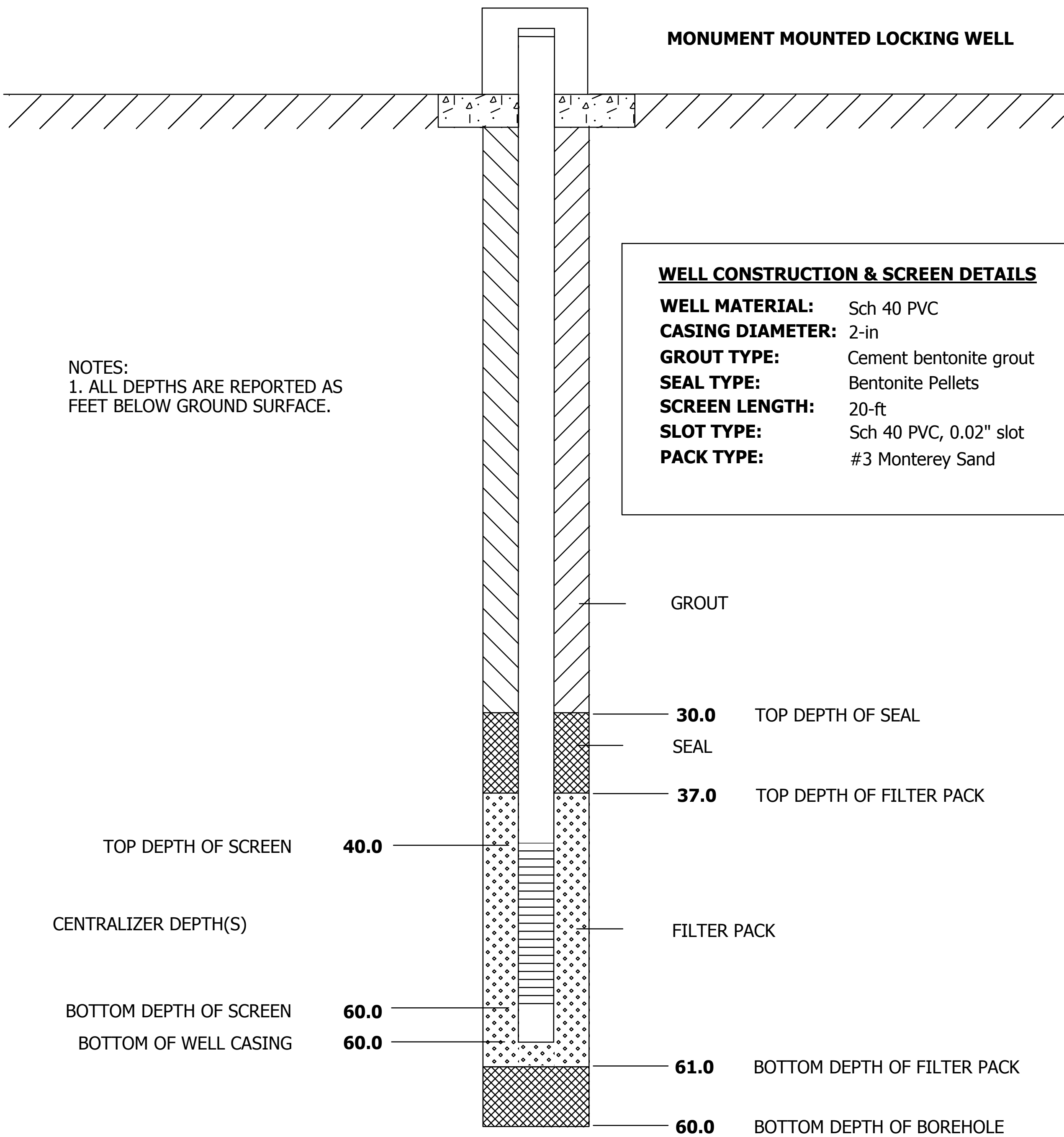
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326128.01.07.AR	**PROJECT:** IM-3 Hydrogeologic Investigation, PG&E Topock	**WELL NO:** **MW-41S**

LOCATION: Bat Cave Wash, Parcel No. 650-151-06

DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	**DRILLING START DATE:** 11/01/2004
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 11/01/2004
LOGGER: T. McDonald	**WELL COMPLETION DATE:** 11/08/2004
TOP OF WELL CASING (NGVD 29): 480.07	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2103518.07
GROUND SURFACE ELEVATION (NGVD 29): 477.41	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7614588.78



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

WELL CONSTRUCTION & SCREEN DETAILS

WELL MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Cement bentonite grout
SEAL TYPE:	Bentonite Pellets
SCREEN LENGTH:	20-ft
SLOT TYPE:	Sch 40 PVC, 0.02" slot
PACK TYPE:	#3 Monterey Sand

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-42

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock, Interim Measures, Phase 2 (2005)	81.2	Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,296.95	**EASTING (CCS NAD 27 Z 5):** 7,616,274.95	**DATE STARTED:** 02/01/2005	**DATE COMPLETED:** 7:00:00 AM
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track-Mounted All Terrain Sonic	
LOCATION: Between to MW-27 & MW-20 on Colorado River floodplain.		**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–7		Bag 10	5.6	SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, 98% f sand, 2% silt, subang qtz, loose, moist	collect bag samples for archive description and potential grain-size testing. moist from previous rain some compaction of surficial sands
5					- becomes subrnd by 6 ft, < 10% m sand	take bag sample at 10 ft, @7:50 MW-42D-GS-10
7–17					- 99% vf-f sand, 1% fines, becomes wet	
10		Bag 10 Bag 25	9.5	SP	**POORLY GRADED SAND (SP)** - dk gray brn, 95% f qtz rich sand, 5% subrnd fines, loose, wet, sulfur smell	saturated zone
15					**POORLY GRADED SAND (SP)** - brn 7.5YR5/3, 97% qtz rich sand, 3% subrnd fines, loose, wet	
17–27					- occasionally micas, <10% mafics, no gravels	
20		Bag 25 Bag 53	9.5	SP		
25					- 98% vf-m sand, 2% fines, rnd to subrnd	take bag sample at 25 ft, @8:15 MW-42D-GS-25
27–35						collect groundwater at 27-37 ft
30		Bag 53	10		**POORLY GRADED SAND (SP)** - brn 7.5YR5/4, 98% sand, 2% fines, qtz rich sand, subrnd to rnd, loose, wet	soft drilling
35						

CH2MHILL

SHEET 2 of 3	PROJECT NUMBER: 326228.IM	BORING NUMBER: MW-42

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		HOLE DEPTH (ft): 81.2	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,296.95	EASTING (CCS NAD 27 Z 5): 7,616,274.95	DATE STARTED: 02/01/2005	DATE COMPLETED: 7:00:00 AM
DRILLING METHOD: Rotosonic		WATER LEVEL (ft):	DRILLING EQUIPMENT: Track-Mounted All Terrain Sonic	
LOCATION: Between to MW-27 & MW-20 on Colorado River floodplain.			LOGGED BY: B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND (SP)** - more gravel below 35 ft, 85% f sand, brn 7.5YR3/4, 13% m sand, 98% sand, <2% fines, 2% fines, qtz rich sand, subrnd to rnd, loose, wet	
					- as above, no gravel	
40						
		Bag 53	9		- 95% sand, 2% gravel, <3% fines, subrnd gravel up to 1" long	
					- silty clay lens 2" thick at 43 ft	
45					- brn 7.5YR5/2, subrnd to subang with gravel up to 3" long, 62% f sand, 30% m sand, 5% gravel, 3% fines, medium to loose	
50					- grades to m sand with gravel by 52 ft	
		Bag 53 Bag 64	8		- brn 7.5YR5/3, 60% m sand, 33% f sand, 5% gravel, 2% fines, subrnd to rnd, qtz rich sand, loose	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 88% sand, 10% gravel, 2% fines	collect bag sample at 53 ft @ 9:45 MW-42-GS-53
55				SP	**POORLY GRADED SAND (SP)** - m sand, <2% fines, no gravel	
				SP	**POORLY GRADED SAND WITH GRAVEL (SP)** - brn, 85% sand, 15% chert and metamorphic gravel, m sand with gravel up to 3" long, medium density, wet	
60						
		Bag 64	9		- 15" thick clay lens at 62.5 ft	
					- gravelly zone at 63-64 ft, 60% sand, 38% gravel, 2% fines	
				SW	**WELL GRADED SAND WITH GRAVEL(SW)** - brn, 75% sand, 25% v round pebbles 1/2 to 1"	collect bag sample at 64 ft @ 10:45 MW-42D-GS-64
65				ML	**SILT (ML)** - strong brn 7.5YR4/6, 70% silt, 30% sand, firm to soft, wet - gravel and cobble zone at 66 to 67 ft, 35% rnd gravel, 65% silt	collect bag sample at 65 ft @ 10:45 MW-42D-GS-65
				ML	**SANDY SILT (ML)** - reddish brn 7.5YR4/4, 65% silt, 32% sand, 3% f rnd gravel, massive, firm, wet	
					- gravelly ML	
70						Top Miocene Conglomerate at 69.5 ft,

CH2MHILL

SHEET 3 of 3	**PROJECT NUMBER:** 326228.IM	**BORING NUMBER:** MW-42

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 81.2	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,296.95	**EASTING (CCS NAD 27 Z 5):** 7,616,274.95	**DATE STARTED:** 02/01/2005	**DATE COMPLETED:** 7:00:00 AM
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:** Track-Mounted All Terrain Sonic	
LOCATION: Between to MW-27 & MW-20 on Colorado River floodplain.			**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			9	BR	**CONGLOMERATE (BR)** - reddish brn 7.5YR4/4, 65% silt, 32% sand, 3% f rnd gravel, massive, firm, wet	hard drilling reddish brn, indurated, cemented, fanglomerate shattered by sonic coring, dry, hard
75						
			4.2			
80						same shattered fanglomerate

Boring Terminated at 81.2 ft

ABBREVIATIONS

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

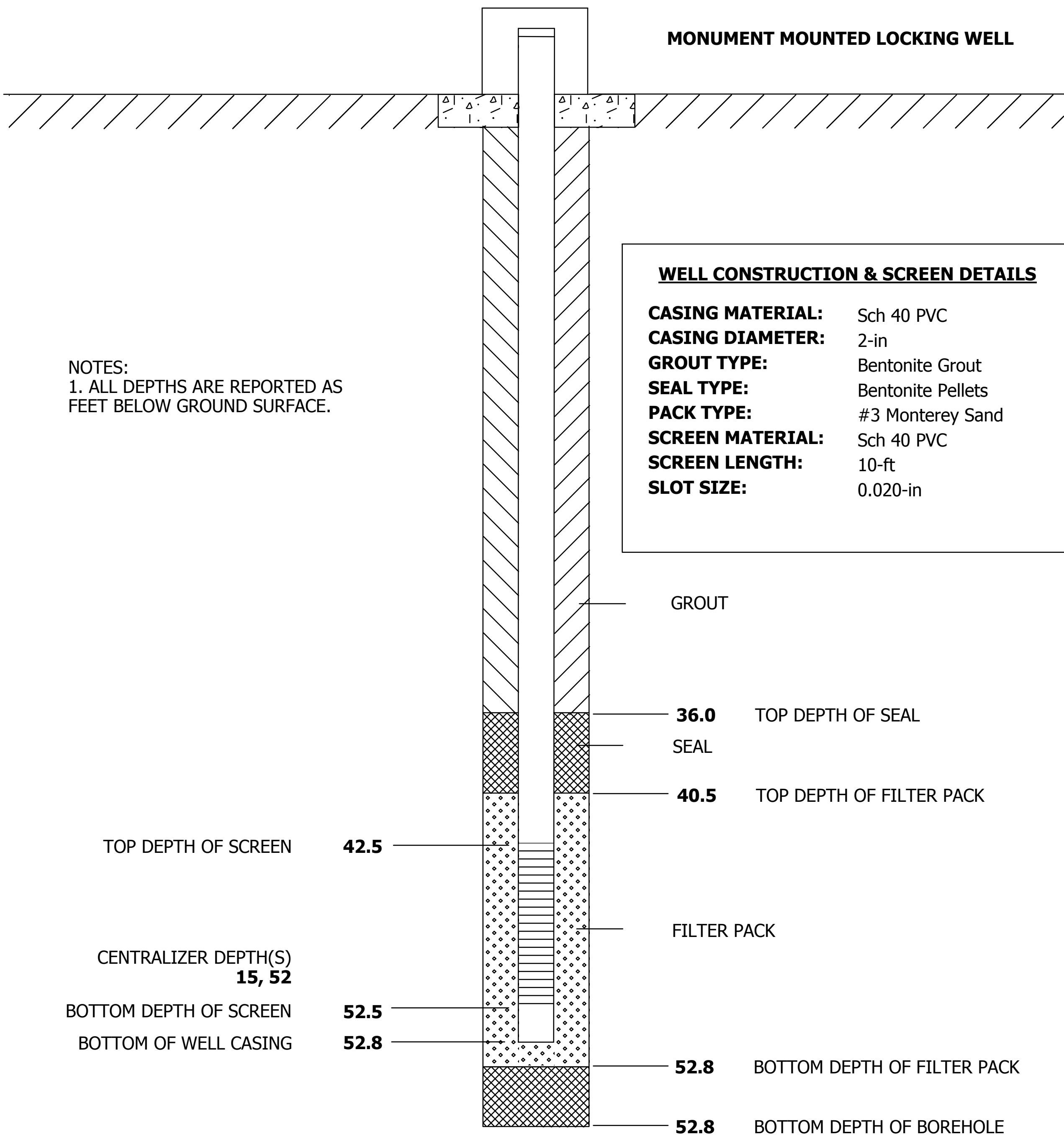
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-42-055**

LOCATION: Between to MW-27 & MW-20 on Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/01/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/01/2005
LOGGER: B. Moayyad, B. Trebble	**WELL COMPLETION DATE:** 02/02/2005
TOP OF WELL CASING (NGVD 29): 463.87	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102303.44
GROUND SURFACE ELEVATION (NGVD 29): 461.23	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616278.56



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in

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

WELL DIAGRAM IS NOT TO SCALE

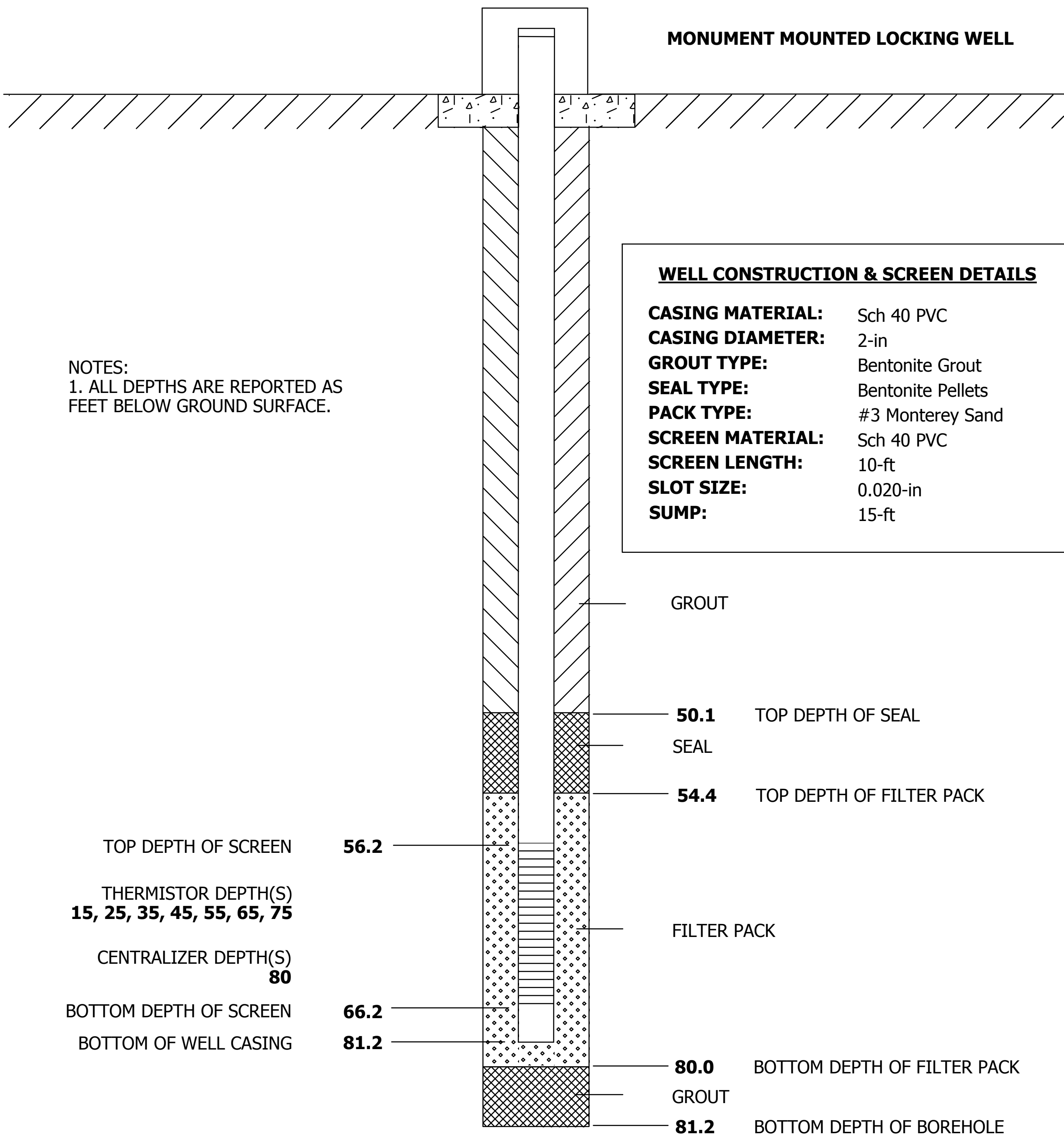
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-42-065**

LOCATION: Between to MW-27 & MW-20 on Colorado River floodplain.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 01/31/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/01/2005
LOGGER: B. Moayyad, B. Trebble	**WELL COMPLETION DATE:** 02/01/2005
TOP OF WELL CASING (NGVD 29): 463.37	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2102296.95
GROUND SURFACE ELEVATION (NGVD 29): 460.97	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616274.95



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

WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in
SUMP:	15-ft

THERMISTOR DEPTH(S)
15, 25, 35, 45, 55, 65, 75

CENTRALIZER DEPTH(S)
80

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-43

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		**HOLE DEPTH (ft):** 97.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 459.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,824.65	**EASTING (CCS NAD 27 Z 5):** 7,616,693.23	**DATE STARTED:** / **DATE COMPLETED:**
DRILLING METHOD:		**WATER LEVEL (ft):**	**DRILLING EQUIPMENT:**
LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.			**LOGGED BY:** B. Trebble, T. Lae

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–5			6		**POORLY GRADED SAND (SP)** - olive yellow 2.5YR6/6, 95% f sand, 5% ang gravel to 4 ft, subrnd, loose, damp, trace organics - topsoil organic rich	collect bag samples for archive description and potential grain-size testing.
10		CC1	10		- 100% subrnd f sand	saturated below 10 ft at 10:00 collect MW43(USGS, PW, RESP)-12
15					- trace organics to ~16 ft	
20		CC2	10		- olive yellow 2.5YR6/6, 100% f sand, saturated	at 10:05 collect MW43(USGS, PW, RESP)-20
25						at 10:45 collect MW43-24.5 (hex chrome)
30		CC3	11	SP		at 11:00 collect MW43(USGS, PW, RESP)-30
35						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326228.IM	MW-43

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		HOLE DEPTH (ft): 97.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 459.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,824.65	EASTING (CCS NAD 27 Z 5): 7,616,693.23	DATE STARTED:	DATE COMPLETED:
DRILLING METHOD:		WATER LEVEL (ft):	DRILLING EQUIPMENT:	
LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.			LOGGED BY: B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					POORLY GRADED SAND (SP) - olive yellow 2.5YR6/6, 95% f sand, 5% ang gravel to 4 ft, subrnd, loose, damp, trace organics	
					- lt brn gray 10YR6/2, 70% f sand, 29% m sand, 1% gravel, subrnd to subang	
40					- olive yellow, 100% sand, subrnd	at 11:15 collect MW43(USGS, PW, RESP)-40
		CC4	10			
45					- 99% sand, 1% fines	at 11:40 collect MW43(USGS, PW, RESP)-44.5
					- increase in fines to 95%	
50						at 13:10 collect MW43(USGS, PW, RESP)-50
		CC5	10		- 95% sand, subrnd to subang, 1st occurrence of 5% subrnd gravel	
55						
					- start of interspersed coarse gravel, 93% sand, 5% gravel, 2% fines	
60					- 84% sand, 15% gravel, 1% fines	
		CC6	10			
65				GW	**WELL GRADED GRAVEL (GW)** - 65% rnd-vrnd gravel up to 2", 33% sand, 2% fines	
				SW	**GRAVELLY SAND (SW)** - lt yellow brn 2.5YR6/3, 65% subrnd to subang sand, 35% f subrnd to rnd gravel, loose	at 14:00 collect MW43-64.5
					- 85% f sand, 10% gravel, 5% m sand	
70						

CH2MHILL

SHEET 3 of 4	PROJECT NUMBER: 326228.IM	BORING NUMBER: MW-43

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		HOLE DEPTH (ft): 97.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 459.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,824.65	EASTING (CCS NAD 27 Z 5): 7,616,693.23	DATE STARTED:	DATE COMPLETED:
DRILLING METHOD:		WATER LEVEL (ft):	DRILLING EQUIPMENT:	
LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.			LOGGED BY: B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC7	10	SW	**GRAVELLY SAND (SW)** - lt yellow brn 2.5YR6/3, 65% subrnd to subang sand, 35% f subrnd to rnd gravel, loose	at 14:05 collect MW43(USGS, PW, RESP)-70
75					- 65% sand, 35% gravel	
					- lt brn gray 2.5YR6/2, 83% sand, 15% gravel, 2% fines	
80		CC8	10			at 14:15 collect MW43(USGS, PW, RESP)-80, GS sample 83'
					- 69% sand, 30% gravel, 1% fines	
85						at 15:00 collect MW43-84.5 (hex chrome)
		CC9	10		- 64% sand, 35% gravel, 1% fines	
90				BR	**CONGLOMERATE (BR)** - dk reddish brn 2.5YR3/4, conglomerate consists of 65% sand, 25% fines (silt), 10% gravel, dry, weakly-moderately cemented fanglomerate	Top Miocene Conglomerate at 89 ft at 15:50 collect MW43(USGS, PW, RESP)-90 very hard drilling
95						at 16:30 collect MW43-94.5 (hex chrome)

Boring Terminated at 97 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained

CH2MHILL

SHEET 4 of 4	PROJECT NUMBER: 326228.IM	BORING NUMBER: MW-43

SOIL BORING LOG

PROJECT NAME: PG&E Topock, Interim Measures, Phase 2 (2005)		HOLE DEPTH (ft): 97.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 459.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,824.65	EASTING (CCS NAD 27 Z 5): 7,616,693.23	DATE STARTED:	DATE COMPLETED:
DRILLING METHOD:		WATER LEVEL (ft):	DRILLING EQUIPMENT:	
LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.			LOGGED BY: B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

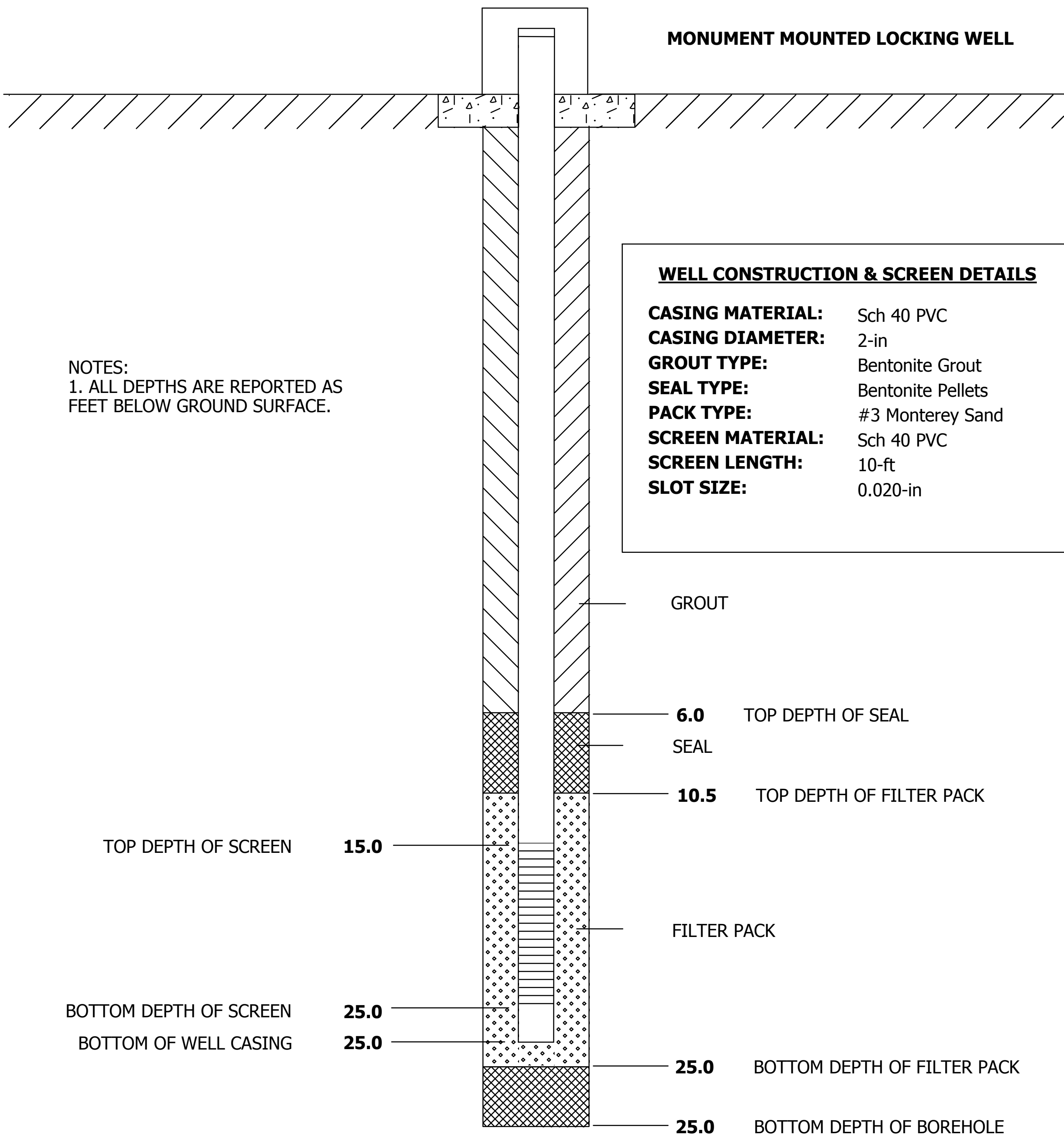
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-43-025**

LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/25/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/25/2005
LOGGER: B. Trebble, T. Lae	**WELL COMPLETION DATE:** 02/25/2005
TOP OF WELL CASING (NGVD 29): 462.54	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101817.50
GROUND SURFACE ELEVATION (NGVD 29): 460.02	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616702.79



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in

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

WELL DIAGRAM IS NOT TO SCALE

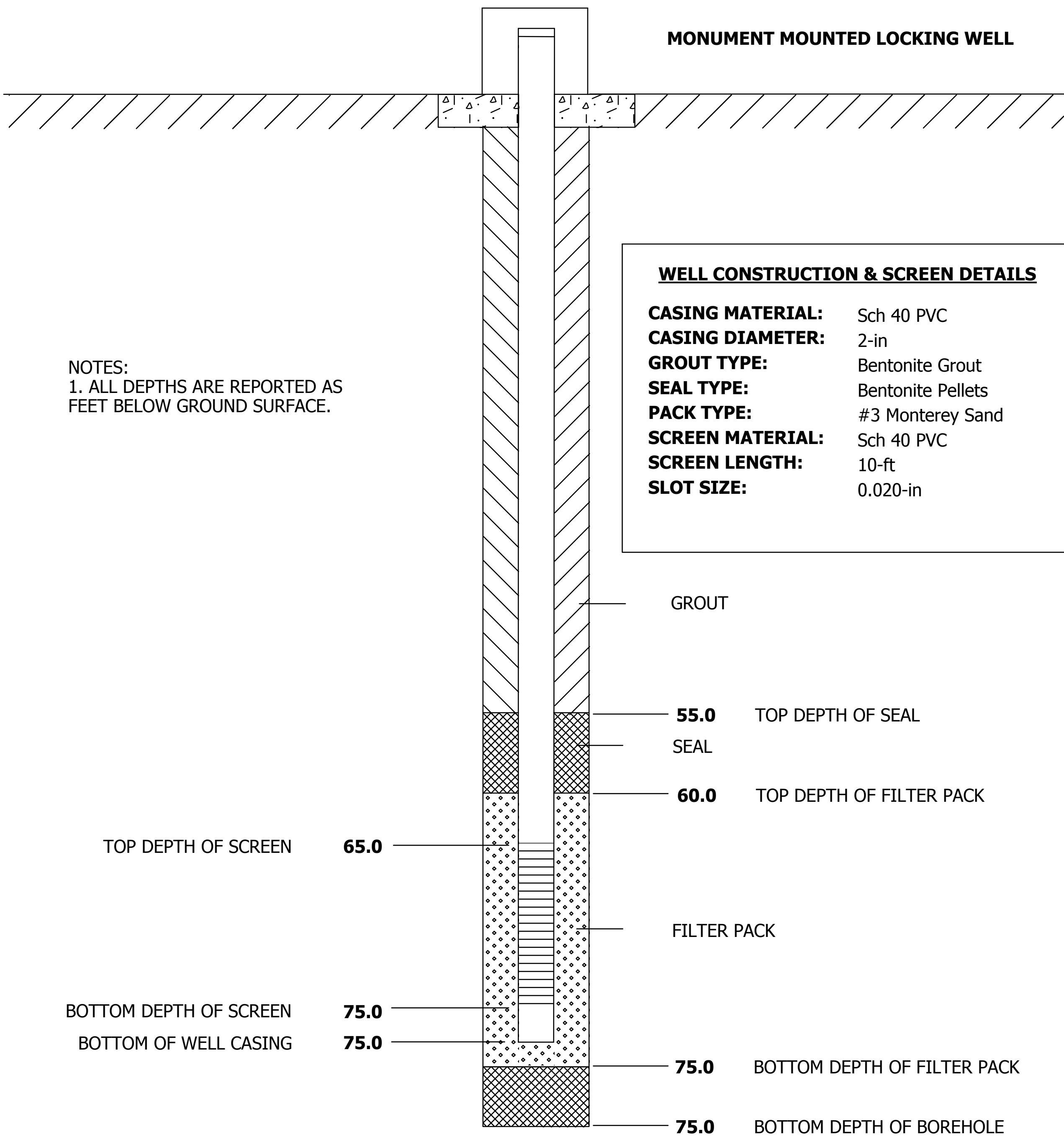
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-43-075**

LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/25/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/25/2005
LOGGER: B. Trebble, T. Lae	**WELL COMPLETION DATE:** 02/25/2005
TOP OF WELL CASING (NGVD 29): 462.71	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101821.29
GROUND SURFACE ELEVATION (NGVD 29): 459.92	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616698.13



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

WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in

WELL DIAGRAM IS NOT TO SCALE

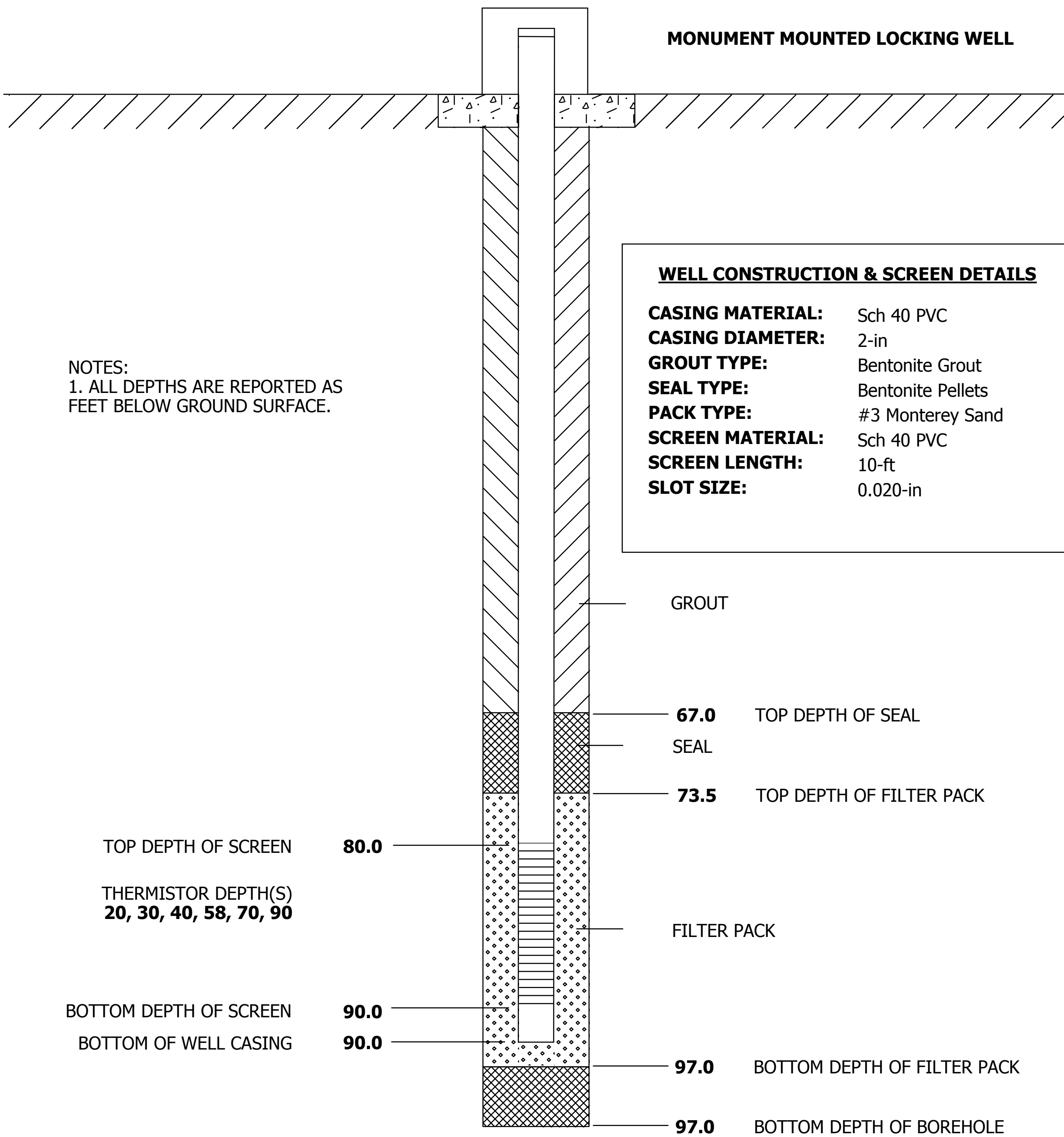
CH2MHILL

WELL COMPLETION DIAGRAM

PROJECT NO: 326228.IM	**PROJECT:** PG&E Topock, Interim Measures, Phase 2 (2005)	**WELL NO:** **MW-43-090**

LOCATION: Floodplain, N. side of 1-40 bridge ROW, 1/4 mi SE of MW-20 Bench.

DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	**DRILLING START DATE:** 02/23/2005
DRILLING METHOD: Rotosonic	**DRILLING END DATE:** 02/23/2005
LOGGER: B. Trebble, T. Lae	**WELL COMPLETION DATE:** 02/24/2005
TOP OF WELL CASING (NGVD 29): 462.76	**NORTHING COORDINATE (CCS DAND 27, ZONE 5):** 2101824.65
GROUND SURFACE ELEVATION (NGVD 29): 459.94	**EASTING COORDINATE (CCS NAD 27 ZONE 5):** 7616693.23



WELL CONSTRUCTION & SCREEN DETAILS

CASING MATERIAL:	Sch 40 PVC
CASING DIAMETER:	2-in
GROUT TYPE:	Bentonite Grout
SEAL TYPE:	Bentonite Pellets
PACK TYPE:	#3 Monterey Sand
SCREEN MATERIAL:	Sch 40 PVC
SCREEN LENGTH:	10-ft
SLOT SIZE:	0.020-in

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

WELL DIAGRAM IS NOT TO SCALE

CH2MHILL

SHEET 1 of 5	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** *MW-44*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 134.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 470.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,729.79	**EASTING (CCS NAD 27 Z 5):** 7,616,251.64	**DATE STARTED:** 3/6/2006	**DATE COMPLETED:** 3/7/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0					**SAND (SP)** - brn (10YR4/3), 95% f sand, <5% silt, 0% gravel, poorly sorted, non-plastic, wet, no odor	Hand augured to 5' bgs
5						
10						
15						
18						0' - 7' was drilled using a 11 3/4 - inch bit with air rotary
20	20-27		7			
22					- color change to very dk brn (10YR2/2)	
23					- color change to very dk grayish brn (2.5YR3/2), fine silt layer (ML), 5% f sand, 95% silt, 0% gravel	
24					- <2% organic specks	
25						
27	27-35		10			
28				SP		
30					- 95% sand, <5% silt, 0% gravel, <2% black organic specks	Drill Rate = 10' / min
35						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-44*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 134.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 470.8 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,102,729.79	EASTING (CCS NAD 27 Z 5): 7,616,251.64	DATE STARTED: 3/6/2006	DATE COMPLETED: 3/7/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SAND (SP) - brn (10YR4/3), 95% f sand, <5% silt, 0% gravel, poorly sorted, non-plastic, wet, no odor	Drill Rate = 10' / min
40					- 95% sand, <5% silt, 0% gravel, <2% black organic specks, gravel up to 2 cm	
			10		- 95% sand, <5% silt, <5% gravel, <2% black organic specks, gravel up to 2 cm, subrnd to rnd, chert & other sed rks present - sand coarsening downward, mostly m sand	
45					- local mottled black organic strings	
50					- 95% sand, <5% silt, <5% gravel, <2% black organic specks, <2% coarse sand	Drill Rate = 10' / min
			10			
55					- sand coarsening downward, mostly m to c sand	
				GW	**SANDY GRAVEL (GW)** - dk yellowish brn (10YR4/4), 35% sand, <5% silt, 60% gravel, well graded, subrnd to rnd up to 10 cm, wet, no odor, mostly sed with minor mm gravel	
					GRAVELLY SAND(SW) - dk yellowish brn (10YR4/4), 70% sand, <5% silt, 30% gravel, well grd, subrnd to rnd up to 9 cm, wet, no odor	
60					- gravelly lens, 35% sand, <5% silt, 60% gravel	
			10		- 70% sand, <5% silt, 25% gravel, max dia 7 cm, trace black organic specks	
					- 55% sand, <5% silt, 40% gravel, trace black organic specks - 85% sand, <5% silt, 10% gravel, gravel fining downward, max dia 5 cm, mostly sed	
65				SW	- 85% sand, <5% silt, 10% gravel - 60% sand, <5% silt, 35% gravel, increased gravel, max dia 7 cm	
					- clayey silt layer, brn (7.5YR4/3), low plasticity, slow dilatancy, soft	Drill Rate = 10' / min
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-44*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 134.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 470.8 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,102,729.79	EASTING (CCS NAD 27 Z 5): 7,616,251.64	DATE STARTED: 3/6/2006	DATE COMPLETED: 3/7/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			10		**GRAVELLY SAND(SW)** - dk yellowish brn (10YR4/4), 70% sand, <5% silt, 30% gravel, well grd, subrnd to rnd up to 9 cm, wet, no odor	Drill Rate = 10' / min
					- 75% f to m grd sand, 10% silt, 15% gravel up to 7 cm	
					- 10% sand, 75% silt, 15% gravel, iron-oxide layering	
75				ML	**SILT (ML)** - dk yellowish brn (10YR4/4), 5% f sand, 95% silt, 5% gravel, gravel very ang to subang up to 4 cm, stiff, very moist to wet alluvial unit with fluvial package	
					- mostly clay lenses with black organic material	
					- 15% sand, 85% silt, <5% gravel, increased f sand, decreased gravel, strong Fe-ox	Drill Rate = 3.3' / min
80			10	SP	**SAND (SP)** yellowish brn (10YR5/4), 70% m sand, <2% silt, 30% gravel, poorly graded, subrnd to rnd up to 8 cm, wet, no odor, distal rock suite assemblage	
					- 65% sand, <5% silt, 30% gravel, rnd to subrnd, max dia 11 cm	
85					- 90% sand, <5% silt, 10% gravel, max dia for gravel 8 cm	
90			10		- 55% m sand, 5% silt, 40% gravel, subrnd to well rnd with max dia 9 cm	
					- Distal Derived Rock Assemblage	
95				GW	**SANDY GRAVEL (GW)** - brn (10YR4/3), 35% sand, <5% silt, 60% gravel, well graded, subrnd to well rnd up to 12 cm, wet, no odor, mostly sed to met	
					- 20% sand, 0% silt, 80% gravel, max dia 11 cm	
100					**SILTY GRAVELLY SAND (SM)** - dk brn (7.5YR3/4), 70% sand, 15% silt, 15% gravel, well graded, subang to subrnd up to 3cm, wet, no odor, mostly met gravel	
					- 40% sand, 25% silt, 15% gravel, subang to subrnd, max dia 3 cm, met gravel	
105						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	MW-44

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 134.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 470.8 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,102,729.79	EASTING (CCS NAD 27 Z 5): 7,616,251.64	DATE STARTED: 3/6/2006	DATE COMPLETED: 3/7/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
			20	SM	**SILTY GRAVELLY SAND (SM)** - dk brn (7.5YR3/4), 70% sand, 15% silt, 15% gravel, well graded, subang to subrnd up to 3cm, wet, no odor, mostly met gravel - 50% sand, 20% silt, 30% gravel, subang to subrnd, max dia 4 cm, met gravel	
110					- 65% sand, 15% silt, 20% gravel, subang to subrnd, max dia 3 cm, met gravel	
115					- very dk gray (7.5YR3/1), 55% sand, 25% silt, 20% gravel, max dia 2 cm, slightly musty-sulphur odor, appears to contain organic material - dk brn (7.5YR3/3), 30% sand, 20% silt, 50% gravel, subang to subrnd, max dia 4 cm, highly weathered met gravel	
120				ML	**GRAVELLY SILT WITH SAND (ML)** - dr reddish brn (5YR3/4), 25% sand, 45% silt, 30% gravel up to 8 cm, well graded, subang to subrnd up to 2 cm, wet, no odor, decomposed	
				SM	**SILTY SAND (SM)** - dr reddish brn (5YR3/4), 75% sand, 15% silt, 10% gravel, well graded, subang to subrnd up to 2 cm,wet, no odor	Top of Reworked Bedrock (?)
125				BR	**MIOCENE CONGLOMERATE (BR)** - reddish brn (5YR4/4), 65% sand, 25% silt, 10% gravel, hard, clasts up to 10 cm, dry	
130						

Boring Terminated at 134 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-44*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 134.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 470.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,729.79	**EASTING (CCS NAD 27 Z 5):** 7,616,251.64	**DATE STARTED:** 3/6/2006	**DATE COMPLETED:** 3/7/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-45*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 97.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 466.6 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,102,559.75	EASTING (CCS NAD 27 Z 5): 7,616,358.13	DATE STARTED: 2/13/2006	DATE COMPLETED: 2/15/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0				SM	**SILTY SAND (SM)** - very pale brn (10YR7/4), 85% mostly f sand, 15% silt, <2% gravel, well sorted, non-plastic, dry, no odor	
5						
10						
15						
17				SP	**SAND (SP)** - brn (10YR4/3), 95% mostly f to m sand, 5% silt, <2% gravel, well sorted, non-plastic, no odor	
20						
25					- grades finer, increased (10% silt), f sand,	
29					- coarsening downward, mostly f to m sand, 5% silt	
30						
35						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-45*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 97.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 466.6 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,102,559.75	EASTING (CCS NAD 27 Z 5): 7,616,358.13	DATE STARTED: 2/13/2006	DATE COMPLETED: 2/15/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SAND (SP) - brn (10YR4/3), 95% mostly f to m sand, 5% silt, <2% gravel, well sorted, non-plastic, no odor	
					- black organic specks, sand fining, mostly f sand	
40					- coarsening downward, 60% med sand, 35% f sand, 5% silt, and black organic specks	
					- f sand w/ clayey silt, very dk grayish brn (10YR3/2)	
45				SW/GW	**GRAVELLY SAND/ SANDY GRAVEL (SW/GW)** - dk grayish brn (10yr4/2), 70% m sand, <5% silt, 5% gravel, poorly sorted, subrnd to rnd up to 8 cm, non-plastic, wet, no odor	
					SAND (SP) - dk yellowish brn (10YR 4/4), 95% mostly f to m sand, <2% f gravel, well sorted, subrnd to rnd up to 2 cm, wet, no odor, abundant black organic specks	
50					- mostly m sand, 5% gravel	
55						
					- 15% gravel, rnd to subrnd up to 5 cm	
					- layer of clayey silt with f sand, brown (7.5YR4/3)	
60					- fining downward, 5% mostly f gravel up to 1.5 cm	
					- layer of silty clay with sand	
65				SP		
					- 90% mostly m sand, 5% silt, 5% gravel	
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-45*

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IMPM Drill Program	97.0	Prosonic Corp. Phoenix, AZ	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
466.6 ft. MSL	2,102,559.75	7,616,358.13	2/13/2006	2/15/2006

DRILLING METHOD: Rotosonic

DRILLING EQUIPMENT: Sonic AT (track mounted)

LOCATION: PG&E Compressor Station - Flood Plain, Topock, California

LOGGED BY: R. Tweidt

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SAND (SP) - dk yellowish brn (10YR 4/4), 95% mostly f to m sand, <2% f gravel, well sorted, subrnd to rnd up to 2 cm, wet, no odor, abundant black organic specks	
75						
					- slity clay lenses intermittent with sand, dk yellowish brn (10YR3/4),	
80						
					- increased gravel (15%) up to 5 cm	
					SANDY SILT (ML) - yellowish brn (10YR 5/4), 30% mostly c to m sand, 70% silt, 0% gravel - coarse river gravel deposit	
85						
				ML		
90						
					- color change to dr reddish brn (5YR3/3), f grained sand, gravel up to 5cm rnd to subrnd	
95				GW	**SANDY GRAVEL (GW)** - brn (10YR4/3), 25% c to m grained sand, 15% silt, 60% gravel, poorly sorted, rnd to subrnd up to 10 cm, low plasticity, wet, no odor	
				BR	**Miocene Conglomerate (BR)** - top 0.5' to 1.0' weathered - BR is competent	

Boring Terminated at 97 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained

CH2MHILL

SHEET 4 of 4	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-45***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 97.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 466.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,559.75	**EASTING (CCS NAD 27 Z 5):** 7,616,358.13	**DATE STARTED:** 2/13/2006	**DATE COMPLETED:** 2/15/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					vc = very coarse-grained *ang = angular* *subang = subangular* *subrnd = subrounded* *rnd = rounded* *br = bedrock formation* *ss = sandstone* *conglom = conglomerate* *comptd = compacted* *qtz = quartz*	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER: MW-46

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 217.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,942.15	EASTING (CCS NAD 27 Z 5): 7,616,194.03	DATE STARTED: 2/7/2006	DATE COMPLETED: 2/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
5		GB	5	SM	**SILTY SAND (SM)** - v pale brn (10YR7/4), 0% gravel, 85% f sand, 15% silts, well sorted, dry, no odor	
10		GB	5			
15		GB	5	SP	**SAND (SP)** - pale brn (10YR6/3), 0% gravel, 95% f sand, 5% fines, slightly moist, no odor	
20		GB	5			
25		GB	5		- encountered groundwater	
30		GB	5		- color change to dr yellowish brn (10YR4/4)	
				SM	**SILTY SAND (SM)** - dk yellowish brn (10YR3/4), 0% gravel, 85% f sand, 15% fines, well sorted, rapid dilatency, low strength, non-plastic, saturated, no odor	
35		GB	5	SP	**SAND (SP)** - brn (10YR4/3), 0% gravel, 90% f sand, 10% fines, well sorted, rapid dilatency, low strength, saturated, no odor	
				ML	**SILT (ML)** - v dk gray (10YR3/1), 0% gravels, 5% f sand, 90% fines,	

CH2MHILL

SHEET 2 of 7	PROJECT NUMBER:	BORING NUMBER: MW-46

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 217.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,942.15	EASTING (CCS NAD 27 Z 5): 7,616,194.03	DATE STARTED: 2/7/2006	DATE COMPLETED: 2/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.)
					well sorted, lateral layering, coarsening downward, saturated, no odor	
				SM	**SILTY SAND (SM)** - v dk greyish brn(10YR3/2), 0% gravel, 80% f sand, 20% fines, wells sorted, rapid dilatency, non-plastic, saturated, no odor	Stop drilling for day (02/07/06)
		GB	5	SP	**SAND (SP)** - brn (10YR4/3), 0% gravel, 90% f sand, 10% fines, well sorted, rapid dilatency, non-plastic, saturated, no odor	Harder drilling at 37'
40						
				ML	**SILT w/ CLAY (ML)** - v dk grayish brn (10YR3/2), slow dilatency, high dry strength, m plasticity, wet, no odor	
		GB	5	SM	**SILTY SAND (SM)** - v dk grayish brn (10YR3/2), 0% gravel, 80% f sand, 20% fines, well sorted, saturated, no odor	
					SAND (SP) - v dk grayish brn (10YR3/2), 0% gravel, 90% f sand, 10% fines, well sorted, saturated	
45						
		GB	5			
50					- dk grayish brn (10YR4/2), thin layer of silt with clay, trace vf sand	
					- subrnd chert pebble (1.5cm), coarsening downwards	
					- 40% m sand, 60% f sand, <2% trace fines, coarsening downward	
		GB	5		- subang pebbles up to 2.5cm, <5% met schist fluvial material	
					- subrnd chert up to 1cm, 65% m sand, 35% f sand, <5% pebbles	
55				SP		
		GB	5		- 85% f sand, 13% m sand, 2% fines, trace subang met pebbles up to 1.5cm	
60					- increased gravel, subrnd to subang up to 4cm, chert and met, coarsening downwards, 50% m sand, 45% f sand, <2% fines	
		GB	5		- fining downwards, 15% m sand, 80% f sand, <5% gravel, trace fines, gravel up to 5cm, subang met	
					- >20% gravel layer, subang to subrnd	
65						
					- gravel layer >20%, subang to subrnd, chert	
		GB	5		**WELL GRADED SAND w/ GRAVEL** - dk yellowish brn (10YR4/4) (changes to 10YR3/2 at 71'), sand (c/m/f) (50/40/5), 5% subrnd to subang gravel up to 8cm, wet, no odor	
					- begin fining down sequence, sand (c/m/f) (20/70/5), 5% gravel	
70				SW		

CH2MHILL

SHEET 3 of 7	PROJECT NUMBER:	BORING NUMBER: MW-46

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 217.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,102,942.15	EASTING (CCS NAD 27 Z 5): 7,616,194.03	DATE STARTED: 2/7/2006	DATE COMPLETED: 2/13/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
75		GB	5		**WELL GRADED SAND w/ GRAVEL** - dk yellowish brn (10YR4/4) (changes to 10YR3/2 at 71'), sand (c/m/f) (50/40/5), 5% subrnd to subang gravel up to 8cm, wet, no odor	
				ML	**CLAYEY SILT w/ GRAVEL (ML)** - yellowish brn (10YR5/4), 10% subang to subrnd gravel, slow dilatency, high dry strength, m plasticity, wet, no odor - gravelly sand with silt layer	
80		GB	5	GM	**CLAYEY SILT w/ GRAVEL (ML)** - yellowish brn (10YR3/4), 10% subang to subrnd gravel up to 6cm, sand (20/30/20), 20% fines, poorly sorted, m dilatency, low dry strength, low plasticity, wet, no odor	Stop drilling for day (02/08/06)
85		GB	5	ML	**SANDY SILT w/ GRAVEL (ML)** - dk yellowish brn (10YR3/4), 5% gravel, sand (c/m/f) (5/20/20), 50% fines, poorly sorted, low to med dilatency, med dry strength, low plasticity, wet, no odor	
90		GB	5			
95		GB	5	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR3/4), 10% subang to subrnd gravel up to 6cm, sand (20/30/20), 20% fines, mostly met gravel, poorly sorted, med dilatency, low dry strength, low plasticity, wet, no odor	
100		GB	5	ML	**SANDY SILT w/ GRAVEL (ML)** - brn (7.5YR4/4), 10% subang gravel up to 3cm, sand (c/m/f) (5/10/10), 65% fines, poorly sorted, low to med dilatency, high dry strength, low plasticity, wet, no odor	Drilling Rate Slows
105		GB	5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 10% subang f gravel up to 5cm, sand (10/15/40), 25% fines, mostly met gravel, poorly sorted, rapid dilatency, non-plastic, wet, no odor	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER: *MW-46*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 217.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,942.15	EASTING (CCS NAD 27 Z 5): 7,616,194.03	DATE STARTED: 2/7/2006	DATE COMPLETED: 2/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
110		GB	5	ML	**SANDY SILT w/ GRAVEL (ML)** - brn (7.5YR4/4), 10% subang f gravel up to 4cm, sand (c/m/f) (5/5/20), 60% fines, poorly sorted, low to med dilatency, med dry strength, low to med plasticity, moist, no odor	
115		GB	5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 10% subang met gravel up to 5cm, sand (10/60/5), 15% fines, mostly met gravel, poorly sorted, med dilatency, non-plastic, wet, no odor	
120		GB	5		**SILT w/ GRAVEL (ML)** - brn (7.5YR4/4), <10% subang to ang gravel up to 8cm, met sand (5/5/5), rapid dilatency, high dry strength, low plasticity, moist, no odor	
125		GB	5	ML	- decomposed halos around met gravel evident - increased silt content (>80%), max gravel up to 3cm, trace clay	
130		GB	5			Drilling Rate Slows
				GM	**SILTY GRAVEL (GM)** - yellowish brn (10YR5/4), 50% ang to subang gravel up to 7cm, 10% c sand, 40% fines, poorly sorted, dry - increased c gravel (>30%), ang to subang up to 7cm, met	
135		GB	5		**SILTY SAND w/ GRAVEL (SM)** - brn (10YR4/3), 10% ang to subang met gravel up to 5cm, sand(10/60/5), 15% fines, poorly sorted, rapid dilatency, non-plastic, wet, no odor	
140		GB	5	SM	- increased fines (25%) - decreased fines (25%) - increased fines (30%), sand (15/15/30), 10% ang to subang met	

CH2MHILL

SHEET 5 of 7	PROJECT NUMBER:	BORING NUMBER: MW-46

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 217.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,942.15	EASTING (CCS NAD 27 Z 5): 7,616,194.03	DATE STARTED: 2/7/2006	DATE COMPLETED: 2/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					gravel up to 3cm, decomp halos around some met gravel	
145		GB	5	ML	**SANDY SILT w/ GRAVEL (ML)** - dk brn (10YR3/3), 10% ang to subang met gravel up to 7cm, sand (c/m/f) (5/5/20), 60% fines, poorly sorted, slow dilatency, med dry strength, low to med plasticity, wet, no odor	Blue clay starts at 142'
150		GB	5			
155		GB	5			Stop drilling for day (02/09/06)
160		GB	5	SM	**SILTY SAND w/ GRAVEL (SM)** - v dk brn (10YR2/2), 10% ang to subang met gravel up to 3cm, stiff sand (5/50/20), 15% fines, poorly sorted, rapid dilatency, non-plastic, slightly moist, no odor	Possible top of reworked Miocene Conglomerate
					SILT w/ GRAVEL (ML) - brn (7.5YR4/4), 15% ang to subang met gravel up to 8cm, 5% c sand, 80% fines, rapid dilatency, high dry strength, low plasticity, slightly moist, no odor. Possible top of reworked conglomerate?	
165		GB	5			
170		GB	5			
175						

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PROJECT NUMBER:	BORING NUMBER: MW-46

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	**HOLE DEPTH (ft):** 217.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,942.15	**EASTING (CCS NAD 27 Z 5):** 7,616,194.03	**DATE STARTED:** 2/7/2006 — **DATE COMPLETED:** 2/13/2006
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		**LOGGED BY:** R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILT w/ GRAVEL (ML) - brn (7.5YR4/4), 15% ang to subang met gravel up to 8cm, 5% c sand, 80% fines, rapid dilatency, high dry strength, low plasticity, slightly moist, no odor. Possible top of reworked conglomerate?	
					- decreased gravel (max dia 2cm), highly decomposed met gravel, dk reddish brn (5YR3/3)	
180						
					- soil becomes moist to wet, increased sand (5/10/15), 15% gravel	
				ML		
185						
					- increased gravel size (up to 6cm)	
190						
195						
					- increased fines, decreased sand & gravel, trace clay, strong brn (7.5YR4/4)	
200						
					- increased sand & gravel gravel size increases up to 5cm, mod to highly weathered	
205						
					- soil becoming harder and more stiff, 75% fines (increase), sand (<5/5/10), 10% gravel, pebble size up to 4cm	
210						

SHEET 7 of 7	PROJECT NUMBER:	BORING NUMBER: MW-46

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 217.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 480.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,942.15	EASTING (CCS NAD 27 Z 5): 7,616,194.03	DATE STARTED: 2/7/2006	DATE COMPLETED: 2/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: R. Tweidt	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				BR	**MIOCENE CONGLOMERATE (BR)** - reddish brn (5YR4/4), mod to strong, matrix supported, gravel size up to 4cm, slightly mosit - bedrock becomes dry and more competent	
215						
					Boring Terminated at 217 ft	

ABBREVIATIONS

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

SHEET 1 of 9	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-47***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ

SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 2/27/2006	**DATE COMPLETED:** 3/13/2006

DRILLING METHOD: Rotosonic	**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California	**LOGGED BY:** B. Moayyad, K. Ebel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–5			6	SP	**POORLY GRADED SAND (SP)** - very lt brn (10YR7/3), =2% fines, 98% f to m lithic quartz sand, subang to subrnd, dry - fine roots, iron staining, some iron oxide coating on grains	Hand augured to 5' bgs
5–15			10	SP	- slightly moist - dry	Rapid drill rate, no chatter
15–25			16	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - lt yellowish brn (10YR6/4), 45% gravel up to 7cm, 50% f to m sand, 5% fines, loose, met subang gravel, dry(moist@ 17') - cobble present in slough - one subrnd chert gravel - Possible Fluvially Reworked Alluvium - lt grey (10YR7/2), subang to rnd met gravel up to 9cm, 2% to 5% fines - dk yellowish brn (10YR4/4), mostly c sand subang to ang, met, some Miocene conglomerate gravel - 65% sand, 30% gravel up to 4cm, 5% fines	
25–30				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk yellowish brn (10YR3/6), 35% gravel up to 4cm, 55% m to c sand, 10% silty fines, met clasts are grain supported some mm siltstone - some oxide staining	
30–34				SW	**WELL GRADED SAND w/ GRAVEL AND CLAY (SW)** - dk yellowish brn (10YR3/6), 30% subang met gravel up to 7 cm, 55% subrnd to subang m to c sand, 15% clayey fines, m density, moist	Drill rate slowed to clean out 8" pipe
35						

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PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IMPM Drill Program	288.0	Prosonic Corp. Phoenix, AZ	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
482.6 ft. MSL	2,103,450.05	7,615,629.49	2/27/2006	3/13/2006

DRILLING METHOD:	DRILLING EQUIPMENT:
Rotosonic	Sonic AT (track mounted)

LOCATION:	LOGGED BY:
PG&E Compressor Station - Flood Plain, Topock, California	B. Moayyad, K. Ebel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			2.5	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dr yellowish brn (10YR3/6), 30% gravel, 60% sand, 10% silty fines	Drilling smooth but preceeds less rapidly
					WELL GRADED SAND w/ GRAVEL (SW) - 40% subang met gravel up to 6cm, 55% subrnd to ang sand, 5% fines - more gravel below 38'	
40						
			10	SW	- gravel is mostly fine	
45						
				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - Pale brn (10YR6/3), 30% subang met gravel up to 5cm, 60% subrnd to subang m to c met sand, 10% silty fines, wet	Soil sample collected
50						
			10	SP	**POORLY GRADED SAND w/ GRAVEL (SP)** - pale brn (10TR6/3), 30% f subang gravel up to 2 cm, 65% mostly c sand, =2% fines	
55				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 40% subang met gravel up to 9cm, 55% f to c met sand, 5% silty fines, clast supported, m density, wet	
					WELL GRADED GRAVEL w/ SILT AND SAND (GW) - brn (7.5YR5/4), 55% subang to ang met gravel up to 4cm, 25% f to c sand, 20% silty fines, dense, moist to dry	
60					- soil dries out	Collected Isoflow sample
			9.5	GW	- lt grey (10YR7/2) and powder dry	Drill rate slows to 2' / min
65					- moist sandy zone, 55% gravel, 35% sand, 10% fines - dry silty lt grey GW below 65'	
				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - yellowish brn (10YR5/4), 35% subang met gravel up to 4cm, 60% subrnd sand, 5% silty fines, loose, moist to wet	Moderate Drill Rate
70						

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 288.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,450.05	EASTING (CCS NAD 27 Z 5): 7,615,629.49	DATE STARTED: 2/27/2006	DATE COMPLETED: 3/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			9.5	SW	**WELL GRADED SAND w/ SILT AND GRAVEL (SW)** - yellowish brn (10YR5/4), 30% gravel, 50% sand, 20% silty fines, massive, dense, moist	Collected soil sample
75				GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - lt gray, 65% ang met gravel, 25% subang sand, 10% fines, dry	
80				SM	**SILTY SAND W/ GRAVEL (SM)** - brn (10YR5/3), 22% subang met gravel up to 3.5cm, 50% subrnd to subang f to c sand, 23% silty fines, m density, wet	Collected Isoflow sample Moderate Drill Rate
85			19	SW	**WELL GRADED SAND w/ SILT AND GRAVEL (SW)** - brn, 30% subang fine gravel, 65% subang to subrnd m to c sand, 10% silty fines, m dense, wet - silty zone, 15% fines - massive silty zone	Driller reports harder drilling, likely stiff clay
90				GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - brn, 55% subrnd to subang met gravel up to 4.5cm, 35% f to c sand, 10% silty fines, lose to medium, wet	
95				SW	**SILTY SAND w/ GRAVEL (SM)** - 20% subang to subrnd met gravel, 60% subang f to c sand, 20% silty fines, massive, blocky, wet	Green alteration mineral in milky quartz fragment Drill Rate = 1.5' / min
100 105			12.5	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - grayish brn (10YR5/2), 15% subang to subrnd met gravel up to 2.5cm, 80% subrnd m to c sand, 5% silty fines, loose, wet - becomes brn and gravelly, 30% gravel up to 3.5cm, 63% m to c sand, 7% fines	Soil sample collected

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IMPM Drill Program	288.0	Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 2/27/2006 — **DATE COMPLETED:** 3/13/2006
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		**LOGGED BY:** B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND w/ GRAVEL (SW) - grayish brn (10YR5/2), 15% subang to subrnd met gravel up to 2.5cm, 80% subrnd m to c sand, 5% silty fines, loose, wet - silty with calcite nodules	Core barrel fills at 108' bgs
110				GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - brn, 60% gravel up to 4cm, 30% sand, 10% fines, dry	
115			7	SW	**WELL GRADED SAND w/ SILT AND GRAVEL (SW)** - brn (7.5YR4/3), 25% subang met gravel up to 3.5cm, 65% subrnd f to c sand, 5% fines, loose, wet - greenish grey sand lenses - 4" gravel zone	Significant rig chatter Driller reports intermittent hard layers
120			10	SM	**SILTY SAND w/ GRAVEL (SM)** - dusky red (2.5YR4/4), 15% subang met gravel up to 2.5cm, 60% subrnd to subang f to c sand, 20% fines, massive, blocky, clast supported, moist to wet	Significant rig chatter
125				GW	**WELL GRADED GRAVEL w/ SILT AND SAND (GW)** - light brownish gray (10YR6/2), 65% ang met gravel up to 4cm, 25% f to c sand, 5% silty fines, dry	
				SW	**WELL GRADED SAND w/ SILT AND GRAVEL (SW)** - dusky red, 15% gravel, 75% sand, 10% fines	
130			9	SM	**SILTY SAND w/ GRAVEL (SM)** - dusky red (2.5YR4/6), 15% subang to subrnd met gravel up to 3cm, 60% sand, 25% fines, massive, dense, clast supported, wet - more loose and less silty	
135				SW	**WELL GRADED SAND w/ SILT (SW)** - dusky red (2.5YR4/6), 5% gravel, 90% subrnd f to c sand, 5% fines, loose, wet	
140					**POORLY GRADED SAND w/ SILT (SP)** - brn (7.5YR4/4), 5% subrnd to subang met gravel up to 4cm, 85% f to c sand, 10% fines, poorly graded, wet, no odor	

CH2MHILL

SHEET 5 of 9	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-47***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 2/27/2006 — **DATE COMPLETED:** 3/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
			6	SP	**POORLY GRADED SAND w/ SILT (SP)** - brn (7.5YR4/4), 5% subrnd to subang met gravel up to 4cm, 85% f to c sand, 10% fines, poorly graded, wet, no odor	
145			3	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 20% subang to subrnd gravel up to 6cm, 60% f to c sand, 20% silty fines, well graded, m consolidated, met, wet, no odor	
150			5	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 25% subang to subrnd up to 4cm met gravel, 60% well graded f to c sand, 15% fines, wet, no odor	
155			4	SW	**WELL GRADED SAND w/ SILT AND SAND (SW)** - dr yellowish brn (10YR4/4), 10% subang to subrnd up to 3cm met gravel, 75%well graded f to c sand, 15% fines, moist to wet	
			2	SW	**SILTY SAND (SM)** - brn (7.5YR4/4), 5% ang to subrnd met gravel up to 1.5cm increasing with depth, 85% poorly graded m to c sand, 10% fines, loose, wet	
			2	SM	**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 15% subang to subrnd up to 2.5cm met gravel, 75% well graded f to c sand, 10% fines, mostly met, trace chert, loose, wet, no odor	Collected Isoflow sample
160			4	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 25% subang to subrnd gravel up to 6.5cm, 60% m to c sand, 15% silty fines, well graded, m consolidated, met, wet, no odor	Drill rate = 0.75' to 1.5' / min
165			4	SW	**SILTY SAND (SW)** - mottled dk reddish brn (5YR3/4), 10% subang to subrnd gravel up to 2.5cm, 50% well graded f to m sand, 40% silt, metamorphic, dry to damp, no odor, interbedded sandy silt laminations	
170			5.5	SW	**SAND w/ GRAVEL (SW)** - dk reddish brn (5YR3/4), 20% subang to subrnd gravel up to 5cm, 75% f to c sand, 5% fines, well graded, loose, met, wet	
175			2.5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 15% subang to subrnd gravel, 70% f to m sand, 15% fines, poorly graded, met,increasingly consolidated, slightly to moderately calcareous, moist to wet	

SHEET 6 of 9	PROJECT NUMBER: 326128.01.16.EN	BORING NUMBER: MW-47

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 288.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,450.05	EASTING (CCS NAD 27 Z 5): 7,615,629.49	DATE STARTED: 2/27/2006	DATE COMPLETED: 3/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
			2	SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 20% subang to subrnd gravel, 60% m to c sand, 20% fines, poorly graded, m consoldated, very calcareous, dry to damp, no odor	
180			4	SW	**SILTY SAND (SW)** - brn (7.5YR4/3), 10% subrnd to subang gravel up to 4.6cm, 70% f to c sand, 20% fines, well graded, met, moist to wet, no odor	Collected Isoflow sample
185			8	SM	**SILTY SAND W/ GRAVEL (SM)** - brn (7.5YR4/4), 20% subrnd to subang gravel up to 2.4cm, 65% f to c sand, 15% clayey fines lenses, well graded, met, very calcareous, dry to damp with locally moist areas, no odor	Drill Rate - 1.6' / min
190			6	SM	**SILTY SAND w/ GRAVEL (SM)** - dr brn (7.5YR3/4), 10% subrnd to subang gravel up to 4cm, 75% f to c sand, 15% fines, well graded, loose to poorly consolidated, met, moist to wet, no odor	
195			2	GM	**SILTY GRAVEL w/ SAND (GM)** - reddish brn (5YR4/4), 45% subang to subrnd gravel up to 5.5cm, 40% f to c sand, 15% fines, slight to moderately calcareous, met, dry to damp with locally moist areas	
200 205			10	SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 15% subang to subrnd gravel up to 5cm, 70% well graded f to c sand, 15% fines, moderately calcareous, loose to poorly consolidated, met, moist to wet - clay locally, slight decrease in gravel	Collected Isoflow sample Drill Rate = 1.5' to 2' / min
210					**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 20% subang to subrnd gravel up to 6.5cm, 65% well graded f to c sand, 15% mostly clay fines, moderately to very calcareous, poorly graded, moist to wet - mostly met w. chloritic alteration	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-47*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 288.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,450.05	EASTING (CCS NAD 27 Z 5): 7,615,629.49	DATE STARTED: 2/27/2006	DATE COMPLETED: 3/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			7	SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 20% subang to subrnd gravel up to 6.5cm, 65% well graded f to c sand, 15% mostly clay fines, moderately to very calcareous, poorly graded, moist to wet	
215			3	GM	**SILTY GRAVEL w/ SAND (GM)** - reddish brn (5YR4/4), subang to subrnd gravel up to 5cm, f to c sand, mostly clay fines, slight to moderately calcareous, moderate to well consolidated, met, dry to moist - minor chert, choloric alteration in parts	
220			3.5	SW	**SILTY SAND (SW)** - reddish brn (5YR4/4), 5% subang to subrnd gravel up to 2cm, 85% subang to subrnd sand, 15% fines, nom to slightly calcareous, well graded, loose to poorly consolidated, moist to wet - minor cloride alteration, increase in silt and clay locally	Collected Isoflow sample Drill Rate = 1.5' / min
225			2.5	GW	**GRAVEL W/ SAND (GM)** - reddish brn (5YR4/4), 80% subang to subrnd gravel up to 6cm, 15% well graded f to c sand, 5% fines, nom to slightly calcareous, loose to poorly consoldated, met, wet, no odor - locally silty and sandy	
			4	GM	**SILTY GRAVEL W/ SAND (GM)** - reddish brn (5YR4/4), 45% subang to subrnd gravel up to 5cm, 40% well graded f to c sand, 15% fines, poor to mod consolidated, mostly met, wet, no odor - minor chert, clayey locally, increase in fines locally	
230 235			6 2	SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 15% subang to subrnd gravel up to 3cm, 75% f to c sand, 10% fines, loose to mod consolidated, mostly met, wet, no odor - minor sed increase in fines, clay locally - met, increased silt and clay fraction, increased gravel, 25% subang to subrnd gravel up to 6.5cm, 55% sand, 20% fines	
			2	GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 45% well graded subang to subrnd gravel up to 3cm, 35% well graded sand, 20% silt, mod to very calcareous, mod to well consolidated, mostly met, minor sed, dry to moist, no odor	Collected Isoflow sample Drill Rate = 1' / min
240 245					**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 55% well graded subang to subrnd gravel up to 7cm, 30% well graded sand, 15% silt, mod to very calcareous, mostly well consolidated, locally hard, mostly met, minor sed, dry to moist, no odor - locally very altered	

CH2MHILL

SHEET 8 of 9	PROJECT NUMBER: 326128.01.16.EN	BORING NUMBER: *MW-47*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 288.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.6 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,450.05	EASTING (CCS NAD 27 Z 5): 7,615,629.49	DATE STARTED: 2/27/2006	DATE COMPLETED: 3/13/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: B. Moayyad, K. Ebel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
245–255 (250)			16	GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 55% well graded subang to subrnd gravel up to 7cm, 30% well graded sand, 15% silt, mod to very calcareous, mostly well consolidated, locally hard, mostly met, minor sed, dry to moist, no odor	Drill rate = 0.75' / min
255–260			10	GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 65% well graded subang to subrnd gravel up to 8cm, 20% well graded sand, 15% silt, very calcareous, mostly well consolidated, mod to locally altered, mostly met, minor sed, dry to moist, no odor	Collected Isoflow sample Drill Rate = 1' / min
260–265				GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 40% well graded subang to subrnd gravel up to 5.5cm, 35% well graded sand, 25% silt, mod to very calcareous, well consolidated, mod altered locally, mostly met, minor sed, dry to moist, no odor	
265–267.5			2.5	SW	**SILTY SAND w/ GRAVEL (SW)** - reddish brn (5YR4/4), 35% gravel up to 8cm, 45% well graded f to c sand, 20% fines, very calcareous, well consolidated, locally very altered, mostly met gravel, dry to moist, no odor	Drill Rate = 0.50' / min
267.5–270			0	GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 65% well graded subang to subrnd gravel up to 5.5cm, 25% well graded f to c sand, 10% silt, very calcareous, well consolidated, mod to locally very altered, mostly met gravel, minor sed, damp to moist, no odor	
270–275			5	GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 55% well graded subang to subrnd gravel up to 11.5cm, 30% well graded sand, 15% silt, very calcareous, well consolidated, very altered locally, mostly met, minor sed, damp to moist, no odor - gravel/sand fractions somewhat variable	
275–277			2	SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR3/4), 30% poorly graded subang to subrnds gravel up to 11.5cm, 40% well graded sand, 30% fines, very calcareous, well consolidated to locally hard, mod to very altered in parts, mostly met, damp to moist, no odor	
277–280 (280)			3	GW	**SILTY GRAVEL w/ SAND (GW)** - reddish brn (5YR3/4), 55% well graded subang to subrnd gravel up to 5.5cm, 30% well graded sand, 15% silt, very calcareous, well consolidated to commonly hard, mod to very altered locally, mostly met, minor sed, dry to moist, no odor	Collected Isoflow sample

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-47*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 288.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 482.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,450.05	**EASTING (CCS NAD 27 Z 5):** 7,615,629.49	**DATE STARTED:** 2/27/2006 / **DATE COMPLETED:** 3/13/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** B. Moayyad, K. Ebel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
285			0	BR	**MIOCENE CONGLOMERATE BEDROCK (BR)** - 60% well graded subang to rnd gravel up to 10cm, 30% well graded sand, 10% fines, very calcareous, well consolidated to mostly hard, mod to very altered locally, mostly met, dry to moist	

Boring Terminated at 288 ft

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*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 INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–6			0	SM	**SILTY SAND (SM)** - 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	Hand auger to ~6'
5					- some c sand, gravel increases to 15%	
6–16			10		- 40% gravel	
					- some <3cm silt nodules, well graded, increased silt, 50% sand, 35% fines, 15% gravel	Drilling Hard
10					- brn (10YR4/3), 65%sand, 10% fines, 25% gravel, increased gravel and c sand, mostly subang, loose, dry	
						Drilling Hard
15						
16–26			10		- becomes moist, dk yellow brn (10YR3/4), 75% sand, 15% fines, 10% silt	
20					- (10YR4/4)	
					- increasing gravel up to 6cm, subrnd, met, 50% sand, 10% fines, 40% gravel	
25						
26–35			10	SM	**SILTY SAND W/ GRAVEL (SM)** - 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	
30				ML	**SANDY SILT W/ GRAVEL (ML)** - 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	
				SM	**SILTY SAND W/ GRAVEL (SM)** - 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	

CH2MHILL

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 INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
			5	SM	**WELL GRADED SAND (SM)** - 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	
40						
			6	SM	**SAND w/ SILT and GRAVEL (SM)** - 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	
45				GM	**GRAVEL w/ SILT and SAND** dk reddish brn (5YR3/4), 25% well graded f to c sand, 30% fines, 45% subang gravel up to 9cm, fine silt, loose, dry	
			8	ML	**SILT w/ SAND and GRAVEL (ML)** - 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	Drilling Hard Drilling Hard - top of old alluvium ?
50						
				GM	**SANDY SILTY GRAVEL (GM)** - 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	
55						
			5			
60						
			5		- increased gravel and silt, 15% sand, 25% silt, 60% gravel - large conglomerate cobbles, no met	
65						
			5			
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-48*

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:
IMPM Drill Program	138.0	Prosonic Corp. Phoenix, AZ

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
484.4 ft. MSL	2,101,435.28	7,615,915.90	5/3/2006	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 INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
75			5		**SANDY SILTY GRAVEL (GM)** - 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			10	GM	**SILTY SANDY GRAVEL (GW)** - reddish brn (5YR4/4), 30% m sand, 20% fines, 50% gravel, subrnd to subang up to 4cm, mm & conglom clasts, loose, dry	
85						
90			10	SM	**SILTY SAND (SM)** - 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				ML	**SANDY SILT W/ GRAVEL (ML)** - 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			10	GM	**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 - coarsening of sand and gravel - brn (7.5YR4/4)	
105						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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)**	Hard Drilling = 3' / min
120			10	GM		
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

CH2MHILL

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SANDY GRAVEL (GM)	
			10		- core sized conglom clasts	Drilling easier = 1.5' / min
					- moist core, subang gravel, 15% sand, 35% fines, 50% gravel	
				GM		
					- dry core, subang gravel, 15% sand, 35% fines, 50% gravel	
					- 20% sand, 30% fines, 50% gravel	
			8			
					MIOCENE CONGLOMERATE (BR)	
				BR	- gravel coarsening up to 9cm	
					Boring Terminated at 155 ft	

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-49*

SOIL BORING LOG

PROJECT NAME:		HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IMPM Drill Program		385.0	Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0				SP	**POORLY GRADED SAND (SP)** - lt reddish brn (5YR6/3), 0% gravel, 98% vf to f mostly quartz sand with some Fe staining, 2% fines, small mm fraction, loose, moist	
5					- grades finer, mostly vf sand, 0% gravel, 95% sand, 5% fines, micareous minerals, dry	
10						
15				SP		
20						No core, only slough
					- some silt/clay nodules up to 3cm, 0% gravel, 90% sand, 10% fines	
25						
30				SM	**SILTY SAND (SM)** - yellowish brn (10YR4/4), 0% gravel, 80% f subrnd sand with silt fraction, 20% fines, moist	
					- very clayey lens, 0% gravel, 55% sand, 45% fines	
				SM	- clay nodules are larger & harder, (0, 70, 30)	
35						

PROJECT NUMBER: 326128.01.16.EN	BORING NUMBER: *MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 385.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,667.51	EASTING (CCS NAD 27 Z 5): 7,615,889.90	DATE STARTED: 3/12/2006	DATE COMPLETED: 3/22/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SAND (SM) - yellowish brn (10YR4/4), 0% gravel, 80% f subrnd sand with silt fraction, 20% fines, moist - few silt nodules, dry, (0, 85, 15)	
				CL	**CLAY w/ SAND (CL)** - brn (10YR4/3), 0% gravel, 5% sand, 95% fines, low hardness, m plasticity, mostly clay	
40				SM	**SILTY SAND (SM)** - brn (10YR4/3) 0% gravel, 75% f subrnd to rnd mostly quartz sand, 25% fines, m density, moist.	
				ML	**SILT w/ SAND (SM)** - brn (10YR4/3), 0% gravel, 15% sand, 85% silt, m density, low plasticity, moist to sat	
45				SM	**SILTY SAND (SM)** - brn (10YR4/4), 0% gravel, 80% sand, 20% silt w/subang - rnd 3 inches in density - 6cm v hard siltstone gravel, cemented - 3" silt - very high dilatency, saturated - 3" clay with silt, gravel up to 2cm - f sand (0.75,15) - mottled brown/blk sand	
50				ML	**SILT w/ SAND (ML)** - brn (10YR4/2), 0% gravel, 9% sand, 10% silt, m density, moist	
55				SM	**SAND w/ SILT (SM)** - yellowish brn (10YR2/16), 30% mostly c to m sand, 70% silt, 0% gravel - clay lens 10,25,75 - saturated v high dilatency w/sand - sand	
60, 65				GW	**SANDY GRAVEL W/SILT (SW/GW)** - drk brn (10yr4/4), 50% m sand, 40% silt, 01% gravel, subrnd gravel up to 8 cm, mostly met or limestone? subang orange m-c sand, met loose, wet	
				ML	**SILTY GRAVELLY SILT (ML)** - drk yellowish brn (10YR4/4), 15% sand, 20% silt, 60% sand, well graded, subang up to 2cm, density, wet	
70						

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SHEET 3 of 12	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-49***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ

SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006

DRILLING METHOD: Rotosonic	**DRILLING EQUIPMENT:** Track Mounted Rotosonic
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California	**LOGGED BY:** K. Ebel / L. Kelly

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				GM	**SILT SANDY GRAVEL (GM)** -drk yellowish brn (10YR4/3, 50% gravel, 35% sand, 15%, sand, subrd-subang, mostly m-c gravel subrnd-subang met, up to 7cm, loose wet - gravel mostly subrnd	Drilling Rate Slows
75						
				GW	**SANDY GRAVEL (GW)** - yellowish brn (10yr5/4), 65% m sand, 30% silt, 5% gravel subnrg, sand mostly c, subrnd-subang only silt	
80					- gravel up to 8 cm - gravel (c sandstone) lt cm	
85				ML	**SANDY GRAVELLY SILT (ML)** - yellowish brn (10YR5/4), 35% sand, 30% silt, 45% subng met gravel up to 4 cm, subrnd-subang m-c sand, v. soft, saturated	
				GW	**SANDY GRAVEL (GW)** - greyish brn (10YR4/2), 30% sand, 68% silt, 2% gravel, subng met, f gravel up to 2 cm and vc sand, well graded, most n, 5 cm 100% wet - minor clay (85,10,5) gravel, coarsens up to to 9 cm, some silt nodules	
90						
95				SW	**GRAVELLY SAND (SM)** - greyish brn (10R4/2) 30% sand, 68% silt 2% gravel silt subrnd-subang gravel up to 3 cm, sand m-c, met - almost no gravel, (5,85,10) sand f-c	
				GM	**SANDY SILTY GRAVEL (GM)** - brn (10YR4/3), 55% subang gravel up to 6cm, 25% subang to subrnd f to c sand, 20% fines, met and some alteration, loose, wet - 3 core barrel (8") 55 clasts	
100						
105						

SHEET 4 of 12	PROJECT NUMBER: 326128.01.16.EN	BORING NUMBER: MW-49

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006 **DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SANDY SILTY GRAVEL (GM) - brn (10YR4/3), 55% subang gravel up to 6cm, 25% subang to subrnd f to c sand, 20% fines, met and some alteration, loose, wet - poor sample quality due to several attemps to recover core	Poor core recovery due to several attemps to recover core
110				SW	**WELL GRADED SAND (SW)** - yellowish brn (10YR5/4), 5% rnd to subrnd gravel up to 1.5cm, 95% f to c sand, 0% fines, ig/met/sed mix, locally more gravel, % gravel increases w/depth, loose, wet	
				SP	**POORLY GRADED SAND w/ GRAVEL (SP)** - yellowish brn (10YR5/4), 40% rnd to subrnd f to c gravel up to 4.5cm, 60% m to c sand, 0% fines, ig/met mix, minor alteration, loose, wet	
115				GW	**WELL GRADED GRAVEL w/ SAND (GW)** - yellowish brn (10YR5/4), 85% subang to subrnd f to c gravel up to 7.5cm, 15% f to c sand, 0% fines, coarse gravel w/depth, ig/met/sed mix, minor alteration, loose, wet	
120				GW	**GRAVEL w/ SAND (GW)** - dr yellowish brn (10YR4/4), 75% subrnd to subang gravel, 20% sand, 5% fines, cobbles up to 12 cm, met/sed/ig mix, loose, wet	
125				GW	**GRAVEL w/ SAND (GW)** - yellowish brn (10YR5/4), 60% f to c gravel up to 6cm, 40% f to c sand, 0% fines, mostly ig/met, loose, wet - poor sample quality due to attemps to recover core	Poor core recovery due to several attemps to recover core
130				GM	**SILTY SAND w/ GRAVEL** - brn (10YR4/3), 45% subang to subrnd f to c gravel up to 4cm, 35% f to c sand, 20% fines, ig to mostly met gravel, some chloritic alteration, fines clay in part, loose to poorly consolidated, wet	
				SW	**WELL GRADED SAND (SW)** - dk yellowish brn (10YR4/4), 5% subang to subrnd gravel up to 2cm, 95% f to c sand, 0% fines, met/sed mix, locally more gravel, % gravel increases w/depth, loose, wet	
135				GW	**WELL GRADED GRAVEL w/ SAND (GW)** - yellowish brn (10YR5/4), 85% subrnd to subang f to c gravel up to 3cm, 15% f to c sand, 0% fines, loose, wet	
				SM	**SILTY SAND w/ GRAVEL (SM)** - brn (7.5YR4/4), 25% subang to subrnd gravel up to 3cm, 45% f to c sand, 30% fines, mostly met, low plasticity, poor to mod consolidated	
140						

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PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	HOLE DEPTH (ft): 385.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,103,667.51	EASTING (CCS NAD 27 Z 5): 7,615,889.90	DATE STARTED: 3/12/2006	DATE COMPLETED: 3/22/2006
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		LOGGED BY: K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	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.
				GM	**SILTY GRAVEL w/ SAND (GM)** - reddish brn (5YR4/4), 55% f to c subang to subrnd gravel up to 7.5cm, 20% sand, 25% fines, mostly met, some chloritic alteration, low plasticity, poorly consolidated, wet	
145				SM	**SILTY SAND (SM)** - brn (7.5YR4/4), 10% f gravel, 50% f to c sand, 40% fines, mostly met, low plasticity, poor to mod consolidated, moist to wet	Good sample quality
				SM	**GRAVELLY SAND (SM)** - drk yellowish brn (10R4/4) 40% sand, 50%silt 10% gravel silt mc sand, gravel up to 3 cm, modtly ig. some met subang wet	Drilling Rate Slow = 0.5' /min
150				GM	**SANDY GRAVEL (GM)** - drk yellowish brn (10YR4/4), 45% sand, 40% silt, 15% sand, subang subrnd gravel up to 5 cm, subrnd-subang m-c sand, ig. and met, loose, wet	
155				SM	**GRAVELLY SAND (SM)** - drk yellowish brn (10R4/4) 20% sand, 65%, 15% silt subang f gravel up to 2 cm, subrnd-subang mc sand, ig & met loose, wet	Drilling Rate = 2' /min
160				SM	**GRAVELLY SILTY SAND (SM)** - reddish brn (5YR4/3), 35% sand, 45% silt, 20% gravel, subang gravel up to 4 cm, well graded for subrnd-subang sand, mostly met, some ig & sed, dark in parts, moist - dr greyish brn (10YR4/2), (25,70,15), more sed. gravels	
165				GM	**SANDY GRAVEL w/ SILT (GM)** - brn (7.5yr5/4), 60% sand, 20% silt, 20% subang f gravel up tp 3 cm, m-c subang sand, mostly met, some ig & sed, loose, wet	
				SM	**SILTY SAND w/ GRAVEL (SM)** brn (7.5/yr4/4 - 10% sand, 70% gravel, 20% sand subrnd-subang met gravel, up t 2 cm - well graded f sand, density moist	
170					**GRAVELLY SAND (SM)** - brn (7.5YR4/3) 20% sand, 60% 15% subrnd subang met & ig f grave up to 5 cm. subrnd-subang m-c sand, loose, wet - brn 7.5yr4/2 (15,80,5), sand mostly poorly graded m. sand	
175					- brn (7.5yr4/4), (25,60,15), siltier gravel up to 7 cm, ig & met	

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SHEET 6 of 12	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-49***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					GRAVELLY SAND (SM) - brn (7.5YR4/3) 20% sand, 60% 15% subrnd subang met & ig f grave up to 5 cm. subrnd-subang m-c sand, loose, wet	
					- reddish brn (5YR4/3), (35,45,20)	
180					- saturated, (33,35,30), gravel up to 8 cm	
				SM		
					- gravel up to 15 cm	
185						
					- sandier, (20,55,25)	
						Driller says hole is soupy
190						
					- dk brn (7.5YR4/3), (35,45,20), gravel subang-ang up to 3 cm, mostly met, some ig sand subrnd-subang, mostly m-c	
					SAND w/ SILT (SM) - drk greyish brn (10YR4/2), 5% mostly c to m sand, 18% silt, 10% gravel, m-c subrnd-subang met sand, loose, wet	
195				SM		
					GRAVELLY SILTY SAND (SM) - greyish brn (10R4/2) 35% sand, 40% silt 25% subrnd-subang met, altered and weathered gravel up to 4 cm, v f-c subang sand,m m dense clast separated, moist	
200					- brn (7.5YR4/4), (20,50,30), met gravel up to 3 cm	
					- sand (30,55,25), sand mostly met, gravel finer up to 2cm	
205						
210						

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SHEET 7 of 12	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** *MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**GRAVELLY SILTY SAND (SM)** - greyish brn (10R4/2) 35% sand, 40% silt 25% subrnd-subang met, altered and weathered gravel up to 4 cm, v f-c subang sand,m m dense clast separated, moist	
					- sand (20,45,35), siltier, gravel up to 5 cm	
215					- dk brn (7YR3/4), (25,45,30), subrnd-subang met gravel up to 6 cm	Stop drilling for the day (03/23/06)
220					- br (7.5YR4/2), (15,70,15), subang gravel up to 2 cm	Drilling Rate = 1' /min
225					- dk reddish brn (5YR3/4), (30,40,30), subrnd-subang, gravel up to 2 cm	
				SP	**POORLY GRADED SAND (SP)** - reddish brn (5YR4/3), 5% sand, 93% silt 2% gravel wet m subrnd-subang met sand minor gravel to 6	
					GRAVELLY SILTY SAND (SM) - reddish brn (5YR4/4), 30% subrnd to subang ig/met gravel up to 3cm, 45% f to c subrnd to subang sand, 25% silt, med density, moist	
230						
235					- (40, 45,15), mostly met	Fast Drilling Rate
240					- (15,55,30), mostly ig	
				SM		
245					- (40,40,20), mixed met, dk reddish brn (5YR3/3), mostly f gravel up to 6cm	

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					GRAVELLY SILTY SAND (SM) - reddish brn (5YR4/4), 30% subrnd to subang ig/met gravel up to 3cm, 45% f to c subrnd to subang sand, 25% silt, med density, moist	
250					- (20,50,30), mostly met, increasing silt, gravel up to 4 cm - (20,85,5), poorly graded, m-c sand, gravel up to 2 cm, loose	
255				SW	**WELL GRADED SAND w/ GRAVEL (GW)** - reddish brn 5YR4/4, 30% f ang to subrnd gravel up to 2.5cm, 65% f to c sand, 5% silt, gravel mostly met, minor alteration, mod to very calcareous, saturated	Stop drilling for the day (03/24/06)
				GW	**WELL GRADED GRAVEL w/ SAND (GW)** - reddish brn (5YR4/4), 50% ang to subrnd f to c gravel up to 6.5cm, 45% f to c sand, 5% fines, gravel mostly met, some alteration, mod to very calcareous, loose, wet	
260					- 65% gravel up to 11cm, 30% sand, 5% fines, mostly met - 55% gravel up to 8cm, 35% sand, 10% fines, clayey in part, locally minor gravel, mostly met, very strong alteration	
				SM	**SILTY SAND w/ GRAVEL (SM)** - brn (5YR4/4), 30% subang to subrnd f gravel up to 3.5cm, 55% f to c sand, 15% fines, mostly met, very calcareous, loose to poorly consolidated, wet	
265				SM	**SILTY SAND (SM)** - reddish brn (5YR4/4), 5% subang to rnd f gravel, 80% f to c sand, 15% silt, fines clayey in part, gravel mostly met, very calcareous, loose to poorly consolidated, wet	
				GM	**SILTY GRAVEL w/ SAND (GM)** - reddish brn (5YR4/4), 60% subang to subrnd f gravel up to 2.5cm, 30% f to c sand, 10% fines, mostly met gravel, fines clayey in part, mod calcareous, low plasticity, loose to poorly consolidated, wet	
270				GM	**SILTY GRAVEL w/ SAND (GM)** - dk reddish brn (2.5YR3/3), 65% f to c subang to subrnd gravel up to 7cm, 20% f to c sand, 15% fines, fines clayey in part, gravel mostly met, mod calcareous, low plasticity, loose to poorly consolidated, wet	
275				SW	**WELL GRADED SAND (SW)** - reddish brn (5YR4/4), 10% subrnd to subang f gravel up to 2cm, 85% f to c sand, 5% fines, gravel mostly met, mod calcareous, loose, wet	
280				SW	**SILTY SAND w/ GRAVEL (SW)** - reddish brn (5YR4/4), 35% subang to subrnd f to c gravel up to 4cm, 45% f to c sand, 20% fines, fines clayey in part, gravel mostly met, poorly consolidated, wet	

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 385.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,667.51	EASTING (CCS NAD 27 Z 5): 7,615,889.90	DATE STARTED: 3/12/2006	DATE COMPLETED: 3/22/2006
DRILLING METHOD: Rotosonic			DRILLING EQUIPMENT: Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				CL	**CLAY w/ SAND (CL)** - reddish brn (2.5YR4/3), 10% f subang to subrnd gravel up to 2cm, 20% sand, 70% fines, low hardness, m plastic fines, mostly clay, moderately consolidated, wet	
285				GC	**CLAYEY GRAVEL w/ SAND (GL)** - reddish brn (2.5YR4/3), 40% f to c subang to subrnd gravel up to 6cm, 35% f to c sand, 25% fines, gravel is mostly met, mod plasticity, mod to well consolidated, wet	
290				ML	**SANDY SILT w/ GRAVEL (ML)** - dk reddish brn (2.5YR3/3), 30% subang to subrnd gravel up to 2.5cm, 25% sand, 45% fines, very calcareous, non to low plasticity, mod to well consolidated, moist to wet	Stop drilling for the day (03/25/06)
295				SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/3), 40% subang to subrnd f to c gravel up to 4cm, 45% f to c sand, 15% fines, non to low plasticity, mostly met, very calcareous, increased fines locally, mod consolidated, moist to wet	Slow Drilling Rate = 0.5' to 0.75' /min
				SW	**SAND w/ GRAVEL (SW)** - reddish brn (2.5YR4/3), 35% subang to subrnd f gravel up to 1.5cm, 60% f to c sand, 5% fines, gravel mostly met, poorly consolidated, wet	
300				GW	**SILTY SAND w/ GRAVEL (GW)** - reddish brn (5YR4/4), 45% subang to subrnd f to c gravel up to 7.5cm, 40% f to c sand, 15% fines, mostly silt fines, mostly met gravel, very calcareous, low plasticity, porr to mod consolidated, wet	
305				SW/SM	**SILTY SAND w/ GRAVEL (SW/SM)** - reddish brn (2.5YR4/4), 40% subang to subrnd f to c gravel up to 2.5cm, 50% f to c sand, 10% fines, fines clayey in part, gravel mostly met, poorly consolidated, wet	Drilling Rate = 2' /min
				GM	**SILTY GRAVEL w/ SAND (GM)** - dr reddish brn (2.5YR4/3), 45% subang to subrnd f to c gravel up to 3cm, 40% f to c sand, 15% fines, gravel is mostly met, mod calcareous	
310				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk reddish brn (2.5YR4/3), 40% subang to subrnd f gravel up to 2.5cm, 55% f to c sand, 5% fines, gravel mostly met, fines clayey in part, loose, wet - 45% subang to subrnd gravel up to 5cm, 40% sand, 15% fines, gravel is mostly met	
315				GM	**SILTY GRAVEL w/ SAND (GM)** - dr reddish brn (2.5YR3/4), 50% subang to ang f to c gravel up to 5.5cm, 35% f to c sand, 15% fines, gravel is mostly met, fines are clayey in part, mod calcareous, poorly consolidated	

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006 / **DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk reddish brn (5YR4/3), subang to subrnd f gravel up to 6cm, f to c sand, fines, gravel mostly met, mod calcareous, loose, wet	Very Slow Drilling Rate = 0.25' to 0.4' /min
320				SW	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 30% subang to subrnd f to c gravel up to 12cm, 50% f to c sand, 20% fines, non to low plasticity, mostly met gravel, mod calcareous, stong chloritic alteration, loose to poorly consolidated, wet	
325				GW	**SILTY GRAVEL w/ SAND (GM)** - reddish brn (5YR4/3), 50% subang to subrnd f to c gravel up to 6cm, 35% f to c sand, 15% fines, mostly silt fines, gravel is mostly met, very calcareous, poor to mod consolidated, wet	
				SC	**CLAYEY SAND w/ GRAVEL (SC)** - reddish brn (5YR4/4), 30% subrnd to subang f gravel up to 4cm, 40% f to c sand, 30% fines, mostly clay fines, mod plastic, mod consolidated, moist	Stop drilling for the day (03/26/06) Very Slow Drilling Rate = 0.25' to 0.4' /min
330				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk brn (7.5YR3/4), 25% subrnd f to c gravel up to 5cm, 70% f to c sand, 5% fines, loose, wet	
				GW	**WELL GRADED GRAVEL w/ SAND (GW)** - brn (7.5YR4/3), 55% subrnd to subang f to c gravel up to 5cm, 40% m to c sand, 5% fines, gravel is mostly met, loose, wet	
335				SM	**SILTY SAND w/ GRAVEL (SM)** - reddish brn (5YR4/4), 20% subang to subrnd f to c gravel up to 4cm, 60% f to c sand, 20% fines, non to low plasticity, mostly met gravel, mod calcareous, poor to mod consolidated, wet	
340 345				GW	**WELL GRADED GRAVEL w/ SAND (GW)** - dk brn (5YR3/4), 60% ang f to c gravel up to 6cm, 35% f to c sand, 5% fines, gravel mostly met, slightly calcareous, loose, wet - locally grades into 1' beds of silty gravel with sand (GM), 60% gravel, 25% sand, 15% fines - 60% subang to subrnd gravel up to 4.5cm, 35% sand, 5% fines, gravel mostly met	Very Slow Drilling Rate = 0.2' to 0.4' /min
350					**WELL GRADED SAND W/GRAVEL (GW)** - reddish brn 5YR4/3, 75% gravel 15% sand 10% silt f-c subang gravel up to 15 cm, mostly met, few conglomerate clasts, well graded subang-subrnd met sand (f-c) mm unconsolidated, saturated	Drilling Rate = 0.3' /min, no recovery first pass, second pass only 4' recovery, slough had sand & gravel

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				GW	**WELL GRADED SAND W/GRAVEL (GW)** - reddish brn 5YR4/3, 75% gravel 15% sand 10% silt f-c subang gravel up to 15 cm, mostly met, few conglomerate clasts, well graded subang-subrnd met sand (f-c) mm unconsolidated, saturated	
355					- avg. clast size is 2 cm	
					- grades coarser with depth	
360					- avg. clast size is 6 cm	Harder Drilling Rate = 0.5" /min
365					- avg. clast size 710 cm	Drilling Rate ~ 1' /min
				ML	**SILT WITH GRAVEL (ML)** - reddish brn (5YR4/4), 15% sand, 20% silt, 65% gravel, gravel up to 2 cm, met, subang silt contains weathered met gravel and v/sand lenses, moderatly consolidated, moist, some fine laminations	
370					- reddish brn (5YR4/4 (75,15,10) sand subang mostly c	
375						
				NR	**NO RECOVERY**	
380						Drilling Rate = 0.1' /min
385					*Boring Terminated at 384 ft*	

CH2MHILL

SHEET 12 of 12	PROJECT NUMBER: 326128.01.16.EN	BORING NUMBER: *MW-49*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 482.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,667.51	**EASTING (CCS NAD 27 Z 5):** 7,615,889.90	**DATE STARTED:** 3/12/2006	**DATE COMPLETED:** 3/22/2006
DRILLING METHOD: Rotosonic			**DRILLING EQUIPMENT:** Track Mounted Rotosonic	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** K. Ebel / L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					ABBREVIATIONS *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

SHEET 1 of 8	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-50***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 248.0	**DRILLING CONTRACTOR:**	
SURFACE ELEVATION: 495.1 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,069.27	**EASTING (CCS NAD 27 Z 5):** 7,615,599.84	**DATE STARTED:** 3/25/2004	**DATE COMPLETED:**
DRILLING METHOD:			**DRILLING EQUIPMENT:**	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–20			0		**NO RECOVERY**	
20–25			5	GM	**SILTY GRAVEL w/ SAND, BOULDERS, AND COBBLES (GM)** - brn (10YR 4/3), 55% rnd to subrnd f to c gravel up to 14cm, 25% f to c sand, 20% fines, mostly met	
25–27			2	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (10YR5/3), 15% ang to subrnd f gravel up to 2.5cm, 45% f to c sand, 40% fines, mostly met gravel, some chloritic alteration, fines clay in part, minor chert, loose, dry	
27–32			5	GM	**SILTY GRAVEL w/ SAND (GM)** - dr yellowish brn (10YR4/4), 50% f to c and to subrnd gravel up to 6.5cm, 35% f to c sand, 15% fines, mostly met, occasional ig,, mod to v calcareous, loose, dry	
32–34			2	GW	**WELL GRADED GRAVEL w/ SAND (GW)** - dr yellow brn (10YR4/4), 50% ang to subrnd f to c gravel up to 6cm, 40% f to c sand, 10% fines, mostly met, very cal, loose, dry	
34–35						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-50*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 248.0	DRILLING CONTRACTOR:	
SURFACE ELEVATION: 495.1 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,069.27	EASTING (CCS NAD 27 Z 5): 7,615,599.84	DATE STARTED: 3/25/2004	DATE COMPLETED:
DRILLING METHOD:			DRILLING EQUIPMENT:	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			5	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk yellowish brn (10YR4/4), 40% subang to subrnd mostly f gravel up to 2cm, 50% f to c sand, 10% fines, mostly met, mod cal, loose to poorly consolidated, dry to damp - groundwater at 35' bgs	
40			5	SM	**SILTY SAND w/ GRAVEL (SM)** - brn (10YR5/3), 30% subang to subrnd f to c gravel up to 6cm, 40% f to c sand, 30% mod clayey fines, mostly met gravel, minor chert, mod to v cal, non to mod plasticity, loose, dry	
45			5	GW	**WELL GRADED GRAVEL w/ SAND (GW)** - dr yellow brn (10YR5/3), well graded ang to subrnd f to c gravel up to 7cm, f to c sand, mod clayey fines, mostly met, mod cal, loose to poorly consolidated, moist to wet	
50			6	SW/SM	**WELL GRADED SAND w/ GRAVEL (SW)** - brn (10YR4/3), 20% subang to subrnd mostly f gravel up to 2cm, 75% f to c sand, 5% mostly silt fines, mostly met w/ chlorite alteration, v cal, loose to poorly consolidated, moist to wet	Drill rate = 0.15' to 0.25' / min
55			6	SW	**WELL GRADED SAND w/ GRAVEL (SW)** - brn (10YR4/3), 30% subang to rnd mostly f gravel up to 7cm, 65% f to c sand, 5% mostly silt fines, mostly met w/ some chlorite alteration, mod to v cal, loose to poorly consolidated, wet - SM interbedded with SW, 20% gravel, 65% sand, 15% fines	
60 65			9	GW	**WELL GRADED GRAVEL w/ SAND (GW)** - brn (10YR4/3), 55% ang to subrnd f to c gravel up to 7cm, 40% f to c sand, 5% fines, mod cal, loose to poorly consolidated, wet - as above, 50% subang to subrnd gravel up to 7.5cm, 45% sand, 5% fines, mostly met w/ occ chert and ig	Drill rate = 0.4' to 0.5' / min
70				SM	**SILTY SAND (SM)** - dk brn (10YR3/3), 5% subang f to c gravel up to 8cm, 70% f to c sand, 20% fines, loose sand, wet	

CH2MHILL

SHEET 3 of 8	**PROJECT NUMBER:** 326128.01.16.EN	**BORING NUMBER:** ***MW-50***

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		**HOLE DEPTH (ft):** 248.0	**DRILLING CONTRACTOR:**	
SURFACE ELEVATION: 495.1 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,069.27	**EASTING (CCS NAD 27 Z 5):** 7,615,599.84	**DATE STARTED:** 3/25/2004	**DATE COMPLETED:**
DRILLING METHOD:			**DRILLING EQUIPMENT:**	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**SILTY SAND (SM)** - dk brn (10YR3/3), 5% subang f to c gravel up to 8cm, 50% f to m sand, 45% fines, wet - sand w/ gravel, strong brn	
			10	SM	**SILTY SAND w/ GRAVEL (SM)** - strong brn (7.5YR3/6), 15% subrnd gravel up to 6cm, 60% m sand, 25% fines, mostly met, wet	
75						
80					**SILTY SAND (SM)** - strong brn (7.5YR3/6), 10% subang gravel up to 6cm, 60% m to c sand, 30% fines, met gravel, wet	
85						
			20	SM		
90						
95						
100					**WELL GRADED SAND w/ SILT and GRAVEL (SW)** - strong brn (7.5YR4/6), 15% met subang gravel up to 8cm, 50% m to c sand, 35% fines, wet	
105				SW		

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PROJECT NUMBER: 326128.01.16.EN	BORING NUMBER: *MW-50*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 248.0	DRILLING CONTRACTOR:	
SURFACE ELEVATION: 495.1 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,069.27	EASTING (CCS NAD 27 Z 5): 7,615,599.84	DATE STARTED: 3/25/2004	DATE COMPLETED:
DRILLING METHOD:			DRILLING EQUIPMENT:	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			20		**WELL GRADED SAND w/ SILT and GRAVEL (SW)** - strong brn (7.5YR4/6), 15% met subang gravel up to 8cm, 50% m to c sand, 35% fines, wet	
110				SW	**WELL GRADED SAND w/ GRAVEL (SW)** - dk brn (7.5YR3/2), 25% met ang gravel up to 4cm, 70% f to c sand, 5% fines, wet	
115				SW	**WELL GRADED SAND w/ SILT and GRAVEL (SW)** - strong brn (7.5YR4/6), 15% met subang gravel up to 8cm, 50% m to c sand, 35% fines, wet	
120						
125					**SILTY SAND (SM)** - dk brn (7.5YR3/4), 5% met ang gravel up to 4cm, 75% f to m sand, 20% fines, wet	
130			20	SM	- increased gravel content and size, 15% met subang gravel up to 8cm, 65% sand, 20% fines, wet	
135						
140					**WELL GRADED SAND w/ SILT and GRAVEL (SW/SM)** - dk brn (7.5YR3/4), 15% subang met f to c gravel up to 6cm, 75% f to c sand, 10% fines, clasts poorly cemented, wet	

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PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-50*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 248.0	DRILLING CONTRACTOR:	
SURFACE ELEVATION: 495.1 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,069.27	EASTING (CCS NAD 27 Z 5): 7,615,599.84	DATE STARTED: 3/25/2004	DATE COMPLETED:
DRILLING METHOD:			DRILLING EQUIPMENT:	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			LOGGED BY: L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND w/ SILT and GRAVEL (SW/SM) - dk brn (7.5YR3/4), 15% subang met f to c gravel up to 6cm, 75% f to c sand, 10% fines, clasts poorly cemented, wet	
145						
			20	SW/SM	- increased gravel content, 25% gravel up to 8cm, 65% sand, 10% fines	
150						
155					- gravel content increased, 35% gravel, 55% sand, 10% fines, gravel more ang	
					POORLY GRADED SAND (SP) - yellowish red (5YR 4/6), 10% gravel, 85% c sand, 5% fines, weak cementation becoming stronger w/ depth, wet	
160					- very evident color change from dk brn to yellowish red	
165						
			17	SP	- lg met cobble up to 12cm, increased gravel content	
170						
					- trans to SILTY GRAVEL w/ SAND, 40% met ang gravel up to 5cm, 30% sand, 30% fines	
175						

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-50*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 248.0	DRILLING CONTRACTOR:	
SURFACE ELEVATION: 495.1 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,069.27	**EASTING (CCS NAD 27 Z 5):** 7,615,599.84	**DATE STARTED:** 3/25/2004	**DATE COMPLETED:**
DRILLING METHOD:			**DRILLING EQUIPMENT:**	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
					POORLY GRADED SAND (SP) - yellowish red (5YR 4/6), 10% gravel, 85% c sand, 5% fines, weak cementation becoming stronger w/ depth, wet	
180				GW/GM	**WELL GRADED GRAVEL w/ SILT and SAND (GW/GM)** - dk reddish brn (5YR3/4), 50% met subang f to c gravel up to 5cm, 40% f to c sand, 10% fines, wet	
185					**SILTY SAND w/ GRAVEL (SM)** - yellowish red (5YR4/6), 25% met subang gravel up to 4cm, 60% f to c sand, 15% fines, weak to mod cementation, wet	Drill rate = 0.1' / min
			18			
190				SM		
195						
					SILTY SAND w/ GRAVEL (SM) - dk reddish brn (5YR3/4), 10% subang f to c gravel, 50% f to c sand, 40% fines, cloritic alteration, cementation increasing to mod, moist	Drill rate = 1' / min
200						
205						
			20	SM		
210						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*MW-50*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program	**HOLE DEPTH (ft):** 248.0	**DRILLING CONTRACTOR:**	
SURFACE ELEVATION: 495.1 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,069.27	**EASTING (CCS NAD 27 Z 5):** 7,615,599.84	**DATE STARTED:** 3/25/2004 / **DATE COMPLETED:**
DRILLING METHOD:		**DRILLING EQUIPMENT:**	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California		**LOGGED BY:** L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SAND w/ GRAVEL (SM) - dk reddish brn (5YR3/4), 10% subang f to c gravel, 50% f to c sand, 40% fines, cloritic alteration, cementation increasing to mod, moist - reworked miocene becomes finer grained/ more massive	
215						
					SILTY SAND w/ GRAVEL (SM) - dk reddish brn (5YR3/4), 10% met subang c gravel up to 8cm, 60% f to c sand, 30% fines, strat layer (8") of dry well-cemented conglom w/ 1' layers of wet clean sand	Drill rate = 2' / min
220						
				SM		Drill Rate = 0.50' / min
225						
			16			
					MIOCENE CONGLOMERATE (BR) - firm, well-consolidated, matrix supported conglomerate, moist (BR), top of weathered bedrock ?	
230						
					- bedrock less weathered and dryer	Drill rate = 0.25' / min
235						
				BR		
240						
			0			
245						

CH2MHILL

PROJECT NUMBER: 326128.01.16.EN

BORING NUMBER: *MW-50*

SOIL BORING LOG

PROJECT NAME: IMPM Drill Program		HOLE DEPTH (ft): 248.0	DRILLING CONTRACTOR:	
SURFACE ELEVATION: 495.1 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,069.27	**EASTING (CCS NAD 27 Z 5):** 7,615,599.84	**DATE STARTED:** 3/25/2004	**DATE COMPLETED:**
DRILLING METHOD:			**DRILLING EQUIPMENT:**	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** L. Kelly	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					MIOCENE CONGLOMERATE (BR)	

Boring Terminated at 248 ft

ABBREVIATIONS

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

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 INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0					**SILTY SAND w/ GRAVEL (SM)** - dk yellowish brn (10YR4/4), 20% well graded subang to subrnd met gravel up to 14cm, 50% sand, 30% fines, slightly moist	
5						
			0			
10						
15				SM		
20					- increased gravel, 40% gravel up to 7cm, 30% sand, 30% fines	
			10		- 20% gravel up to 5cm, 50% sand, 30% fines	
25					- 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	
30				ML	**SILT (ML)** - dk greyish brn (10YR4/2), 10% well graded subang to subrnd gravel up to 5cm, 10% sand, 10% fines, gravel mostly met, slightly moist	
			8		**SILT w/ SAND and GRAVEL (ML)** - dr yellowish brn (10YR4/4), 20% well graded subang gravel up to 6cm, 20% sand, 60% fines, mostly met gravel, slightly moist	
35						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	*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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILT w/ SAND and GRAVEL (ML) - dr yellowish brn (10YR4/4), 20% well graded subang gravel up to 6cm, 20% sand, 60% fines, mostly met gravel, slightly moist	
40					- 25% gravel up to 7cm, 15% sand, 60% fines	
			10			
					- increased moisture	
45				ML	- 25% gravel up to 6cm, 15% sand, 60% fines	
50					- 20% gravel up to 7cm, 20% sand, 60% fines	
			10			
55					- 20% gravel up to 5cm, 15% sand, 65% fines	
					SAND (SP) - dk brn (7.5YR 3/4), 5% f gravel, poorly sorted, subang to subrnd up to 12 cm, 85% sand, 10% fines, wet	
60						
			10			
65				SP	- 10% gravel up to 8cm, 80% sand, 10% fines	
70						

PROJECT NUMBER:	BORING NUMBER:
326128.01.16.EN	***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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			6	SP/SM	**SAND (SP/SM)** - dk greyish brn (10YR4/2), 0% gravel, 90% subang to subrnd sand, 10% fines, poorly graded, wet	
75				SM	**SAND (SM)** - brn (10YR4/3), 5% subang gravel up to 5cm, 75% sand, 20% fines, mostly met gravel, poorly graded, moist	
80			7		- 15% gravel up to 10cm, 70% sand, 15% fines	
85						
				ML	**SILT (ML)** dk brn (7.5YR3/4), 10% ang to subang gravel up to 5cm, 15% sand, 75% fines, mostly met gravel, slightly moist	
90			10			
95					- 20% gravel up to 10cm, 10% sand, 70% fines	
100			10		- 10% gravel up to 4cm, 15% sand, 75% fines	
105					- 10% gravel up to 5cm, 15% sand, 75% fines	

CH2MHILL

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:			**DRILLING EQUIPMENT:**	
LOCATION: PG&E Compressor Station - Flood Plain, Topock, California			**LOGGED BY:** R. Tweidt / A. Brewster	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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	
110			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

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-52*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		**HOLE DEPTH (ft):** 158.0	**DRILLING CONTRACTOR:** Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,738.98	**EASTING (CCS NAD 27 Z 5):** 7,616,776.33	**DATE STARTED:** 2/23/2007	**DATE COMPLETED:** 2/27/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		**DRILLING EQUIPMENT:** Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020134
LOCATION: South of I-40 on the west bank of the river		**LOGGED BY:** R. Tweidt/C Kreller	**DRILLER NAME:** Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)		SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
							ORGANIC SURFACE MATERIAL	
							POORLY GRADED SAND (SP) - yellowish brn (10YR 5/6), 95% fn sand, 5% subrnd gravel (up to 3/4 inch), moist, loose, trace organic	Boring drilled at azimuth 087 and dip of 40 degrees from horizontal (beneath the Colorado River). Grab groundwater samples (GGW) and discrete soil samples (CS) were collected at the depths indicated. All depths expressed as length drilled (ft) and must be corrected for angle to derive elevation.
							100% fn sand	
5								
							SP AS ABOVE: dk olive brn (2.5YR 3/3)	
							SP AS ABOVE: yellowish brn (10YR 5/6)	
							SP AS ABOVE: dk olive brn (2.5YR 3/3), saturated	
10								Collect MW52-CS-9-10'
								No recovery from 10' to 12'
							SP AS ABOVE: 100% fn sand, saturated	
							SP AS ABOVE: yellowish brn (10YR 5/6) and dk olive brn (2.5Y 3/3) mottled appearance, 100% fn sand, saturated	
15								
				MW-52-GGW-23		SP	SP AS ABOVE: dk olive brn (2.5Y 3/3), mottling absent, 100% fn sand, organics present	
20								Collect MW52-CS-20-21'
							SP AS ABOVE: dk gray (2.5YR 4/3), 100% med sand, loose, moist	
25							SP AS ABOVE: dk grayish brn (10YR 5/4), 100% fn-med sand, trace organics	Driller indicates slough in hole after 15-foot core run
							SP AS ABOVE: yellowish brn (10YR 5/4)	
30								
							SP AS ABOVE: 100% fn-med sand	
							SP AS ABOVE: dk grayish brn (10YR 4/2)	
35								

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-52*

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock	158.0	Prosonic/Boart Longyear - Phoenix, AZ	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
461.9 ft. MSL	2,101,738.98	7,616,776.33	2/23/2007	2/27/2007

DRILLING METHOD:	DRILLING EQUIPMENT:	
Rotosonic-continuous 4-inch core	Track Mounted Rig - up to 7-inch drive casing	SB County Permit No. 2007020134

LOCATION:	LOGGED BY:	DRILLER NAME:
South of I-40 on the west bank of the river	R. Tweidt/C Kreller	Denzel Roberts

DRILL DEPTH (feet)	SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
	MW-52-GGW-43			**POORLY GRADED SAND (SP)** - yellowish brn (10YR 5/6), 95% fn sand, 5% subrnd gravel (up to 3/4 inch), moist, loose, trace organic	
				SP AS ABOVE: 100% fn sand	
40				SP AS ABOVE: dk grayish brn (10YR 4/2), 100% fn sand, moist, loose, trace organics	
					No recovery from 43' to 45'
45					Collect MW52-CS-45-46'
				SP AS ABOVE: 100% fn sand, trace med sand component	
50				SP AS ABOVE: 100% fn sand, trace med sand component	Collect MW52-CS-51-52'
			SP		
55	MW-52-GGW-63			SP AS ABOVE: brn (10YR 5/3), organic material present (plant material)	
				POORLY GRADED SAND WITH GRAVEL (SP) - brn (10YR 5/3), 85% fn sand, 15% subrnd to rnd gravel (up to 3.5 inches), brn (10YR 5/3)	
60				SP AS ABOVE: 5% gravel, large pieces of organic (plant) material	Collect carbon samples
					Collect MW52-CS-60-61'
				SP AS ABOVE: trace fines	
					No recovery from 63' to 67'
65				**POORLY GRADED SAND (SP)** - dk yellowish brn (10YR 4/4), trace fines, 95% fn sand, 5% subrounded to round gravel (up to 1 inch), saturated, loose, trace organics	
				SP AS ABOVE: trace med sand component	
70					

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PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-52*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		HOLE DEPTH (ft): 158.0	DRILLING CONTRACTOR: Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,738.98	EASTING (CCS NAD 27 Z 5): 7,616,776.33	DATE STARTED: 2/23/2007	DATE COMPLETED: 2/27/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		DRILLING EQUIPMENT: Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020134
LOCATION: South of I-40 on the west bank of the river		LOGGED BY: R. Tweidt/C Kreller	DRILLER NAME: Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	RECOVERY (ft)		Isoflow Sample	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
						SP	**POORLY GRADED SAND (SP)** - yellowish brn (10YR 5/6), 95% fn sand, 5% subrnd gravel (up to 3/4 inch), moist, loose, trace organic	Collect MW52-CS-71-72'
75				MW-52-GGW-83		GW	**WELL GRADED GRAVEL WITH SAND (GW)** - brn (10YR 5/5), 65% subrnd to rnd gravel (up to 2.5 inches), 35% fn to med sand, trace fines, saturated, loose	
						SP	**POORLY GRADED SAND (SP)** - brn (10YR 5/3), 85% fn sand, 10% med subrnd sand, 5% subrnd to rnd gravel (up to 1/2 inch), wet, loose	Collect MW52-CS-77-78'
80								
85						SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 60% fn-cse sand, 40% subrnd to rnd gravel (up to 3 inches)	Collect MW52-CS-84-85'
90						SP	**POORLY GRADED SAND (SP)** - dk grayish brn (2.5YR 4/2), 100% fn sand, trace subrnd to rnd gravel, trace fines, wet, loose	
				MW-52-GGW-103			SP AS ABOVE: 100% fn sand, trace fines, gravel component absent	
95								Driller indicates borehole collapses with casing withdrawal
100								
							SP AS ABOVE: 100% fn sand	Collect MW52-CS-101-102'
105								No recovery from 103' to 107'

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-52*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		HOLE DEPTH (ft): 158.0	DRILLING CONTRACTOR: Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,738.98	EASTING (CCS NAD 27 Z 5): 7,616,776.33	DATE STARTED: 2/23/2007	DATE COMPLETED: 2/27/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		DRILLING EQUIPMENT: Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020134
LOCATION: South of I-40 on the west bank of the river		LOGGED BY: R. Tweidt/C Kreller	DRILLER NAME: Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	RECOVERY (ft)		Isoflow Sample	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
110						SP	**POORLY GRADED SAND (SP)** - dk grayish brn (2.5YR 4/2), 100% fn sand, trace subrnd to rnd gravel, trace fines, wet, loose	Slough material from 107' to 109'
115						SP	**POORLY GRADED SAND (SP)** - dk brn (2.5YR 4/1), 100% fn-med sand (25% med sand), trace subrnd to rnd gravel (up to 2.5 inches), moist, loose	No recovery from 113' to 119'
120				MW-52-GGW-123			SP AS ABOVE: lt olive brn (2.5Y 4/1), decrease in med grained component, increased fn grained component	Poor core recovery from 119' to 123' Material heaving into hole with bit removal Collect MW52-CS-122-123'
125							SP AS ABOVE: 100% fn sand, trace med sand, trace fines, gravel absent	
130						SP	**POORLY GRADED SAND WITH GRAVEL(SP)** - yellowish brn (10YR 5/4), 80% cse sand, 20% subrnd to rnd gravel (up to 2 inches), moist, loose	Increase rig chatter and difficult drilling at 127'
135						GW	**WELL GRADED GRAVEL WITH SAND (GW)** - 65% subrnd to well rnd gravel (up to 6 inches), 30% fn-cse subrnd sand, 5% fn sand	Drill bit has cobbles in it Very slow drilling
140				MW-52-GGW-143		BR	**MIOCENE CONGLOMERATE (BR)** - dk red (2.5YR 3/6), 65% sand, 25% fns, 10% gravel, dry, moderate to strongly cemented	

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-52*

SOIL BORING LOG

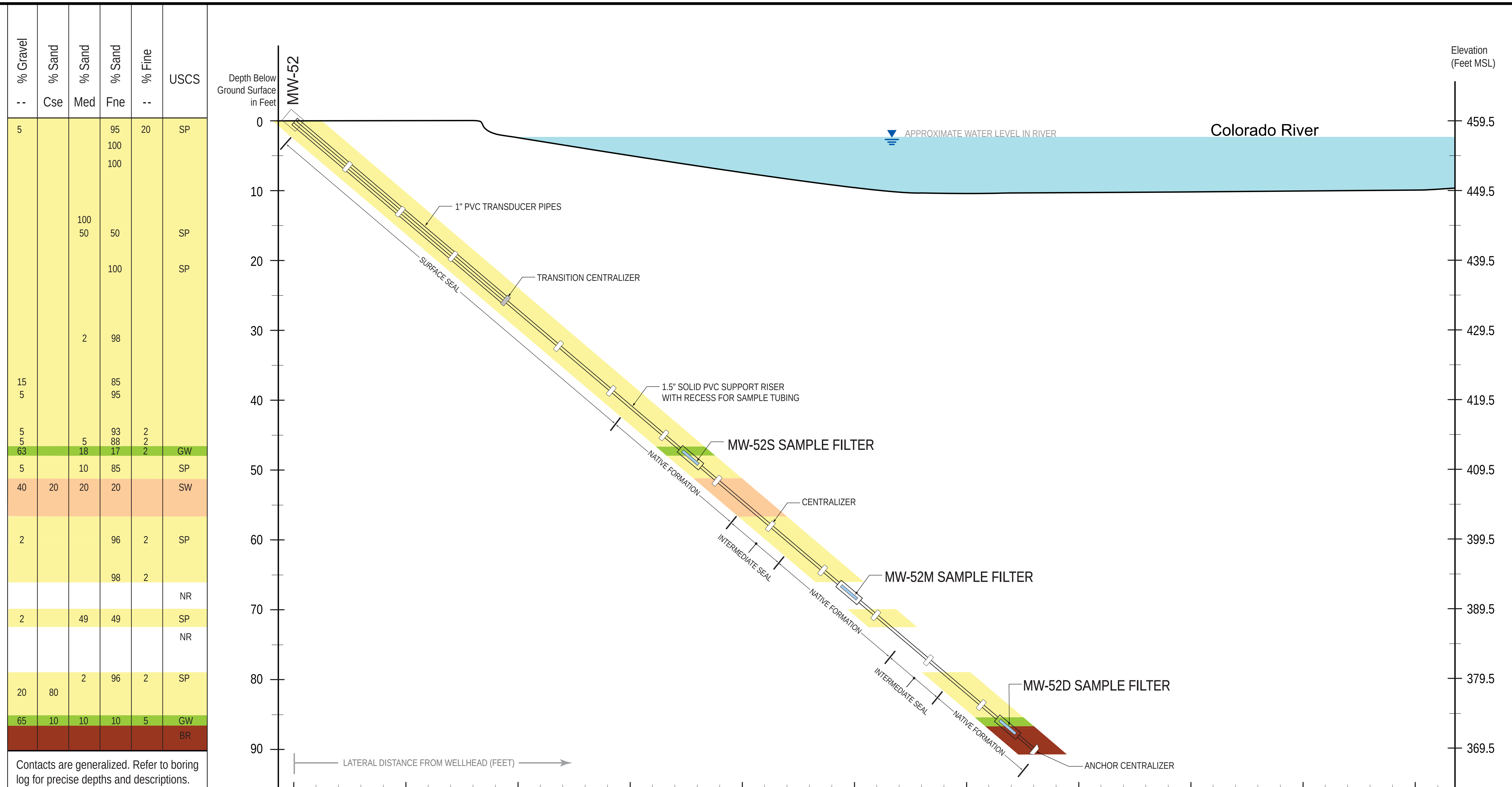
PROJECT NAME: PG&E Topock		HOLE DEPTH (ft): 158.0	DRILLING CONTRACTOR: Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,738.98	EASTING (CCS NAD 27 Z 5): 7,616,776.33	DATE STARTED: 2/23/2007	DATE COMPLETED: 2/27/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		DRILLING EQUIPMENT: Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020134
LOCATION: South of I-40 on the west bank of the river	LOGGED BY: R. Tweidt/C Kreller		DRILLER NAME: Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE	SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
							MIOCENE CONGLOMERATE (BR) - dk red (2.5YR 3/6), 65% sand, 25% fns, 10% gravel, dry, moderate to strongly cemented	
145								
						BR		
150								
155								
							Total Drilled Depth = 158 ft bgs as defined at the top of the borehole.	

ABBREVIATIONS

brn = brown
lt = light
dk = dark
vf = very fine-grained
fn = fine-grained
med = medium-grained
cse = coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded

CH2MHILL



LEGEND

- SM
- SP
- SW
- SP/GW
- SP/SW
- GW
- GM
- BR
- NR - No Recovery

Well Construction Information

Drilling Contractor: Prosonic/Boart-Longyear (Driller-Denzil Roberts)
Drilling Method: Rotosonic
Drilling Start: February 23, 2007
Drilling End: February 27, 2007
Well Installation Complete: March 10, 2007
Logged By: Rob Tweidt, P.G.

Borehole Diameter: 6 inches
Borehole Angle: 40 Degrees from Horizontal
Borehole Azimuth: 087 Degrees
Drilled Borehole Depth: 158 feet
Annular Materials:
Native Formation – Native sands and gravels as logged.
Intermediate Seal – Native sands and gravels with bentonite slurry grout (approx. 5 gallons) placed every 10 feet.
Surface Seal – Bentonite slurry grout.
Completion Type: 10" steel monument casing placed at an angle within 3'x3'x4" concrete pad.

Notes:
1. Drawing scale is approximate.
2. Lithology is conceptual. Color bands should not be interpreted as laterally extensive stratigraphic units.
3. River bed depth estimated from "Transect B" of July 2005 Riverbed Survey.

MULTI-LEVEL MONITORING WELL CONSTRUCTION DIAGRAM MW-52 LOCATION

PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

ES042007002BAO slant_wells_MW-52_v2.ai 06-27-07 llui

PROJECT NUMBER: 354948.FP.05

BORING NUMBER: *MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock	**HOLE DEPTH (ft):** 265.0	**DRILLING CONTRACTOR:** Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,101,761.47	**EASTING (CCS NAD 27 Z 5):** 7,616,788.39	**DATE STARTED:** 3/12/2007	**DATE COMPLETED:** 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core	**DRILLING EQUIPMENT:** Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river	**LOGGED BY:** R. Tweidt	**DRILLER NAME:** Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE INTERVAL	RECOVERY (ft)		Isoflow Sample	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
0–15	0–15	15				SM	**SILTY SAND (SM)** - lt yellowish brn (2.5YR 6/4), 80% fn grained (up to 1.5 cm), sand (trace cse), 20% fines, well sorted, slightly moist, no odor, plant roots,	Boring drilled at azimuth 090 and dip of 30 degrees from horizontal. Grab groundwater samples (GGW) and depth discrete soil samples (CS) were collected at depths indicated. All depths expressed as length drilled (ft) and must be corrected for angle to derive elevation.
							SM AS ABOVE: lt olive brn (2.5YR 5/3), saturated	
						SP	**SAND (SP)** - lt olive brn (2.5YR 5/4), 5% gravel [minor subrnd to rnd gravel and cobble (up to 5.5 cm)], 90% fn sand, 5% fines, well sorted, wet, no odor, cobble is locally derived diorite that is subrnd.	
							SP AS ABOVE: gravel is absent, micaceous, tree roots	
15–25	15–25	10					SP AS ABOVE: trace gravel (up to 0.1 cm)	
							SP AS ABOVE: dk grayish brn (2.5YR 4/2)	
25–28				MW53-GGW-35'			SP AS ABOVE: trace gravel (up to 0.2 cm)	No Recovery from 25 - 28'
28–35	28–35	7					SP AS ABOVE: very dk gray brn (10YR 3/2)	
							SP AS ABOVE: abundant tree roots	Collect wood sample MW-53-30'
							SP AS ABOVE: dk organic material present	
					31.5–32		SP AS ABOVE: 98% med sand, trace fines, trace gravel (up to 0.1 cm)	Collect sample MW-53-CS-31.5-32'

CH2MHILL

PROJECT NUMBER: 354948.FP.05

BORING NUMBER: *MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		HOLE DEPTH (ft): 265.0	DRILLING CONTRACTOR: Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,761.47	EASTING (CCS NAD 27 Z 5): 7,616,788.39	DATE STARTED: 3/12/2007	DATE COMPLETED: 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		DRILLING EQUIPMENT: Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river	LOGGED BY: R. Tweidt		DRILLER NAME: Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE:	SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
							SAND (SP) - lt olive brn (2.5YR 5/4), 5% gravel [minor subrnd to rnd gravel and cobble (up to 5.5 cm)], 90% fn sand, 5% fines, well sorted, wet, no odor, cobble is locally derived diorite that is subrnd.	
40								
							POORLY GRADED SAND (SP) - dk yellowish brn (10YR 4/4), 90% fn sand, 5% med sand, 5% fines	
45		20		MW53-GGW-55'			SP AS ABOVE	
50							SP AS ABOVE	
						SP		Collect sample MW53-CS-52.5-53'
55							SP AS ABOVE	
60		0						
65							SP AS ABOVE: 85% fn sand, 10% med sand, 5% fines	
70		11						

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PROJECT NUMBER: 354948.FP.05

BORING NUMBER: *MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock	**HOLE DEPTH (ft):** 265.0	**DRILLING CONTRACTOR:** Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL **NORTHING (CCS NAD 27 Z 5):** 2,101,761.47	**EASTING (CCS NAD 27 Z 5):** 7,616,788.39	**DATE STARTED:** 3/12/2007	**DATE COMPLETED:** 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core	**DRILLING EQUIPMENT:** Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river	**LOGGED BY:** R. Tweidt	**DRILLER NAME:** Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE INTERVAL	RECOVERY (ft)	Isoflow Sample	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
			MW53-GGW-75'			**SAND (SP)** - lt olive brn (2.5YR 5/4), 5% gravel [minor subrnd to rnd gravel and cobble (up to 5.5 cm)], 90% fn sand, 5% fines, well sorted, wet, no odor, cobble is locally derived diorite that is subrnd.	
						becoming more cse-grained	
75						POORLY GRADED SAND (SP) - dk gray (10YR 4/1), 5% gravel (up to 1.75 cm), well rnd, (70% fn sand, 15% med sand, 5% cse sand), 5% fines, chert and sandstone	
80							
						SP AS ABOVE: dk organic-rich layer with abundant, 2% gravel, 95% sand (2% cse sand, 25% med sand, 73% fn sand), 3% fines, wood pieces and plant roots, moderate organic/sulfur odor	Collect wood sample MW-83ft
						minor cse gravel, dioritric, angular to subangular	
85		20	MW53-GGW-95'		SP	SP AS ABOVE: 98% sand (2% cse sand, 10% med sand, 88% fn sand), 2% fines, abundant plant roots, slightly more fn grained sand	
						SP AS ABOVE: brn (10YR 5/3), 2% gravel (up to 2 cm), rnd to subrnd, 95% sand (2% cse sand, 95% med sand, 3% fn sand), 3% fines, chert	
90						SP AS ABOVE: 5% gravel (up to 2.5 cm), rnd to subrnd, 93% sand, (5% cse sand, 40% med sand, 55% fn sand), 2% fines	
95		0				SP AS ABOVE	No Recovery from 95 - 97'
100						SP AS ABOVE: 2% gravel, 96% sand (5% cse sand, 40% med sand, 55% fn sand), 2% fines	
105					SP	**POORLY GRADED SAND WITH GRAVEL (SP)** - dk grayish brn (10YR 4/2), 20% gravel [fn to cse gravel (up to 6.5 cm)], 78% sand (5% cse sand, 60% med sand, 35% fn sand), 2% fines, mod to well sorted, wet, no odor, subrnd to rnd, volcanogenic origin (rhyolitic to andesitic) and limestone.	

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		HOLE DEPTH (ft): 265.0	DRILLING CONTRACTOR: Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,761.47	EASTING (CCS NAD 27 Z 5): 7,616,788.39	DATE STARTED: 3/12/2007	DATE COMPLETED: 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		DRILLING EQUIPMENT: Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river		LOGGED BY: R. Tweidt	DRILLER NAME: Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE INTERVAL	RECOVERY (ft)		Isoflow Sample	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
		18		MW53-GGW-115'		SP	**SAND (SP)** - dk yellowish brn (10YR 4/4), 98% fn sand, 2% fines, well sorted, wet, no odor,	
110							SP AS ABOVE: 5% gravel (up to 4 cm), subrnd to rnd, 93% sand (20% med sand, 80% fn sand), 2% fines	
115		0					SP AS ABOVE: 30% med sand, 70% fn sand	No Recovery from 115 - 120'
120							SP AS ABOVE: 10% med sand, 90% fn sand	
						SP	SP AS ABOVE: 5% gravel(up to 4 cm), rnd to subrnd, 93% sand, 2% fines	
125		15		MW53-GGW-135'			SP AS ABOVE: 98% sand (10% med sand, 90% fn sand), 2% fines	
							SP AS ABOVE: appearance of cse gravel (up to 12 cm), rnd to subrnd	
130							SP AS ABOVE: 98% sand, (5% cse sand, 20% med sand, 75% fn sand), 2% fines	
							coarsening of sand	
135							SP AS ABOVE: 5% cse sand, 40% med sand, 55% fn sand	
140							wood pieces present SP AS ABOVE: 15% gravel (up to 8 cm), subang to rnd, 83% sand (5% cse sand, 70% med sand, 25% fn sand), 2% fines, composed of metasediments, granite, limestone	Collect wood MW-53-137' Collect MW-53-CS-137.5-138'

SHEET 5 of 8	**PROJECT NUMBER:** 354948.FP.05	**BORING NUMBER:** ***MW-53***

SOIL BORING LOG

PROJECT NAME: PG&E Topock		**HOLE DEPTH (ft):** 265.0	**DRILLING CONTRACTOR:** Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,761.47	**EASTING (CCS NAD 27 Z 5):** 7,616,788.39	**DATE STARTED:** 3/12/2007	**DATE COMPLETED:** 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		**DRILLING EQUIPMENT:** Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river	**LOGGED BY:** R. Tweidt		**DRILLER NAME:** Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)		SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
						SP	**SAND (SP)** - dk yellowish brn (10YR 4/4), 98% fn sand, 2% fines, well sorted, wet, no odor, wood chips	Collect wood sample MW-53-142.5'
145		20				SW	**WELL GRADED SAND WITH GRAVEL (SW)** dk grayish brn (10YR 4/2) SP AS ABOVE: 40% gravel (up to 6 cm), subrnd to rnd, 60% sand (5% cse sand, 45% med sand, 50% fn sand), composed of chert, limestone, volcanic and granitic rocks SP AS ABOVE: 40% gravel (up to 6 cm), 60% sand (20% cse sand, 60% med sand, 20% fn sand)	Collect sample MW-53-CS-143.5-144' Collect wood sample MW-53-144'
150				MW53-GGW-155'		SP	SP AS ABOVE: 5% gravel (up to 6 cm), subrnd to rnd, 95% sand (50% med sand, 50% fn sand), limestone & granite composition	
						SW	**WELL GRADED SAND WITH GRAVEL SAND (SW)** - dk grayish brn (10YR 4/2), 30% gravel [fn to cse gravel (up to 5 cm)], subang to well rnd, 70% sand (20% cse sand, 50% med sand, 30% fn sand), mod sorted, wet, no odor, sandstone, chert, limestone, granite SP AS ABOVE: 30% gravel (up to 4 cm), 70% sand (10% cse sand, 30% med sand, 60% fn sand) clay lens with silt, yellowish brn (10YR 5/4), med stiff, slow dilantency, high to moderate plasticity, mod to high dry strength	
155						SP	**SAND (SP)** - dk yellowish brn (10YR 4/4), 20% gravel (up to 8 cm), subrnd to rnd, 80% sand, (15% cse sand, 70% med sand, 15% fn sand), well sorted, wet, no odor, limestone, chert, diorite	
160							SP AS ABOVE: 20% gravel (up to 5 cm), 80% sand (15% cse sand, 70% med sand, 15% fn sand) SP AS ABOVE: 5% gravel (up to 3 cm), 95% sand (12% cse sand, 78% med sand, 10% fn sand)	
165		20				SP	SP AS ABOVE: 10% cse sand, 80% med sand, 10% fn sand	
170				MW53-GGW-175'			SP AS ABOVE: gravel (up to 5 cm) subang to rnd, composed of chert, quartz, granitics, 5% cse sand, 35% med sand, 60% fn sand SP AS ABOVE: 5% gravel (up to 3 cm), 95% sand (5% cse sand, 35% med sand, 60% fn sand) gravel is absent	
175							SP AS ABOVE: 70% med sand, 30% fn sand	

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PROJECT NUMBER: 354948.FP.05

BORING NUMBER: *MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		**HOLE DEPTH (ft):** 265.0	**DRILLING CONTRACTOR:** Prosonic/Boart Longyear - Phoenix, AZ
SURFACE ELEVATION: 461.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,761.47	**EASTING (CCS NAD 27 Z 5):** 7,616,788.39	**DATE STARTED:** 3/12/2007 — **DATE COMPLETED:** 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		**DRILLING EQUIPMENT:** Track Mounted Rig - up to 7-inch drive casing	SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river		**LOGGED BY:** R. Tweidt	**DRILLER NAME:** Denzel Roberts

DRILL DEPTH (feet)	SAMPLE: INTERVAL	RECOVERY (ft)		Isoflow Sample	SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
							SAND (SP) - dk yellowish brn (10YR 4/4), 20% gravel (up to 8 cm), subrnd to rnd, 80% sand, (15% cse sand, 70% med sand, 15% fn sand), well sorted, wet, no odor, limestone, chert, diorite	
							SP AS ABOVE: 5% gravel (up to 3 cm), subrnd to rnd, 95% sand (3% cse sand, 68% med sand, 24% fn sand), granite, diorite, quartz, chert	
180							SP AS ABOVE: 5% cse sand, 70% med sand, 25% fn sand	
185		20		MW53-GGW-195'			SP AS ABOVE: 5% gravel (up to 2.5 cm), subang to subrnd, 95% sand (30% med sand, 70% fn sand)	
							SP AS ABOVE: 5% gravel (up to 3 cm), subrnd to well rnd , 95% sand (5% cse sand, 70% med sand, 25% fn sand), gravel composed of chert, silicified silt & sandstone	
190						SP	SP AS ABOVE: lt-gray mottling patches within the sand. Slight musty organic odor	Collect sample MW-53-CS-192-193'
195								No Recovery from 195 - 205'
200		0						
205							SP AS ABOVE: 20% med sand, 80% fn sand	
210								

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		HOLE DEPTH (ft): 265.0	DRILLING CONTRACTOR: Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,101,761.47	EASTING (CCS NAD 27 Z 5): 7,616,788.39	DATE STARTED: 3/12/2007	DATE COMPLETED: 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		DRILLING EQUIPMENT: Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river	LOGGED BY: R. Tweidt		DRILLER NAME: Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
		10	MW53-GGW-215'		SW	**GRAVELLY SAND (SW)** - dk yellowish brn (10YR 4/4), 40% gravel (up to 8 cm), rnd to well rnd, 60% sand, (10% cse sand, 30% med sand, 60% fn sand), moderately sorted, gravel composition is granite, diorite and chert, wet, no odor,	
					GM	**SANDY GRAVEL WITH SILT (GM)** - dk reddish brn (2.5YR 2.5/3), 30% gravel (up to 12 cm), very ang to subrnd, 20% sand, (50% fines, 30% cse sand, 30% med sand, 40% fn sand), poorly sorted, wet, gravel composition is granite, diorite, vesicular rhyolite, miocene conglomerate fragments, no odor	
215					SW	**GRAVELLY SAND (SW)** - reddish brn (5YR 4/3), 40% gravel (up to 10 cm), subrnd to well rnd, 58% sand, 2% fines, poorly sorted, wet, gravel composition is granite, diorite, chert, cilicified sandstone, no odor	
220		13			GM	**SANDY GRAVEL WITH SILT (GM)** - dk grayish brn (10YR 4/2), 40% gravel (up to 11 cm), very ang to well rnd, 30% sand (30% cse sand, 30% med sand, 40% fn sand), 30% fines, poorly sorted, wet, mixture of metamorphic, volcanic and sedimentary rock assemblage, no odor	
225			MW53-GGW-235'		SW	**GRAVELLY SAND (SW)** - dk yellowish brn (10yr 4/4), 40% gravel (up to 8 cm), rnd to well rnd, 60% sand (10% cse sand, 30% med sand, 60% fn sand), moderately sorted, wet, volcanic and sedimentary with minor metamorphic rock assemblage, no odor increased metamorphic rocks present	No Recovery from 228 - 237'
230		0					
235							
240						SW AS ABOVE: 30% gravel (up to 8 cm), 70% sand (40% cse sand, 40% med sand, 20% fn sand) SW AS ABOVE: 40% gravel, 60% sand	
245					SP	**SAND (SP)** - dk yellowish brn (10YR 4/4), 40% med sand, 60% fn sand, well sorted, wet, no odor	

PROJECT NUMBER:	BORING NUMBER:
354948.FP.05	*MW-53*

SOIL BORING LOG

PROJECT NAME: PG&E Topock		**HOLE DEPTH (ft):** 265.0	**DRILLING CONTRACTOR:** Prosonic/Boart Longyear - Phoenix, AZ	
SURFACE ELEVATION: 461.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,101,761.47	**EASTING (CCS NAD 27 Z 5):** 7,616,788.39	**DATE STARTED:** 3/12/2007	**DATE COMPLETED:** 3/25/2007
DRILLING METHOD: Rotosonic-continuous 4-inch core		**DRILLING EQUIPMENT:** Track Mounted Rig - up to 7-inch drive casing		SB County Permit No. 2007020135
LOCATION: South of I-40 on the west bank of the river	**LOGGED BY:** R. Tweidt		**DRILLER NAME:** Denzel Roberts	

DRILL DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)		SAMPLE: Isoflow Sample	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, GRAIN SIZE DISTRIBUTION, MINERALOGY, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE	COMMENTS: DRILLING OBSERVATIONS AND OPERATIONS, DRILL RATE, REFUSALS, SAMPLING AND TESTING NOTES.
		18		MW53-GGW-255'		SW	**GRAVELLY SAND (SW)** - very dk grayish brn (10YR3/2), 30% gravel (up to 7 cm), subrnd to well rnd, 70% sand (20% cse sand, 40% med sand, 30% fn sand), moderately sorted, wet, sedimentary & metamorphic rock assemblage, no odor	
250						GM	**SILTY GRAVEL WITH SAND (GM)** - dk grayish brn (10YR4/2), 50% gravel (up to 12 cm), ang to well rnd, 30% sand (30% cse sand, 30% med sand, 40% fn sand), 20% fines, poorly sorted, wet, sedimentary, volcanic, metamorphic rock assemblage, no odor decomposed metamorphics	
255								
						GC	**CLAYEY GRAVEL WITH SAND (SP)** - dk brn (7.5YR 3/3), 40% gravel (up to 9 cm), ang to rnd, 20% sand (30%cse sand, 30% med sand, 40% fn sand), 40% fines, poorly sorted, slightly moist, combination of fluvial and reworked miocene conglomerate, no odor	
260		10				BR	**MIOCENE CONGLOMERATE**	
265								

Total Drilled Depth = 265 ft bgs as defined at the top of the borehole.

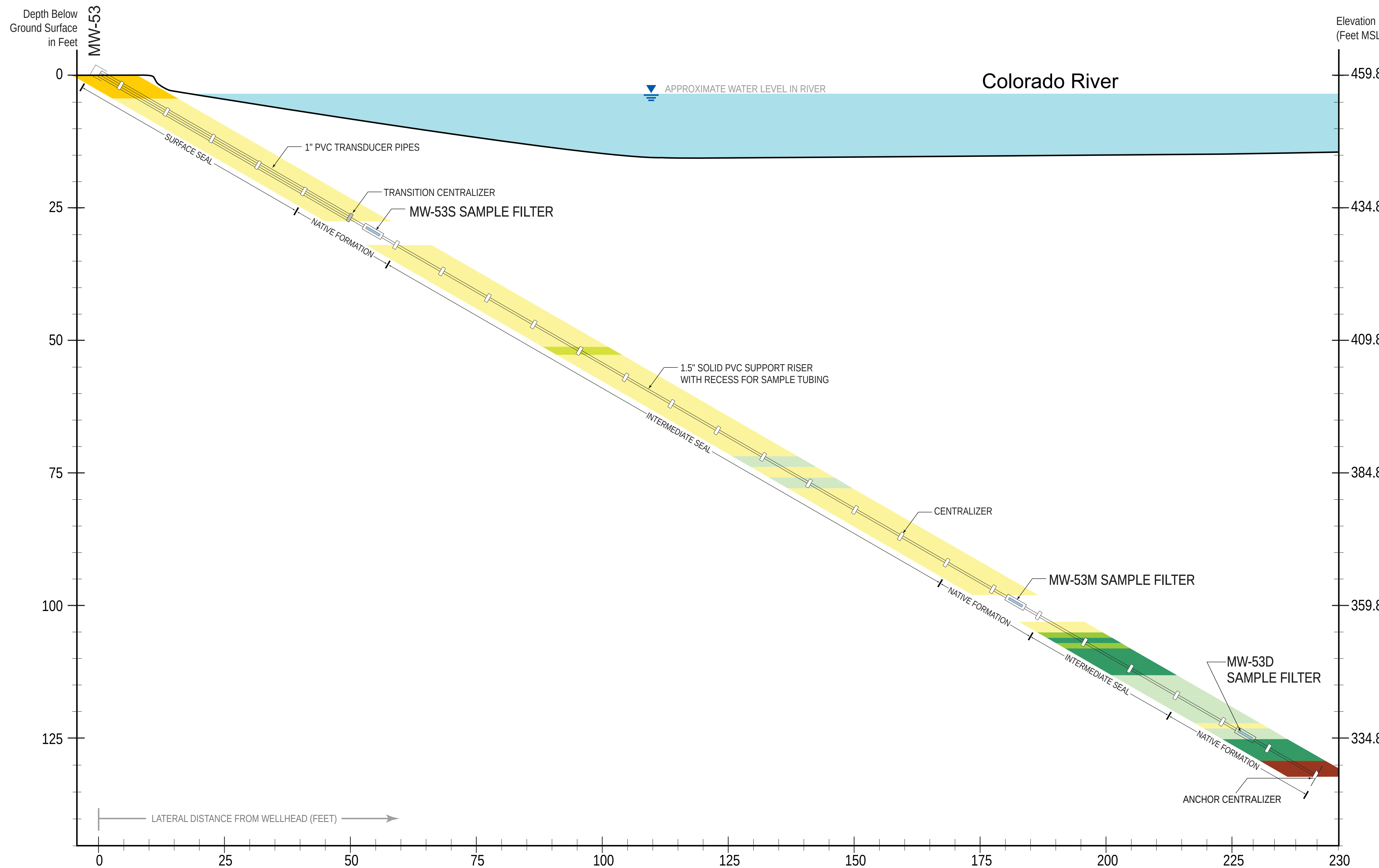
ABBREVIATIONS

brn = brown
lt = light
dk = dark
vf = very fine-grained
fn = fine-grained
med = medium-grained
cse = coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded

CH2MHILL

% Gravel --	% Sand Cse	% Sand Med	% Sand Fne	% Fine --	USCS
0	2	0	78	20	SM
5	0	0	90	5	SP
0	0	68	30	2	
0	0	2	93	5	
					NR
5	5	15	70	5	
5	1	24	67	3	
5	4	38	51	2	
20	4	49	25	2	SP/GW
0	0	1	98	2	SP
5	0	25	68	2	
0	3	40	55	2	
15	2	61	20	2	
40	2	24	34	0	SP/SW
5	0	47	48	0	SP
20	10	60	10	0	SP/SW
					SP
5	9	78	8	0	
0	0	70	30	0	
5	3	68	24	0	
5	4	68	23	0	
					NR
0	0	20	80	0	
40	6	18	36	0	GW
30	6	6	8	50	GM
40	9	9	12	30	
40	6	18	36	0	SW
30	21	28	21	0	
50	9	9	12	20	GM
					BR

Contacts are generalized.
Refer to boring log for precise depths and description.



LEGEND

SM	GW
SP	GM
SW	BR
SP/GW	NR - No Recovery
SP/SW	

Well Construction Information

Drilling Contractor: Prosonic/Boart-Longyear (Driller-Denzil Roberts)
Drilling Method: Rotosonic
Drilling Start: March 12, 2007
Drilling End: March 25, 2007
Well Installation Complete: March 29, 2007
Logged By: Rob Tweidt, P.G.

Borehole Diameter: 6 inches
Borehole Angle: 30 Degrees from Horizontal
Borehole Azimuth: 090 Degrees
Drilled Borehole Depth: 265 feet
Annular Materials:
Native Formation – Native sands and gravels as logged.
Intermediate Seal – Native sands and gravels with bentonite slurry grout (approx. 5 gallons) placed every 10 feet.
Surface Seal – Bentonite slurry grout.
Completion Type: 10" steel monument casing placed at an angle within 3'x3'x4" concrete pad.

Notes:
1. Drawing scale is approximate.
2. Lithology is conceptual. Color bands should not be interpreted as laterally extensive stratigraphic units.
3. River bed depth estimated from "Transect B" of July 2005 Riverbed Survey.

MULTI-LEVEL MONITORING WELL CONSTRUCTION DIAGRAM MW-53 LOCATION
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

ES042007002BAO slant_wells_MW-53_v3.ai 06-27-07 llui

SHEET 1 of 9	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 563.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005 **DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K
LOCATION: East Mesa Area, BLM Land			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0						Conductor casing set to 10 ft bgs, wash casing to 100 ft bgs without collection of core. Per work-plan, drilled interval in unsaturated zone was not logged.
100				SP	**POORLY GRADED SAND WITH GRAVEL (SP)** -brn (7.5YR5/4), 40% gravel m-c, 30% c sand, 20% m sand, 5% f sand, <5% silt, ang-subang, wet sand and gravel, igneous / metamorphic, massive.	possible slough and all core may not have been retrieved from 100-106 ft bgs
105				SP-SC	**POORLY GRADED SAND WITH SILTY CLAY (SP-SC)** -reddish brn 5YR4/4, 40% m-sand, 20% c-sand, 15% f-gravel, 15% clay-silt, 10% f-sand, ang-subang, igneous / metamorphic, mottles of dk reddish-brn 5YR3/4 and grnish-gry GLEY1 5/5GY, massive.	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 360.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 563.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,692.93	EASTING (CCS NAD 27 Z 5): 7,613,263.17	DATE STARTED: 01/04/2005	DATE COMPLETED: 01/13/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Speedstar 15K	
LOCATION: East Mesa Area, BLM Land			LOGGED BY: T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND WITH GRAVEL (SP)** -reddish brn 5YR4/4 to 5/4, 50% m sand, 20% c-sand, 15% f-c gravel, 10% f-sand, 5% clay/silt, ang-subang, igneous/meta., faint gravel-fabric and v-faint bedding, soft-firm in intervals.	
110		S1	16			
115						
				SM	**SILTY SAND (SM)** -lt yellowish-gry 2.5Y 6/2, 40% m-sand, 30% f-sand, 15% silt, 10% m-sand, 5% c-sand, soft, dry, massive.	
					- brn7.5YA 4/3-5/3, 25% c-sand, 25% m-sand, 20% clay/silt, 15% f-gravel, 15% f-sand, ang-subang, igneous and metamorphic, massive, .5 cm-3cm, wet	
120						100-120ft bgs open hole, bailed and collect water sample, sample ID: CW1-120 @14:15
125						
					- brn 10YR 4/3-5/3, 30% m-sand, 25% c-sand, 25% clay/silt, 10% f-gravel, 10% f-sand, ang-subang, igneous/metamorphic, .5-1cm, massive	
130		S2	20			
135						
				SP	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP)** -dk reddish-gray (5YR4/3) to dk-gray (7.5YR4/1), 50% m-sand, 20% c-sand, 10% f-sand, 10% clay/silt, 10% f-c gravel, hard w/caliche development, moist to drier.	
140						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-1

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	360.0	WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 563.8 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005	**DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K	
LOCATION: East Mesa Area, BLM Land		**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
140–153		S3	20	SP	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP)** - brn (7.5YR 5/3) with mottles of reddish-brn (5YR4/3), 65% m-sand, 20% c-sand, 10% f-gravel, <5% clay/silt, ang-subang, igneous/meta., massive, wet.	stop drilling at 140 ft on 1/5/05, but core not removed, continue drilling on 1/6/05
153–160				SM	**SILTY SAND WITH GRAVEL (SM)** -brn (7.5YR4/3), 30% f-sand, 20% silt/clay, 20% m-sand, 15% f-c-gravel, ang-subang, igneous/meta, 1-2cm., 10% mottling dk reddish gry(5YR4/3).	
160		S4	16	SW	**WELL GRADED SAND (SW)** -gray-brn (10YR5/2) 30% c-gravel, 30% m-sand, 25% f-sand, 15% gravel, <5% clay/silt, ang-subang, igneous/meta, color homogenized to high permeability, ave-1-3cm.	160-180ft open hole, bailed one hour (130 gallons), and collect water sample, Sample ID:CMW-1-180 @13:15
164					-10% more clay/silt	very hard drilling 165-170 ft
170					-75% m-sand, 10% f-sand, 5% c-sand, 5% gravel, 5% clay/silt	
175						

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 563.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005 **DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K
LOCATION: East Mesa Area, BLM Land			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
175-185					**WELL GRADED SAND (SW)** -gray-brn (10YR5/2) 30% c-gravel, 30% m-sand, 25% f-sand, 15% gravel, <5% clay/silt, ang-subang, igneous/meta, color homogenized to high permeability, ave-1-3cm. -75% c-gravel	lost core from 175-180 ft
180						
185				SM	**SILTY SAND WITH GRAVEL (SM)** -reddish brn 5YR5/3, 30% m-sand, 30% f-sand, 20% clay/silt, 10% f-gravel, 10% c-sand, ang-subang, igneous./meta., massive, moist-wet.	
190		S3	20	SC	**CLAYEY SAND (SC)** dk grayish-brn 10YR4/2, 50% m-sand, 20% silt/clay, 10% f-sand, 5% f-gravel, 5% c-sand, ang-subang, igneous/meta, silty sticky/plastic, wet.	
195				SW-SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** -reddish brn 5YR5/3, 30% m-sand, 30% f-sand, 20% c-sand, 10% f-gravel, 10% clay/silt, 5% mottles of reddish-brn 2.5YR4/4, ang-subang, igneous/meta, moist-wet. -weak caliche 196-199 ft -sand layer, brn 7.5YR4/4, 80% m-f sand	
200				MH	**SILT (MH)** -dk grayish brn 10YR4/2, 75% silt, 15% f-sand, 10% clay, sticky/plastic, moist-wet.	
205				SP	**POORLY GRADED SAND (SP)** -brn 10YR5/3, 50% m-sand, 45% f-sand, 5% clay/silt, v-soft, massive, wet. -yellowish-brn 10YR5/4, 60% m-sand, 20% c-sand, 10% f-sand, ,5% gravel, 5% clay/silt, ang-subang, igneous/meta, soft-firm, wet	200-204 ft sand not typical, sand end possibly reworked slough
210						

CH2MHILL

SHEET 5 of 9	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 563.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005 **DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K
LOCATION: East Mesa Area, BLM Land			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		S4	20	SW-SM	**WELL GRADED SAND WITH SILT (SW-SM)** -brn 10YR5/3, 10% mottles of brn 7.5YR4/4 weak caliche, 40% m-sand, 25% f-sand, 20% c-sand, 10% f-gravel, 10% clay/silt, ang-subang, massive, wet, igneous/metamorphic, abrupt lower boundary, firm.	
215						
				SP-SM	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)** -brn 7.5YR5/3-4/3, 35% f-sand, 20% m-sand, 15% c-sand, 15% f-gravel, 10% clay/silt, 30% mottling reddish-brn 5YR4/4, ang-subang, igneous/metamorphic, hard-v. hard.	
					WELL GRADED SAND (SW) -brn 7.5YR5/3, 60% m-sand, 20% f-sand, 15% c-sand, 5% clay/silt, ang-subang, igneous/metamorphic, massive, wet.	
220						open hole 220 to 240 ft bgs, bail one hour (~110 gals), and collect groundwater grab sample, sample ID:CW1-240
225						
230		S5	20		-10% clay/silt	
					-shift in color, reddish brn, 7.5YR4/4 to 5YR 4/4	
235						
240					-brn 7.5YR4/4 to 5YR4/4	
					-6" caliche zone 10-20% clay/silt	
245						

CH2MHILL

SHEET 6 of 9	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 563.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005	**DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K	
LOCATION: East Mesa Area, BLM Land			**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND (SW) -brn 7.5YR5/3, 60% m-sand, 20% f-sand, 15% c-sand, 5% clay/silt, ang-subang, igneous/metamorphic, massive, wet.	
				SW		
250		S6	0			
255						
260						260-280 ft bgs core may have been fully recovered, but same bags filled with >2 ft of core
265						
					-40-50% gravel	
270		S7	16		-20% silt/clay	
275						
280						

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 563.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005 / **DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K
LOCATION: East Mesa Area, BLM Land			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
285				SW	**WELL GRADED SAND (SW)** -brn 7.5YR5/3, 10-15% yellowish-red 5YR4/6 mottling, 60% m-sand, 20% f-sand, 15% c-sand, 5% clay/silt, ang-subang, igneous/metamorphic with weak caliche development, massive, firm-hard, wet.	
290		S9	20			
295				SW-SC	**WELL GRADED SAND WITH CLAY (SW-SC)** -brn 7.5YR4/4, 30% m-sand, 20% f-sand, 20% c-sand, 15% f-gravel, 15% clay/silt, ang-subang, heterogeneous w/sand layers, igneous/metamorphic, massive, wet.	
300				SW	**WELL GRADED SAND (SW)** -brn 7.5YR4/4, 40% m-sand, 30% c-sand, 15% f-gravel, 15% f-sand, 5% clay/silt, ang-subang, igneous/metamorphic, massive, wet.	300-309 ft appears core is washed cut and not representative 300-320 ft only received 16ft of core
305					-reddish brn, 7.5 YR4/4	
				SC-SM	**SILTY CLAYEY SAND (SC-SM)** - 40% dk greenish-gray (Gley1 4/104), 40% brown (7.5YR4/4), 20% yellowish red (5YR4/5), 10% f-c gravel, 5-10% c sand, 20% m sand, 30% f sand, 30-35% clay/silt, subang to ang, m plastic to plastic, m sticky, massive, ig and mm gravels up to 1 cm (one 9 cm), weak to mod. caliche at 306'	
				SW	**WELL GRADED SAND (SW)** -brn 7.5YR4/4, 40% m-sand, 30% c-sand, 15% f-gravel, 15% f-sand, 5% clay/silt, ang-subang, igneous/metamorphic, massive, wet.	
310		S10	15			
315				SW-SM	**WELL GRADED SAND WITH SILT (SW-SM)** - brn 7.5YR4/3-5/3, 30-35% f sand, 30% m sand, 10-15% c sand, 10% f gravel, 10-15% silt/clay, subang to ang, massive, wet, igneous and metamorphic, max silt at 311', 313', 316',	

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-1

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	360.0	WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 563.8 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,692.93	**EASTING (CCS NAD 27 Z 5):** 7,613,263.17	**DATE STARTED:** 01/04/2005	**DATE COMPLETED:** 01/13/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 15K	
LOCATION: East Mesa Area, BLM Land		**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.)
316-320					**WELL GRADED SAND WITH SILT (SW-SM)** - brn 7.5YR4/3-5/3, 30-35% f sand, 30% m sand, 10-15% c sand, 10% f gravel, 10-15% silt/clay, subang to ang, massive, wet, igneous and metamorphic, max silt at 311', 313', 316',	
320				SC	**CLAYEY SAND WITH GRAVEL (SC)** - gray (10YR5/1), 30% gravel up to 6 cm (freshly broken), 25% f sand, 20% clay, 15% m sand, 5% c sand, 5% silt, massive, soft, wet, decreasing sand with depth. 80% gravel at 321'.	very hard drilling conditions from 320-330 ft, only 10 foot run possible, observed discharged, changed to reddish brn/red
325		S11	10	SM	**SILTY SAND (SM)** - brn 7.5YR5/2-4/2 with reddish brown 5YR5/4 at 324', 35% f sand, 25% m sand, 15% c sand, 20% silt, 5% f very weathered in-place gravel, subang to ang, firm to hard, weak bedding, massive, igneous and metamorphic, moist. At 325', in-ground igneous / metamorphic rock, v pale brn (10YR3/2), broken to clay / silt size dust, whitish, few gravels	
330-335				SW-SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** yellowish red to red (7.5YR5/6 to 5YR5/6), 40% m sand, 20% f sand, 10-15% f gravel, 10-15% c sand, 5-10% clay / silt, weak caliche throughout, subang to ang, m hard to hard, massive, igneous / metamorphic, moist.	
340						lost bottom 3 ft of core from 340-345 ft very hard drilling from 340-350 ft
345				SC	**CLAYEY SAND (SC)** - greenish gray (Gley1 5/10GY), 30% m sand, 30% f sand, 15% f-c gravel, 10-15% clay, 10% c sand, subang to ang, massive, igneous / metamorphic, wet.	
350					**CONGLOMERATE (BR)** - reddish brn (5YR5/4), 40% m sand, 20% f sand, 15% f-c gravel, 15% c sand, 5-10% clay / silt, hard, massive	appears to be weathered Miocene conglomerate from 348-360 ft

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 360.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 563.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,692.93	EASTING (CCS NAD 27 Z 5): 7,613,263.17	DATE STARTED: 01/04/2005	DATE COMPLETED: 01/13/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Speedstar 15K	
LOCATION: East Mesa Area, BLM Land			LOGGED BY: T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
355			12	BR	**CONGLOMERATE (BR)** - reddish brn (5YR5/4), 40% m sand, 20% f sand, 15% f-c gravel, 15% c sand, 5-10% clay / silt, hard, massive	12 ft core recovered from 350-360 ft, 2 ft from core lost with previous run
360					- 8 cm igneous gravel cored through	

Boring Terminated at 360 ft

ABBREVIATIONS

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

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005 — **DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0						Conductor casing set to 10 ft bgs, wash casing to 88 ft bgs without collection of core. Per work-plan, drilled interval in unsaturated zone was not logged. Drilling returns in unsaturated zone were primarily well-graded sand with silt and gravel.
85						
88–98		CC1	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - pale brn (10YR6/3), 65% sand, 15% igneous and metamorphic gravel, 10% silt, 10% cobbles up to 4.3" long, ang, medium density, dry-silty moist. - more coarse 2.5-3", 60% sand, 35% subang gravel, 5% fines - becomes moist - 4-4.5 inch cobbles at 94', 96' and 97' - brn 7.5YR4/4, 55% ang to subang sand, 30% subang gravel, 10% subang cobbles, 5% fines, dense, moist to wet	continuous coring started at 88 ft bgs
90						
95						
98–105		CC2	8.5	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn 7.5YR4/3, 60% sand, 30% subang gravel, 10% fines, medium density, wet.	
100				SW	**WELL GRADED SAND WITH SILT (SW)** - brn 7.5YR4/3, 80% sand, 10% gravel, 10% silt, medium density, wet.	
105				GW	**WELL GRADED GRAVEL (GW)** - brn 7.5YR5/3, 55% mostly f gravel,	

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 385.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,097.47	EASTING (CCS NAD 27 Z 5): 7,613,798.05	DATE STARTED: 01/18/2005	DATE COMPLETED: 01/21/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06			LOGGED BY: B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					42% sand, 3% fines, ang metamorphic, dense, wet.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 55% sand, 40% gravel, 3% fines, subang igneous and metamorphic grains, medium density, wet.	
110				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - gray 7.5YR5/1, 70% sand, 15% gravel, 10% fines, cobbles up to 4", subang, medium density, wet.	
115		CC3	8	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/2, 70% subrnd m sand, 27% c gravel up to 2.2" long, 3% fines, hard, wet. - 4.5" metamorphic cobbles, possibly larger, fractured by core	
120				SW	**WELL GRADED SAND WITH SILT (SW)** - brn, 70% sand, 20% silt, 10% gravel, medium density, wet.	collect sample CW2-118 at 13:30
125		CC4	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/2, 70% sand, 27% gravel, 3% fines, occasional cobbles up to 4" long, subrnd to subrnd, hard, wet. - becomes coarser below 121.5 ft, more silt, less fine sand, 60% sand, 32% gravel, 8% silt	core settles in bags and looks shorter
130				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn 7.5YR4/2, 65% subrnd sand, 20% subang gravel, 15% fines, cobbles up to 3.3" long, medium density, wet.	bail 30 gals at 128 ft bgs
		CC5	9	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn, 80% subrnd sand, 12% subang gravel up to 2" long, 8% fines, hard, wet.	
135 140				SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - brn 7.5YR4/2, 55% subrnd sand, 25% subang gravel, 15% fines, 5% cobbles up to 4.2" long, hard, wet.	no core 138-140 ft bgs - seemed similar not preserved, fell into cutting pipe

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	HOLE DEPTH (ft): 385.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL / NORTHING (CCS NAD 27 Z 5): 2,103,097.47	EASTING (CCS NAD 27 Z 5): 7,613,798.05	DATE STARTED: 01/18/2005	DATE COMPLETED: 01/21/2005
DRILLING METHOD: Rotosonic	WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06		LOGGED BY: B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC6	7.2	SW	**WELL GRADED SAND (SW)** - gray 7.5YR5/1, 93% sand, 5% gravel, 2% fines, subang to ang igneous and metamorphic, medium density, wet.	
145				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 75% sand, 17% subang gravel up to 2.5" long, 8% fines, hard, wet. - more gravel below 146 ft, 70% sand, 25% gravel, 5% fines - material fell back into hole when pipe breaks, appears to be well graded sand with gravel and silt	core barrel breaks on 148-158 ft run, retrieve, end day 1/19/05
150						
155		CC7	18	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR5/2, 84% f sand, 12% f gravel, 4% fines, subang to ang, medium density, wet. - grades to more and c gravel - 157-158.5 ft: 70% sand, 25% gravel up to 2.2 inch long, 5% fines	logging on 1/20/05
160				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - brn, 60% sand, 25% gravel, 15% clay, subang, hard, wet.	
				SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - brn 7.5YR5/2, 60% sand, 30% gravels up to 2.3" long, 10% fines, subang igneous and metamorphic grains, medium hard, wet.	
165				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 7.5YR4/3, 60% sand, 12% gravel, 23% silt, subang to subrnd, medium density, non-plastic, wet. - sand grades to gravel	
				GM	**SILTY GRAVEL (GM)** - brn, 45% gravel, 30% silt, 25% sand, hard, wet.	
170				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR5/2, 70% sand, 25% gravel up to 2.5" long, 5% fines, occasional cobbles, subang, metamorphic, medium density, wet .	
175				SW	**SILTY SAND WITH GRAVEL (SW)** - brn 7.5YR5/2, 60% sand, 20-25 % silty and silty plastic fines, 15-20% gravel which is predominantly <1" long, no cobbles, subang, hard, wet. - 60% sand, 20-25% gravel, 15-20% fines	

SHEET 4 of 10	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005 **DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SAND WITH GRAVEL (SW) - brn 7.5YR5/2, 60% sand, 20-25 % silty and silty plastic fines, 15-20% gravel which is predominantly <1" long, no cobbles, subang, hard, wet.	
		CC8	18	GW	**WELL GRADED GRAVEL WITH CLAY (GW)** - brn 7.5YR4/3, 50% gravel, 35% sand, 15% fines, no cobbles, clay and silt present, ang, hard, wet.	
180					- more sandy below 183 ft	
185				GW/SW	**WELL GRADED GRAVEL AND SAND (GW/SW)** - brn, 45% gravel, 45% sand, 10% fines, subang, hard, wet.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn, 70% sand, 20% subang f gravel, 10% fines, medium density, wet.	
				GW	**WELL GRADED GRAVEL (GW)** - brn 7.5YR5/2, 60% f c gravel, 30% sand, 10% fines, subrnd, hard, wet.	
190				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn 7.5YR5/2, 58% sand, 30% subrnd gravel up to 2.5" long, 12% silty fines, hard, wet.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn, 60% sand, 35% gravel, 5% fines, subrnd, hard, wet.	
				GM	**SILTY GRAVEL AND COBBLES (GM and COBBLES)** - 30% gravel, 25% cobbles, 25% sand, 20% silty fines.	
195				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - reddish brn 5YR4/4, 70% sand, 20% subrnd gravel, 5% fines, 5% cobbles up to 3.7" long, subang igneous and metamorphic grains, medium hard, wet.	
		CC9	17		- more brn and silty more silty from 196.5-199 ft	
200				SM	**SILTY SAND WITH GRAVEL (SM)** - reddish brn 5YR4/4, 55-60% sand, 25% silty fines, 15-20% gravel, predominantly silt to f gravel, medium density, wet. - more gravel below 202.5 ft, 50% sand, 25% gravel, 25% silt and clay	
205				GW	**WELL GRADED GRAVEL WITH CLAY (GW)** - gray 7.5YR5/1, 65% gravel, 25% sand, 10% fines, ang metamorphic sand and gravel, hard, moist, clay lenses and coatings on gravel. - evidence of clay infiltration by water	
210				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 5YR4/3, 65% sand, 25% clay and silt, 15% f gravel, subrnd to subang, medium density, wet.	

CH2MHILL

SHEET 5 of 10	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-2

SOIL BORING LOG

PROJECT NAME:		**HOLE DEPTH (ft):**	**DRILLING CONTRACTOR:**	
IM-3 Hydrogeologic Investigation, PG&E Topock		385.0	Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005	**DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC10	8.5	SM	**SILTY SAND WITH GRAVEL (SM)** - brn 5YR4/3, 60-65% sand, 20-25% silty fines, 15% gravel, subrnd, medium density, wet.	
215					- some larger gravels	
220		CC11	8.5	GW	**WELL GRADED GRAVEL WITH CLAY (GW)** - brn, 50% gravel, 35% sand, 15% fines, hard, wet, some clay coatings on gravel, silt and clay lenses. - 75% sand, 55% gravel, 25% cobbles, 5% fines	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 70% sand, 20% gravel, 10% fines, subrnd, hard, wet.	
225				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - brn, 50% sand, 35% gravel, 15% fines, subang, hard, wet.	
				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - brn, 55% gravel, 40% sand, 5% fines, clay coatings, ang, hard, wet.	
230		CC12	17	SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - reddish brn 5YR4/4, 60% sand, 30% gravel up to 2.3" long, 10% fines, subrnd igneous and metamorphic grains, medium density, wet. - well graded sand with gravel, as above with less fines and gravel, brn 7.5YR4/4, 75% sand, 20% gravel, 5% fines	
235					- becomes gray 7.5YR5/1	core through 6+ inches intact rock hard
				ML	**SANDY SILT (ML)** - dk greenish gray 10BG4/1, 30% sand, silty plastic, soft, wet.	
				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 5YR5/2, 60% sand, 20% gravel, 20% fines, subrnd, medium density, wet.	
240				SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - reddish brn 5YR4/3, 67% sand, 30% gravel, 13% fines including some clay, subang, medium hard, wet.	
245						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005 — **DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06		**LOGGED BY:** B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.)
					WELL GRADED SAND WITH GRAVEL AND SILT (SW) - reddish brn 5YR4/3, 67% sand, 30% gravel, 13% fines including some clay, subang, medium hard, wet.	
250				ML	**WELL GRADED SAND WITH SILT AND GRAVELS (ML)** - grayish brn 2.5YR5/2, 60% subrnd sand, 20% subang gravel, 20% fines, m dense, damp. -increasing sand, decreasing silt, gravels ang to 3 cm	
				SP	**POORLY GRADED SAND WITH SILT (SP)** - brn 7.5YR5/3, 85-90% sand, 5-10% gravel, <5% fines, subrnd, loose, damp.	
255				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - olive gray 5YR5/2, gravels to 7 cm, few cobbles to 10cm, subang, medium dense, damp.	hard, slow and steady drilling
260		CC13	20	SW	**WELL GRADED SAND WITH SILT AND GRAVELS (SW)** - grayish brn 2.5YR5/2, 60% subrnd sand, 20-25% subang gravel, 15-20% fines, low density, moderate plasticity, damp. - color change to brn 10YR5/3 - same as above with fewer fines, 70-80% sand, 10-20% gravel, <10% fines	
265				SP	**POORLY GRADED SAND (SP)** - brn 10YR5/3, 90% f to m sand, 5% gravel, <5% fines, loose, damp.	
270				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - reddish brn 5YR4/3, 60-70% m sand, 35-25% subang gravel to 4cm, <5% fines, damp. - cobble with fines - silt/clay, fragments up to 9 cm - very soft clay with cobble fragments up to 10cm	
275					**MODERATELY GRADED SAND WITH GRAVEL (SW/SP)** - reddish brn 5YR4/3, 80-90% sand, 5-15% subang gravel, <5% fines, damp.	
280		CC14	20			

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 385.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,097.47	EASTING (CCS NAD 27 Z 5): 7,613,798.05	DATE STARTED: 01/18/2005	DATE COMPLETED: 01/21/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06			LOGGED BY: B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW/SP	**MODERATELY GRADED SAND WITH GRAVEL (SW/SP)** - reddish brn 5YR4/3, 80-90% sand, 5-15% subang gravel, <5% fines, damp.	
285						
					- same as above, damp to wet	
					- cobble, same as 270-272 ft, damp to wet	
290						
				SM	**SAND WITH SILT AND GRAVEL (SM)** - grayish brn 2.5YR5/2, 70% subrnd sand, 20% gravel, 10% fines, loose.	
				SP	**POORLY GRADED SAND WITH GRAVEL (SP)** - grayish brn 2.5YR5/2, m sand, few gravels, wet.	
295						
				SM	**SAND WITH SILT AND GRAVEL (SM)** - grayish brn 2.5YR5/2, 70% sand, 15% gravel, 15% fines, low plasticity, loose, wet.	
		CC15	20	SM/SP	**MODERATELY GRADED SAND WITH GRAVEL (SM/SP)** - grayish brn 2.5YR5/2, gravels subang to 5cm, wet.	
300						
					- wet grading to damp at 302.5 to 308 ft bgs	
305						
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR5/3, 80% subrnd sand, 15% subang gravel up to 4 cm, <5% fines, loose, moist to wet.	
310						
				SM	**SILTY SAND WITH COBBLES (SM)**	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/4, 80% subrnd m to c sand, 15% subang gravel up to 4cm, <5% fines, loose, moist to wet.	
315						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005 — **DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06		**LOGGED BY:** B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					- f-m sand, medium density	
		CC16	20	SP/GP	**POORLY GRADED SAND WITH GRAVEL (SP/GP)** - gley 2.5/5BG, greenish black, 95% sand and gravel, <5% fines, gravels up to 3 cm when cleaned gravels resemble gneissic clasts, gravels mottled with red oxidation, subrnd to subang.	
320				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - reddish brn 5YR4/4, 60% subrnd f to m sand, 30-35% subang to ang gravel up to 5 cm, 5-10% fines, few cobbles that resemble gneiss when cleaned, moist.	
325				SW/SP	**MODERATELY GRADED SAND WITH GRAVEL (SW/SP)** - reddish brn 5YR5/4, 85% subrnd f to m sand, 10% subang to ang gravels to 3 cm, <5% fines. - color grades to dk gray 5YR4/1	
330		CC17	20	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - olive brn 2.5YR4/3, 70-80% subrnd f to m sand, 15-25% subang gravel to 5 cm, <5% fines, loose, moist to wet.	
335						
340				GW	**GRAVELLY SAND/GRAVEL WITH SAND (GW)** - reddish brn 5YR4/4, gravels subang to ang to 6 cm, increasing fines content with depth from 5-10% to 20%, low plasticity, dense.	
				CL	**CLAY WITH GRAVEL (CL)** - brn 10YR4/3, few f to m sand, few gravels up to 2 cm, low to medium plasticity.	
				SP	**POORLY GRADED SAND (SP)** - reddish brn 5YR4/4, fine to medium, subrnd, <5% fines, damp.	
345				SM	**SILTY SAND WITH GRAVEL (SM)** - olive brn 2.5YR4/3, 50% sand, 35-30% gravel, 15-20% fines, dense, low plasticity, damp.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - dk grayish brn 2.5YR4/2, 70% subrnd sand, 15-20% subang gravel, 10-15% fines, dense, low plasticity, dry to damp.	
350					**MODERATELY GRADED SAND WITH GRAVEL (SW/SP)** - brn 7.5YR4/4, 80% m to c subrnd sand, 15% subang gravel to 5 cm, <5% fines, very low plasticity, loose, damp.	

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 385.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005	**DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
355		CC18	20	SW/SP	**MODERATELY GRADED SAND WITH GRAVEL (SW/SP)** - brn 7.5YR4/4, 80% m to c subrnd sand, 15% subang gravel to 5 cm, <5% fines, very low plasticity, loose, damp.	
360						
365				SM/ML	**SANDY SILT WITH GRAVEL (SM/ML)** - brn 7.5YR4/4, 50-60% sand, >20% fines, remainder subang gravel, well graded, dense, damp.	
370		CC19	17	SW	**WELL GRADED SAND (SW)** - reddish brn 5YR5/3, 40% m sand, 25% c sand, 25% f sand, 5% gravel, 5% fine, soft, saturated. - 60-70% m sand, 10-30% gravel, 10-20% fines	
				SM/SP	**SILTY SAND (SM/SP)** - greenish gray 5GY6/1, 40% silty clay, 30% f sand, 25% m sand, <5% c sand, <5% gravel, moderately soft, moist. - large cobbles - increasing c sand, mottling with reddish brn 5YR4/4	
375				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR5/3, 30% c sand, 30% m sand, 25% f sand, 10% gravel, 5% silt and clay, clasts subang to subrnd up to 4 cm, saturated, soft.	lots of chatter during drilling, drilling is hard
380				SP/SM	**SILTY SAND WITH GRAVEL (SP/SM)** - greenish gray 5GY6/1, 30% f sand, 30% silt, 20% m sand, 10% c gravel, 5% f gravel, 5% c sand. - mottling with reddish brn 5YR4/4, decreasing gravel, increasing c and m sand - reddish brn 5YR4/4, 35% m sand, 20% c sand, 10% gravel, clasts ang to subang	distinct sweet odor noted from 378-380 ft in one sleeve when cut open on 1/21/05
385						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-2

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	385.0	Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 546.7 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,103,097.47	**EASTING (CCS NAD 27 Z 5):** 7,613,798.05	**DATE STARTED:** 01/18/2005	**DATE COMPLETED:** 01/21/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: East Mesa Area, Parcel No. 650-151-06		**LOGGED BY:** B. Moayyad	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					Boring Terminated at 385 ft	

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-3

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	360.0	WDC Exploration & Wells, Montclair, CA	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
531.5 ft. MSL	2,103,348.44	7,613,849.33	01/19/2005	01/25/2005

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic	---	Gefco SS-15K-HL

LOCATION:	LOGGED BY:
East Mesa Area, Parcel No. 650-151-06	C. Dougherty

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
						Conductor casing set to 10 ft bgs, wash casing to 70 ft bgs without collection of core. Per work-plan, drilled interval in unsaturated zone was not logged.
5						
10						
15						
20						
25						
30					**WELL GRADED SAND (SW)** - olive gray (5YR4/2) 50% m sand, 20% f sand, 5% gravel, ang.	logged from cuttings
					- mostly f sand and silt	
35						

CH2MHILL

SHEET 2 of 11	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 360.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,348.44	EASTING (CCS NAD 27 Z 5): 7,613,849.33	DATE STARTED: 01/19/2005	DATE COMPLETED: 01/25/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06			LOGGED BY: C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND (SW) - olive gray (5YR4/2) 50% m sand, 20% f sand, 5% gravel, ang.	
						cutting not monitored continuously
40						
45						
50				SW		
55						
60					- grayish brn (10YR,5/2), 50% m sand, 30% f ang sand, no gravel	
65						
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 360.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,348.44	EASTING (CCS NAD 27 Z 5): 7,613,849.33	DATE STARTED: 01/19/2005	DATE COMPLETED: 01/25/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06			LOGGED BY: C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					POORLY GRADED SAND WITH SILT AND GRAVEL (SP) - brn 10YR5/3, 40% f-m sand, 20% c sand, 10-15% silt, 10% subang gravel, gnessis as large as 4 cm, firm, moist.	continuous coring started at 70 ft bgs
					- silty more silt and clay in thin layers	
75		CC1	10	SP	- gravel increasing in size to 6-7 cm, silty more clay	large gravel possibly cobble fragments?
80					**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** - brn 10YR5/3, 30% m sand, 25% f sand, 20% ang c sand, 15% ang to subang gravel up to 6 cm size, 10% silt-clay, firm moist.	
				SW-SM	- some caliche, slit imbrication of fine gravel at base of core, dry	
85					**SILTY SAND (SM)** - brn 10YR5/3, 50% f sand, 25% m and c ang sand, 20% silt, 5% subang gravel, firm, clasts are gneiss-few larger than 2 cm, moist.	
90		CC2	20	SM	- decreasing silt and increasing c sand	
95					**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** - brn 10YR5/3, 30% m sand, 30% f sand, 25% ang c sand, 10% silt-clay, 5% subang gravel generally 2 cm or less, firm moist.	
100						
105					- silt and clay increased to 20%, 15% decreased c sand	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005	**DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06		**LOGGED BY:** C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SW-SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** - brn 10YR5/3, 30% m sand, 30% f sand, 25% ang c sand, 10% silt-clay, 5% subang gravel generally 2 cm or less, firm moist.	
110		CC3	20			
					- increased 10% gravel content, color mottled with brn (7.5YR4/4)	
115						
					- dry	
120				SW	**WELL GRADED SAND (SW)** brn 10YR5/3, 10% c sand, 5% silt and clay, <5% gravel, saturated, clasts are ang.	grab water sample collected, ID: CW-3-140 at 10:40hrs, on 1/20/05
				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 7.5YR5/3, 30% f sand, 20% ang gravel up to 4cm, 20% c sand, 20% m sand, 15% silt, firm, moist, gradational contact above, abrupt below.	
125					**SILTY SAND (SM)** - brn 10YR4/3, 30% m sand, 25% f sand, 20% ang c sand, 20% silt, 5% subang gravel up to 2cm size, firm.	
					- increased gravel content	
130		CC4	16	SM	- slit increase in clay	
135					- lt large 2 inch gravel	
					NO RECOVERY	
140						

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 531.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005 **DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** C. Dougherty

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SAND (SM) - brn 10YR4/3, 30% m sand, 25% f sand, 20% ang c sand, 20% silt, 5% subang gravel up to 2cm size, firm.	cobble possibly part of larger rock
					- 9 cm cobble	
					- brn 10YR5/3, 30% f sand, 25% silt, 15% ang c sand, <5% ang gravel	
145					- moderately firm, dry, moist	
						hard drilling
					- increasing c sand 25%	
150		CC5	20	SM	- increasing gravel 5-10%	
					- several 2cm to 4cm gravel, less gravel below 152ft, Increased clay at 152-153.5 ft, very moist	
155					- silty sand, brn 7.5YR5/4, 5% ang gravel up to 2 cm or less, 25% silt, 20% c sand, 20% f sand	
					- caliche, moist	
160					**CLAYEY SAND (SC)** - brn 10YR5/3, 70% f to m sand, 20% silt and clay,<10% c sand, <5% gravel, firm, moist to wet.	drill pipe broken when just starting to push core
				SC	- color mottled with reddish brn 2.5YR4/4, decreasing 65% m and f sand, increasing 15% c sand	
165					**SILTY SAND (SM)** - brn 10YR5/3, 50% f and m sand, 25% c sand, 15% silt, 10% f gravel, silty soft, moist to wet.	
				SM	- some reddish brn 2.5YR4/4 mottling, large 4-6cm gravel	
170		CC6	20		**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 40% c sand, 35% f and m sand, 15% f gravel, 5% silt, ang to subang, loose.	
				SW		
175						

CH2MHILL

SHEET 6 of 11	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005	**DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND WITH GRAVEL (SW) - brn 10YR4/3, 40% c sand, 35% f and m sand, 15% f gravel, 5% silt, ang to subang, loose.	
				SW-SM	**WELL GRADED SAND WITH SILT (SW-SM)** - brn 10YR 4/3 and dk reddish brn (2.5YR3/4) mottled, 40% c sand, 40% f and m sand, 10% f gravel, 10% silt, moderately firm. - thin zone of dark greenish gray (5GY4/1), silt, some caliche	
180						groundwater grab sample collected, ID: CW-3-200 at 9:52 hrs
185					- pale brn (10YR6/3), 35% c sand, 15% gravel, saturated, soft, clasts are angular up to 6 cm size	
				SM	**SILTY SAND (SM)** - mottled dk grayish brn 2.5YR4/2 and brn 7.5YR4/4, 60% f and m sand, 15% silt, 15% c sand, 10% f gravel, firm, moist.	
190		CC7	20			
					- larger gravel clasts (2-4 cm)	
195						
					- larger gravel clasts (2-4 cm)	
200					**NO RECOVERY**	lost core due to broken core barrel down hole
205						hard drilling
210						

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005	**DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
		CC8	0		**NO RECOVERY**	periodic hard drilling
215						
220					**WELL GRADED SAND WITH SILT (SW-SM)** - dk grayish brn 2.5YR4/2, 40% m ang sand, 25% c ang sand, 20% f ang sand, 10% silt, 5% f subang gravel up to 2 cm, moderately firm, moist to wet.	
225						
230		CC9	20	SW-SM		
					- large gravel 3-4 cm, also increasing c sand	
235					- mottling with reddish brn 5YR4/4	dry, maybe from drilling friction heat?
					- dry	
240					**SILTY SAND (SM)** - brn 7.5YR4/4, 50% f to m sand, 25% c sand, 20% silt, 5% gravel, moderately soft, moist.	collected grab groundwater sample, ID: CW-3-260 at 14:40 hrs, pH=8.9/8.7, conductivity = 730/850 ms, TDS = 4500/5100 ppm
				SM	- 7 cm cobble	hard drilling
245						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 360.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,348.44	EASTING (CCS NAD 27 Z 5): 7,613,849.33	DATE STARTED: 01/19/2005	DATE COMPLETED: 01/25/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06			LOGGED BY: C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					NO RECOVERY	
250		CC10	6			
255						
260				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - grayish brn 2.5YR5/2, 35% f ang to subang gravel, 30% c ang sand, 20% c ang to subang gravel, 15% f sand, 5% silt, soft, saturated, clasts are metamorphic rock.	periodic hard drilling
				SW-SM	**WELL GRADED SAND WITH SILT (SW-SM)** - grayish brn 2.5YR5/2, 40% f and m sand, 30% c sand, 20% silt, 10% f gravel, soft, saturated.	
265				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - grayish brn 2.5YR5/2, 35% f ang to subang gravel, 30% c ang sand, 20% c ang to subang gravel, 15% f sand, 5% silt, soft, saturated, clasts are metamorphic rock.	
				SM	**SILTY SAND (SM)** - brn 10YR5/3, 40% m sand, 20% silt, 20% c sand, 20% f sand, very soft, saturated.	
270		CC11	16	SW-SM	**WELL GRADED SAND WITH SILT (SW-SM)** - brn 10YR5/3, 30% f sand, 25% c sand, 10% silt, 5% f gravel, soft, saturated. - some f gravel (<5%), less silt, grades into SW below - coarse gravel present (3cm in size- rock fragments) - increasing silt, less c sand - caliche and mottling with reddish br (5YR4/4)	
275					**NO RECOVERY**	very hard drilling
280						

CH2MHILL

SHEET 9 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 531.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005	**DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** C. Dougherty	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND (SW)** - brn 7.5YR5/4, 45% f and m sand, 40% c sand, 10% subang to subrnd gravel, 5% silt, soft, wet.	rig chatter
285				SC	**CLAYEY SAND (SC)** - brn 10YR4/3, 65% f and m sand, 20% silt and clay, 10% c sand, 5% f gravel, firm, moist. - increased gravel 10% - caliche	
290		CC12	20	SW	**WELL GRADED SAND (SW)** - brn 7.5YR5/3, 40% m sand, 25% c sand, 20% f sand, 10% fine ang to subang gravel, 5% silt, moderately firm, moist to wet.	
295					- increasing 15% gravel and c sand	
300					- 6 inch thick zone of silt and gravel, brn 10YR5/3, 3-5cm ang gravel	no recovery due to over drilling with casing to remove broken drill pipe core recovered, appears to be slough material
305				SM	**SILTY SAND (SM)** - brn 10YR5/3, 40% m sand, 35% f sand, 20% silt and clay, 5% c sand, <5% gravel, moderately soft, moist.	
310		CC13	20	SW-SM	**WELL GRADED SAND WITH SILT (SW-SM)** - brn 7.5YR5/3, 40% m sand, 30% f sand, 25% c sand, 25% m sand, 10% silt, 10% gravel, soft, wet.	
315						

CH2MHILL

SHEET 10 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 531.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005 / **DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** C. Dougherty

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
	X				**WELL GRADED SAND (SW)** - reddish brn 5YR5/3, 40% m subang to ang sand, 25% c subang to ang sand, 20% f subang to ang sand, 10% subang to subrnd gravel, 5% silt, soft, wet.	
320					- few clasts of lithified matrix	collected grab groundwater sample, ID: CW-3-320 at 9:32 hrs, from 300-320 ft interval
325					- slit color change to 5YR4/3, 25-30% increasing sand, 20% f sand, increasing gravels to 15%, c sand, 5% silt	
330					- few clasts of lithified matrix	
335				SW	- 40% gravel up to 9 cm, multiple lithologies	
340						
345						
350						

CH2MHILL

SHEET 11 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 360.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 531.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,348.44	**EASTING (CCS NAD 27 Z 5):** 7,613,849.33	**DATE STARTED:** 01/19/2005 / **DATE COMPLETED:** 01/25/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa Area, Parcel No. 650-151-06			**LOGGED BY:** C. Dougherty

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND (SW) - reddish brn 5YR5/3, 40% m subang to ang sand, 25% c subang to ang sand, 20% f subang to ang sand, 10% subang to subrnd gravel, 5% silt, soft, wet.	
355					- color to 5YR4/3	
					- brn (7.5YR5/2), 45% m sand, 30% c sand, 10% f sand, 10% gravel, <5% silt	
360					Boring Terminated at 360 ft	total drilled depth

ABBREVIATIONS

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

SHEET 1 of 10	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 337.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 515.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,263.03	**EASTING (CCS NAD 27 Z 5):** 7,612,928.74	**DATE STARTED:** 01/10/2005 **DATE COMPLETED:** 01/14/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0						Conductor casing set to 10 ft bgs, wash casing to 48 ft bgs without collection of core. Per work-plan, drilled interval in unsaturated zone was not logged.
45						cuttings well graded sand with gravel, brn 10YR5/3, medium hard, dry
48	48-58	CC1	10	SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - brn 10YR3/2, 50% sand, 35% gravel up to 2.2" long, 15% fines (silt), no clay (predominantly f sand), subang Igneous and metamorphic. - becomes moist - sand becomes more coarse. Pale brn 10YR6/3, 60% sand, 30% gravel, 10% fines	continuous coring started at 48 ft bgs saturated (water table)
60	58-68	CC2	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR5/3, 70-75% sand, 15-20% gravel, 10% fines (some clay), subrnd, igneous and metamorphic, hard, wet. - becomes subang with more clay, 65% sand, 20% gravel, 5% fines - <5% fines	some decomposing MM gravels drilling becomes difficult
68	68-70			SW	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW)** - brn 10YR4/3, 55% f sand, 25% fines, 20% gravel, subang, one cobble 4" long, metamorphic, hard, wet.	collect CW-4-68 @ 10:40 on 1/11/05
70						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-4

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	337.0	Prosonic Corp. Maretta, OH	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
515.9 ft. MSL	2,103,263.03	7,612,928.74	01/10/2005	01/14/2005

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic	---	Sonic AT (track mounted)

LOCATION:	LOGGED BY:
Wash Between East & West Mesas, Parcel No. 650-151-06	B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
75		CC3	9.5	SW	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW)** - brn 10YR4/3, 70% sand, 20% gravel, 10% fines, subang, one cobble 4" long, metamorphic, hard, wet.	
80 – 85		CC4	9.5	SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - dk grayish brn 10YR4/2, 45% ang sand with med c grains, 25% gravel, 20% fines, 10% cobbles up to 4.5", igneous and metamorphic, hard, wet. - no cobbles, 60% sand, 25% gravel, 15% fines	stop drilling at 78ft to bail from 58-78 ft very difficult drilling
90		CC5	9	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - dk grayish brn 10YR4/5, 72% subrnd sand, 25% subang to subrnd gravel, < 3% fines, m dense, wet.	cleaner, grayer zone
95				SW-GW	**WELL GRADED SAND AND GRAVEL (SW)** - dk grayish brn 10YR4/3, 50% sand, 40% gravel, 10% fines, subang to ang metamorphic, hard, wet.	decomposing MM cobbles
100		CC6	9	SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - dk brn 7.5YR3/3, 65% sand, 20% gravel, 15% fines, hard, wet.	
105					**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 75% subang to subrnd sand, 20% subang gravel, 5% fines, medium density.	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 337.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 515.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,263.03	EASTING (CCS NAD 27 Z 5): 7,612,928.74	DATE STARTED: 01/10/2005	DATE COMPLETED: 01/14/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			LOGGED BY: B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 75% subang to subrnd sand, 20% subang gravel, 5% fines, medium density.	
				GW	**WELL GRADED GRAVEL AND COBBLES (GW)** - 40% gravel, 10% sand, 10% fines, subrnd.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 75% sand, 20% gravel, 5% fines.	
110				ML	**SANDY SILT (ML)** - brn 7.5YR4/3, 35% sand, 5% gravel, non plastic, firm, wet.	
		CC7	9.5		**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 60% sand, 30% gravel, 10% fines, subang, medium density, wet.	
115						
					- 65% sand, 5% fines, gravel is predominantly gneiss	
					- 58% c subrnd sand, 10% gravel, 5% fines	
120					- silty layer, 60% sand, 25% gravel, 5% fines	
		CC8	10	SW	- well graded sand with gravel (SW), grayish brn 10YR 5/2, 75% subrnd sand, 20% subang gravel, 5% fines, igneous and metamorphic, medium density, wet	
125					- cobbles	
						collect sample CW-4-128 on 1/11/05. End of 1/11/05 drilling day
130					- color changes to brn 7.5YR4/3	
		CC9	10		- 75% sand, 15% gravel, 10% fines	
135				SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - brn 7.5YR4/3, 65% sand, 20% gravel, 15% fines, subang, igneous and metamorphic, hard, wet.	at 15:45 stop drilling to bail for sample
					- cobble zone	
140						

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 337.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 515.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,263.03	**EASTING (CCS NAD 27 Z 5):** 7,612,928.74	**DATE STARTED:** 01/10/2005 **DATE COMPLETED:** 01/14/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
145		CC10	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 75% f and c sand, 20% predominantly f gravel, 5% fines, subang, igneous and metamorphic, medium density, wet, occasional cobble 3".	slough not kept for core box
150		CC11	9.5	GW	**WELL GRADED GRAVEL WITH COBBLES (GW)** - gray 10YR6/1, 55% gravel, 35% subang cobbles up to 5.7" long, 5% sand, igneous and metamorphic, hard, dry.	fines wash into cobbles and gravel?
				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - 55% sand, 25% gravel, 20% fines.	
155				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - gray 5YR5/1 sand and gravel, strong brn 7.5YR4/6 fines, 65% sand, 30% gravels up to 2.5", 5% fines, subang to ang, igneous and metamorphic, hard, wet. - gray sand	
160		CC12	10	SW	**WELL GRADED SAND (SW)** - dk gray 7.5YR4/2, 85% sand, 10% fines, 5% gravel, subang, medium.	
				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - brn 7.5YR4/4, 55% sand, 30% gravel, 15% fines, subang, medium hard, wet. - gravel is mostly coarse, cobbles present up to 5.5 inch	
165					**WELL GRADED SAND WITH GRAVEL (SW)** -brn 7.5YR4/4, 65% sand, 30% gravel which is mostly fine, 5% fines, subang, igneous and metamorphic, medium density, wet.	
170		CC13	9.5		- 60% sand, 10% fines	
175					- color change to gray and brn 7.5YR5/1 and 5/2	

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PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	CW-4

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	337.0	Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 515.9 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,103,263.03	**EASTING (CCS NAD 27 Z 5):** 7,612,928.74	**DATE STARTED:** 01/10/2005	**DATE COMPLETED:** 01/14/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)	
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06		**LOGGED BY:** B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** -brn 7.5YR4/4, 65% sand, 30% gravel which is mostly fine, 5% fines, subang, igneous and metamorphic, medium density, wet. - less gravel, 75% sand, 20% gravel, 5% fines - gray 7.5YR5/1, 55% sand, 35% gravels, 10% fines, cobbles up to 3.3 inch - less gravel, 75% sand, 20% gravel, 5% fines	
180		CC14	9.5			
185					- brn 7.5YR4/4, better grading below 185.5ft, cobbles up to 3-4 inch, 80% sand, 10% gravel, 5% cobbles, 5% fines	
				SP	**POORLY GRADED SAND (SP)** - gray, f sand fining upwards, <3% fines, subang, clean, wet.	
				GP	**POORLY GRADED GRAVEL (GP)** - gray 7.5YR5/1. - grades to subrnd c sand - fine gravel	
190		CC15	9	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - gray, 80% sand, 15% subang to subrnd c gravel, 5% fines, wet. - becomes brn with more gravel and cobbles up to 3 inch long, 70% sand, 20% gravel, 5-10% fines	
195						
200				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 7.5YR4/4, 40% sand, 30% f to c gravel, 30% fines, ang, igneous and metamorphic, medium density, wet.	
205				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - brn 7.5YR4/4, 50% subang sand, 30% ang gravel, 20% fines, hard, wet.	
		CC16	18		**WELL GRADED SAND WITH GRAVEL (SW)** - strong brn 7.5YR4/6, 60% sand, 35% gravel, 5% fines, subrnd igneous and metamorphic, hard, wet.	
210						

SHEET 6 of 10	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 337.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 515.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,263.03	EASTING (CCS NAD 27 Z 5): 7,612,928.74	DATE STARTED: 01/10/2005	DATE COMPLETED: 01/14/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			LOGGED BY: B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - strong brn 7.5YR4/6, 60% sand, 35% gravel, 5% fines, subrnd igneous and metamorphic, hard, wet. - gravels up to 1.5 inch	
215				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - strong brn 7.5YR4/6, 55% sand, 30% gravel, 15% fines, subang, hard, wet.	
220		CC17	19	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/4, 60% sand, 30% gravel, 10% fines, subang to subrnd, medium density, wet. - cobble zone, 35% sand, 30% cobbles, 20% gravel, 15% fines - brn 7.5YR4/3 - becomes strong brn 7.5YR4/6 with more c sand, 65% sand, 25% gravel, 10% fines	refusal in metamorphic bedrock
235				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - brn 7.5YR4/3, 45% sand, 35% gravel, 20% fines, subang, igneous and metamorphic, medium hard, wet.	
240				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/3, 78% subrnd sand, 15% subang gravel up to 2" long, 7% fines, medium density, wet.	
245						

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SHEET 7 of 10	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 337.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 515.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,263.03	EASTING (CCS NAD 27 Z 5): 7,612,928.74	DATE STARTED: 01/10/2005	DATE COMPLETED: 01/14/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			LOGGED BY: B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				GW	**WELL GRADED GRAVEL WITH COBBLES AND SAND (GW)** - brn 7.5YR4/3, 40% gravel, 30% sand, 20% cobbles, 10% fines, ang, wet.	
		CC18	18	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - 75% sand, 20% gravel. - cobble zone, 45% sand, 25% gravel, 20% cobbles, 10% fines - 50% sand, 40% gravel, 10% fines	
250				SW	**WELL GRADED SAND WITH GRAVEL AND CLAY (SW)** - brn 7.5YR4/2, 50% sand, 30% gravel, 10% fines, 10% cobbles, ang to subang, hard, wet.	
255				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/2, 65% sand, 30% gravel, 5% fines, subang to ang, hard, wet.	
260				GW	**WELL GRADED GRAVEL WITH SILT AND SAND (GW)** - brn, 60% subang to ang gravel, 20-25% sand, 15-20% fines (silt), hard, wet.	
		CC19	9	SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - 45% sand, 40% gravel, 15% fines.	
265				GW	**WELL GRADED GRAVEL WITH SAND AND SILT (GW)** - brn, 60% gravel, 20-25% sand, 15-20% fines, hard.	
				GW	**WELL GRADED GRAVEL (GW)** - bluish gray 10YR36/1, 65% ang gravel, 32% sand, 3% fines, hard, wet.	
270				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR5/6, 75% sand, 20% fine gravel, subrnd igneous and metamorphic, medium density, wet. - gravel becomes more coarse and subang below 273 ft	
275						
		CC20	18	GW	**COBBLES WITH SAND** - bluish gray, 25% sand, 5% fines, ang cobbles.	
280					**WELL GRADED SAND WITH GRAVEL (SW)** - reddish brn 7.5YR4/4, 55% subang sand, 40% c gravel, 5% reddish brn silt, ang, medium hard, wet.	

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 337.0	**DRILLING CONTRACTOR:** Prosonic Corp. Maretta, OH
SURFACE ELEVATION: 515.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,263.03	**EASTING (CCS NAD 27 Z 5):** 7,612,928.74	**DATE STARTED:** 01/10/2005 **DATE COMPLETED:** 01/14/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic AT (track mounted)
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			**LOGGED BY:** B. Moayyad, B. Trebble

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - reddish brn 7.5YR4/4, 55% subang sand, 40% c gravel, 5% reddish brn silt, ang, medium hard, wet.	
				SW	**WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)** - bluish gray 10B6/1, 55% sand, 25% cobbles, 15% gravel, 5% fines, hard, wet.	
285				SW / GW	**WELL GRADED SAND AND GRAVEL (SW / GW)** - brn 7.5YR5/4, ang 45-50% gravel, 45-50% sand, 3-5% fines, hard, wet. - silty zone, 50% gravel, 35% sand, 15% fines	
290						
		CC21	9.5	SW	**WELL GRADED SAND WITH GRAVEL AND SILT (SW)** - reddish brn 5YR4/4 and 2.5YR4/4, 50% sand, 25% gravel, 25% silty fines, subang, medium density, wet. - metamorphic, boulder? cobbles? weathered	red fanglomerate (reworked)
295						
300		CC22	9	GC / SC	**CLAYEY SAND AND GRAVEL (GC / SC)** - reddish brn 5YR4/4, 35-40% ang gravel, 35-40% subang sand, 25% fines, hard, wet. - weathered MM bedrock, bolder? cobbles? - cobbles	red fanglomerate (reworked)
305						
310		CC23	9.5	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR4/4, 60% sand, 25% f gravel, 5% fines, subang to ang, medium, wet. - more silt below 312 ft, 60% sand, 25% gravel, 15% fines	oldest alluvium?
315						

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 337.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 515.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,263.03	EASTING (CCS NAD 27 Z 5): 7,612,928.74	DATE STARTED: 01/10/2005	DATE COMPLETED: 01/14/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			LOGGED BY: B. Moayyad, B. Trebble	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				BR	**CONGLOMERATE (BR)** - brn 7.5YR4/4, 55% fines, 20% cobbles, 15% sand, 10% gravel, subang, non plastic, hard.	top Miocene conglomerate estimated at 315 ft bgs
320				BR	**CONGLOMERATE (BR)** - reddish brn (5YR4/14), hard, 25% gravel, subang, 30% rnd, 45% fines.	encountered rocks at 323'
325		CC24	17.1	BR	**CONGLOMERATE (BR)** - brn 7.5YR4/4, hard, 20% subang gravel, 15% cobbles, 25% sand, 40% fines - cobbles and ang rock fragments are metamorphic - weathered, fractured metamorphic rock with fill	
330						
335						

Boring Terminated at 337 ft

ABBREVIATIONS

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

CH2MHILL

SHEET 10 of 10	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: CW-4

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 337.0	DRILLING CONTRACTOR: Prosonic Corp. Maretta, OH	
SURFACE ELEVATION: 515.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,263.03	EASTING (CCS NAD 27 Z 5): 7,612,928.74	DATE STARTED: 01/10/2005	DATE COMPLETED: 01/14/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic AT (track mounted)	
LOCATION: Wash Between East & West Mesas, Parcel No. 650-151-06			LOGGED BY: B. Moayyad, B. Trebble	

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.
					conglom = conglomerate comptd = compacted qtz = quartz	

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004 **DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** J. Weigel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–10		Box 1 Box 2	10	SM	**GRAVEL WITH SAND AND SILT (SM)** - lt brnish gray (10YR 6/2), 50% f-c sand, 25% f-m gravel, 25% fines, subang to subrnd clasts.	11:40, dry-hot core barrel
10–15		Box 3	5	SM	-layers of carbonate cement up to 3" thick, cemented layers are GM/SM. Cemented zones from 11' to 15' bgs - 3" metamorphic gneissic cobble	12:00, 3" cobble at 11 ft bgs, metamorphic gneiss
15–21		Box 4 Box 5	6	SM	- 10YR6/2 fines decreasing, cemented layers 1-2" thick - wet color 7.5YR5/3 - think cemented zones	15:30, set casing stage bins
21–26		Box 5 Box 6	5	GM/SM	**WELL GRADED GRAVEL WITH SAND AND SILT (GM/SM)** - <= 20% fines.	
26–34		Box 6 Box 7 Box 8	8	GM	**WELL GRADED SANDY GRAVEL (GM)** - lt brnish gray to lt gray (10YR 6/2 to 7/2), 50% f-m gravel, 40% f-c sand, 10% fines, schist, gneiss, metamorphic clasts. - 50% f-c subrnd to subang gravel, 40% f-c subang sand, moist	hot core barrel
34–35				GM		

CH2MHILL

SHEET 2 of 9	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004 **DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** J. Weigel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
40		Box 8	8	GM	**WELL GRADED SANDY GRAVEL (GM)** - lt brnish gray to lt gray (10YR 6/2 to 7/2), 50% f-m gravel, 40% f-c sand, 10% fines, schist, gneiss, metamorphic clasts. - thin, weakly cemented zones fining upward	
45		Box 11	5	SM	**SAND WITH GRAVEL AND SILT (SM)** - lt gray (10YR 7/2), 50% f-c sand, 30% f-c gravel, 20% silt, subrnd to subang, little cementation, moisture increasing with depth. - white 10YR8/1, 50% f-c sand, 30% silt, 20% gravel, subang-subrnd	
50		Box 12 Box 13	5	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - very pale brn (10YR 7/3), 75% f-c sand, 25% gravel, subang to subrnd, no cementation. - igneous/metamorphic rock up to cobble size	
55		Box 13 Box 14	4.5	ML/CL	**SILT/CLAY WITH SAND (ML/CL)** - pale brn (10YR 6/3), 60% silt, 37% f-c sand, < 3% gravel, wet, decreasing moisture with depth.	wet sample, decreasing moisture with increase in depth
60		Box 14 Box 15 Box 16	6	SW	**SAND WITH GRAVEL AND FINES (SW)** -lt gray (2.5Y 7/1), 60% f-c sand, 30% gravel, 10% silt, subrnd to subang, coarsening downwards, relatively dry. - gravel increasing to 40% subang-ang	sample relatively dry compared to upper sections, coarsening downward
65 70		Box 16 Box 17	6	SW/GM	**SAND/GRAVEL WITH SILT (SW/GM)** - lt gray (10YR 7/2), 55% f-c sand, 40% gravel, 5% silt, ang to subrnd. - some minor cementation, dissolves in water - metamorphic and gneissic clasts - lt gray 10YR7/2 50% f-m sand, 30% silt, 20% ang-subang gravel	

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004 **DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** J. Weigel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
		Box 18	6	SW/GM	**SAND/GRAVEL WITH SILT (SW/GM)** - lt gray (10YR 7/2), 55% f-c sand, 40% gravel, 5% silt, ang to subrnd. -calcium carbonate cement caliche 3-5"	
75		Box 19 Box 20	6	SM	**SAND WITH SILT AND CLAY (SM)** - 80% f-c sand, 20% silt/clay. - caliche 1-2"	clay on sides of core from core barrel
				ML/SM	**SILT WITH SAND (ML/SM)** - lt gray (10YR 7/2), 50% silt/clay, 50% fine sand.	5" silt zone
80		Box 21	4	SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** - 60% f-c sand, 30% gravel, 10% fines, ang to subang. - cemented, not CaCO3	
85		Box 22 Box 23	10	SM	**SAND WITH SILT (SM)** - very pale brn (10YR 7/3), 50% f-m sand, 45% silt, 5% gravel, ang to subang. - lt gray 10YR7/2, 65% well graded f-c sand, 20% silt, 15% subrnd-ang gravel, fairly moist but drying with depth, igneous and mm clasts - very pale brn 10YR7/3, 50% sand, 30% silt/clay, 20% gravel, fining upward, grain supported, quartzite and mm clasts	
90						
95		Box 24 Box 25 Box 26	12		- composition pale brn, 10YR6/3 - lt gray 10YR7/2 - 40% silt/clay, 30% f-c sand ang-subang, 10% gravel	
100				ML	**SILT WITH SAND AND GRAVEL (ML)** - lt brnish gray (10YR 6/2), 50% silt, 40% f-c sand, 10% gravel, ang-subrnd, low plasticity.	
105				SW/SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW/SM)** - lt reddish	

SHEET 4 of 9	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004 **DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** J. Weigel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW/SM	brn (5YR 6/3), 75% f-c sand, 15% fines, 10% gravels, subrnd, grain supported, mm clasts.	
					WELL GRADED SAND WITH SILT AND GRAVEL (SW/SM) - lt reddish brn (5YR 6/3), 75% f-c sand, 15% fines, 10% gravels, subrnd.	
110		Box 27 Box 28 Box 29	10	SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SM)** - lt reddish gray (5YR 5/2), 70% f-c sand, 25% fines, 5% gravels, subang to subrnd, grain supported, natural soil moisture.	fell apart in core barrel
					- less cemented zone	
115					- 3-4" sandy silt zone 55% silt, 45% f-c sand, gneissic cobble-sized subang clasts	
					- pale brn 10YR6/3, 50% fines, 45% f-c sand, 5% gravels	
		Box 30 Box 31	7		- alternating units are grain-supported and matrix-supported	
120				CL/ML	**CLAY AND SILT WITH SAND AND GRAVEL (CL/ML)** - olive gray (5Y 5/2), 65% med plasticity silt/clay, 30% f-c sand, 5% gravel, matrix supported.	
				SM/SC	**WELL GRADED SAND WITH GRAVEL AND SILT AND CLAY (SM/SC)** - 55% f-c sand, 40% silt/clay, 5% gravel.	
125				ML/CL	**SILT AND CLAY WITH GRAVEL AND SAND (ML/CL)** - olive brn (2.5Y 4/3 to 4/4) to lt yellowish brn (2.5Y 6/4), 65% silt/clay, 25% f-c sand, 10% gravel, subang, low-med plasticity, matrix supported, wet.	
					- lt olive 2.5Y5/3, 60% silt/clay, 35% f-c sand, 5% gravel, dry	hot core barrel
130		Box 32 Box 33 Box 34	10	SC	**SAND WITH SILT, CLAY AND GRAVEL (SC)** - pale brn (10YR 6/3) to lt olive gray (5Y 6/2), 60% f-m sand, 35% silt/clay, 5% gravel, ang to subang.	
					- fining up sequence	
135				SM	**SAND AND SILT WITH GRAVEL (SM)** - dark grayish brn (2.5Y 4/2), 50% f-c sand, 40% silt/clay, 10% gravel, ang-subang, med plasticity.	
					- 4" seam of low plasticity silt / clay	
140		Box 35 Box 36	6			

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 291.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 547.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,030.90	EASTING (CCS NAD 27 Z 5): 7,613,420.85	DATE STARTED: 09/09/2004	DATE COMPLETED: 09/22/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic SS-15K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: J. Weigel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**SAND AND SILT WITH GRAVEL (SM)** - dark grayish brn (2.5Y 4/2), 50% f-c sand, 40% silt/clay, 10% gravel, ang-subang, med plasticity, grain edge contact, grain supported, dry. -sand with silt and gravel, lt yellowish brn 2.5YR6/3 and 10YR7/1, 60% f-c sand, 40% silt/clay, 5% gravel	
145		Box 36 Box 37 Box 38	10	ML/SM	**SAND AND SILT WITH GRAVEL (ML/SM)** - lt gray (10YR 7/1) to lt gray (2.5Y 7/2) 40% f-c sand, 40% silt, 20% gravel. - 2.5Y7/2 lt gray, 55% silt, 35% f-c sand, 10% gravel	
150				SM/ML	**SAND AND SILT WITH GRAVEL (SM/ML)** - brn (10YR 5/3), 50% fines, 45% f-c sand, 5% gravel, not cemented, wet. - grayish brn 10YR5/2 45% f-c sand, 40%silt, 15% gravel, ang-subang, dry	
155		Box 39 Box 40 Box 41	10	SM	**SAND WITH GRAVEL AND SILT (SM)** - brn (10YR 5/3), 55% f-c sand, 30% silt, 15% gravel. -silt content increasing with depth, gravel content decreasing - brn 10YR5/3,C208 50% silt, 48% f-c sand, 2% gravel	
160						
165		Box 41 Box 42	8		- brn 10YR5/3, 65% f-c sand, 20% silt, 15% gravel, ang-subang, moist - gray 2.5Y5/1, 60% silt, 30% sand, 10%gravel, ang-subang, med plasticity - wet - metamorphic clasts	
170					- lt olive brn 2.5Y5/3, 75% well grade f-c sand, 20% silt, 5% gravel, loose - lt yellowish brn 2.5YR6/3, 50% sand, 45% silt, 5% gravel, moist, tight	gw sample collected at 7:50, 9/12/04; casing at 160', borehole to 180'
175						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock	**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004 — **DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K	
LOCATION: East Mesa, Parcel No. 650-151-06		**LOGGED BY:** J. Weigel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		Box 43 Box 44	8	SM	**SAND WITH GRAVEL AND SILT (SM)** - brn (10YR 5/3), 55% f-c sand, 30% silt, 15% gravel. - compacted - lt olive brn 2.5Y5/3, 55% sand, 30% silt, 15% gravel, ang mm clasts, sample broken and dry	
180						
				SW/SM	**SAND WITH SILT AND GRAVEL (SW/SM)** - yellowish brn (10YR 5/4), 70% subang to ang sand, 20% silt, 10% subrnd gravel up to 3".	
				ML/SM	**SILT AND SAND WITH GRAVEL (ML/SM)** - yellowish brn (10YR 5/4), 50% silt/clay, 45% sand, 5% gravel, ang to subang. - last sand and gravel, mm origin	
185		Box 45 Box 46	6.5		- lt yellowish brn 2.5Y6/3, 60% silt/clay, 30% f-c sand, 10% gravel, subang-subrnd, med plasticity, matrix supported	
190					- dry and loose, oscillating silt and clay - moist and tight	
195		Box 47 Box 48 Box 49	10		- moist mm clasts	
200				SM	**WELL GRADED SAND AND SILT WITH GRAVEL (SM)** - pale brn (10YR 6/3), 50% sand, 40% fines, 10% coarse gravel up to 1.5", ang, stiff, grain edge supported, moist to wet. - lt olive brn 2.5Y5/3, 50% sand ang, clast supported, 45% silt/clay, 5% gravel	
205					- 65% f-c sand, 20% silt, 15% gravel ang-subang, metamorphic clasts, loose, wet	
		Box 50 Box 51 Box 53	0	ML/CL	**SILT AND CLAY WITH SAND AND GRAVEL (ML/CL)** - lt olive brn (2.5Y 5/3), 60% silt/clay, 35% f-c sand, 5% gravel, matrix supported, med plasticity, alternates between clast and matrix supported.	8:00, tripping in
210						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004 **DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** J. Weigel

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					NO RECOVERY	sample fell out of core barrel and was redrilled
215						drilling is hard
					SAND AND SILTY CLAY WITH GRAVEL (SM/ML) - lt olive brn (2.5Y 5/3), 55% f-c sand, 40% silt/clay, 5% ang to subang gravel up to 1.75", moist, cohesive, soft, mm clasts, increasing sand and clay with depth.	
220		Box 54	6		- gravel up to 3"	
					- 3" sand zone, 65% sand, 30% silt, 5% gravel up to 3", stiff	sample went from hard to soft
225					- lt yellowish brn 2.5Y6/3, 80% f-c sand subang-ang, 15% gravel subrnd-subang, 5% silt, soft, loose and moist	
				SM/ML	- 80% silt/clay, 10% gravel to cobble, 10% f-m sand, m-h plasticity	
					- 60% sand, 20% silt, 20% gravel, 3" sand / silt seam	
230		Box 55 Box 56 Box 57	12		- lt yellowish brn 2.5Y6/3, 85% f-c sand, 10% silt, 5% gravel	
235					- grayish brn 2.5Y5/2, 45% f-c sand, 40% silt/clay, 15% gravel, subrnd-ang, mm	
					NO RECOVERY	drilling is hard, broke casing at drill head at depth, casing at 180 ft bgs, had to shake core barrel to get out of hole, lost sample
240		Box 53	0			
245						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 291.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 547.8 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,030.90	EASTING (CCS NAD 27 Z 5): 7,613,420.85	DATE STARTED: 09/09/2004	DATE COMPLETED: 09/22/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Sonic SS-15K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: J. Weigel	

DEPTH BGS (feet)	SAMPLE TYPE/NUMBER	RECOVERY (ft)	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.)
				NO RECOVERY	
250	Box 59 Box 60 Box 61	11	SW/GP	**SAND AND GRAVEL WITH FINES (SW/GP)** - grayish brn (2.5Y 5/2), 55% m-c subang to subrnd sand, 40% f-m subang to rnd gravel, 5% silt. - gravely well graded sand with silt, lt olive brn 2.5Y5/3, 65% f-c sand, 20% f gravel ang-subang grain supported	246 ft bgs - formation tight, water flows out of casing while tripping in core barrel drilling is hard
			ML/CL	**SILT AND CLAY WITH SAND (ML/CL)** - lt olive brn (2.5Y 5/3), 70% m. plasticity fines, 35% f-c sand, 5% gravel, ang to subang.	
255			SM/ML	**SAND WITH SILT AND CLAY (SM/ML)** - lt olive brn (2.5Y 5/3), 50% fines, 48% f-c sand, 2% gravel, ang to subang, med plasticity, alternating zones of matrix and grain supported. - silty well graded sand with gravel, 55% f-c sand, 35% silt/clay, 10% f-m gravel, 2.5" max gravel size	
260					
265	no sample return	0			drilling is hard, tried to wash down with casing from 246 to 266 ft bgs, cement casing broke on washdown, core barrel stuck -- had to vibrate to get it out, lost sample
270				- sandy silty clay with gravel, grayish brn, 60% fines, 30% f-c sand, 10% ang-subang gravel	
	Box 62	3	GM	**GRAVEL WITH SILT (GM)** - grayish brn (2.5Y 5/2), 90% f-c gravel, 10% fines, bimodal distribution.	
	Box 63	5	ML/CL	**SANDY SILTY CLAY WITH GRAVEL (ML/CL)** - dark grayish brn (2.5Y 4/2), 60% silt, 35% f-c sand, 5% gravel, subrnd to subang, matrix supported, metamorphic, stiff, moist.	
275			CL	**SILT AND CLAY WITH SAND (CL)** - lt olive brn (2.5Y 5/3), 80% silt/clay, 15% sand, 5% gravel.	hard and tight
			SW	**WELL GRADED SAND WITH GRAVEL (SW)** - grayish brn (2.5Y 5/2), 75% f-c sand, 20% gravel, 5% fines, bimodal distribution.	
280			SM/ML	**SILTY SAND WITH GRAVEL (SM/ML)** - lt olive brn, 55% f-c sand, 40% fines, 5% f-gravel, edge supported, increasing silt with depth.	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 291.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 547.8 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,030.90	**EASTING (CCS NAD 27 Z 5):** 7,613,420.85	**DATE STARTED:** 09/09/2004	**DATE COMPLETED:** 09/22/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Sonic SS-15K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** J. Weigel	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
285		Box 65	6	SM/ML	**SILTY SAND WITH GRAVEL (SM/ML)** - lt olive brn, 55% f-c sand, 40% fines, 5% f-gravel, edge supported. - calcium carbonate cement - gravely silt/clayey sand, 40% f-c sand, 35% silt/clay, 25% f-gravel, subang-subrnd, grain supported, l-m dense, wet	
290		no sample return	0		**NO RECOVERY**	ran casing after core barrel became stuck, casing broke, lost sample

Boring Terminated at 291 ft

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 347.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,142.09	**EASTING (CCS NAD 27 Z 5):** 7,613,374.28	**DATE STARTED:** 11/22/2004	**DATE COMPLETED:** 12/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–20				GW	**GRAVELLY SAND (GW)** - dark olive gray 5YR3/2, 80% gravel, 20% sand, ang gneiss, qtz and k-spar fragments from cuttings, loose, wet.	cutting return from setting 20 ft conductor casing for core sampling, water used as drilling fluid
20–25	X	CC01	10	GM	**SILTY GRAVEL (GM)** - dk grayish brn 2.5YR4/2, 50% ang gravel, 50% silt supported, caliche layer, gneiss and qtz, cobbles to 2", cemented with CaCO3, loose to hard, dry.	
25–28				GW	**SANDY GRAVEL (GW)** - lt brn 7.5YR6/4, to dk greenish gray 5.6YR4/1(rock), 50% ang c sand, 40% gravel, 10% fines, ang to subrnd clasts to 3", caliche cemented clasts, gneiss, qtz and chalcedony, loose to cemented, dry.	
28–30				SG	**GRAVELLY SAND (SG)** - brn 7.5YR5/4, 70% sand,25% gravel, 5% fines, cemented subang qtz, lithic c sand, firm, dry.	
30–34	X			GW	**SANDY GRAVEL (GW)** - grayish brn 2.5YR5/2, 80% gravel, 20% m c sand, gneiss, granodiorite, qtz and volcanics, loose to cemented, dry.	
35						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 347.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,142.09	EASTING (CCS NAD 27 Z 5): 7,613,374.28	DATE STARTED: 11/22/2004	DATE COMPLETED: 12/05/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC02	10	SW	**GRAVELLY SAND (SW)** - lt yellowish brn 10YR6/4, 80% sand, 15% gravel, 5% fines, clasts up to 1", gneiss, qtz and lithics, firm, dry, thick with silty sand.	
				GW	**SANDY GRAVEL (GW)** - brn 7.5YR5/4, 60% gravel, 35% f c ang sand, 5% fines, subang to subrnd clasts to 3", matrix supported, loose to firm, dry, upward fining.	
40						
				GP	**GRAVEL (GP)** - gray, 95% gravel, 5% sand, subang, gneiss, granodiorite, qtz, clasts 1/2"-1", loose, wet.	
				GC	**CLAYEY GRAVEL (GC)** - grayish brn 2.5YR5/2, 40% m sand, 30% gravel, 30% fines, subang clasts to 2", gneiss, granodiorite, qtz, low plasticity, soft, moist.	
45		CC03	10			
				SM	**SILTY SAND (SM)** - lt brn 7.5YR6/4, (sand is pale yellow 2.5YR7/3), 45% sand, 45% fines, 10% gravel, imbricated clasts, medium grained qtz and lithic sand, loose, dry, rhythmic bed to 1/4" thick.	
				GW	**SANDY GRAVEL (GW)** - grayish brn 2.5YR5/2, 60% f gravel, 30% m c sand, 10% fines, subang clasts up to 2", soft, moist, upward coarsening.	
50						not cored, large cobble at 50 ft, advance casing without sampling
55		CC04	0	GW		on 12/6/04 at 7:00: At 50' with casing cuttings show sand with silt from 50-60 ft, 40% c sand? 10-15% fines?
60						
				GW	**GRAVEL (GW)** - grayish brn 2.5YR5/2, 60% gravel, 30% sand, 10% fines, subang clasts to 4" at base, silty matrix at base, gneiss and granodiorite, loose, wet, upward fining.	
				GW	**SANDY GRAVEL (GW)** - brn 7.5YR5/4, 50% f subang to subrnd gravel, 40% c sand, 10% fines, gneiss, granodiorite and qtz, loose, moist to dry.	
65		CC05	10			
				SW	**SAND (SW)** - grayish brn 2.5YR5/2, 90%, 10% gradational with below, upward fining to v f sand, subrnd, qtz, lithic and biotite, soft, wet.	
				GC	**CLAYEY GRAVEL (GC)** - lt olive brn 2.5YR5/3, 70% gravel, 20% sand, 10% fines, >clay content at base, clasts to 3" at base, gneiss, granodiorite, qtz, upward fining, low plasticity, firm, moist.	
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-2

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	347.0	WDC Exploration & Wells, Montclair, CA	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
546.7 ft. MSL	2,103,142.09	7,613,374.28	11/22/2004	12/05/2004

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic	---	6" casing w/ 4" cont. core

LOCATION:	LOGGED BY:
East Mesa, Parcel No. 650-151-06	M. Godwin

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
75		CC06	10	GW	**SANDY GRAVEL (GW)** - brn 7.5YR5/4, 60% gravel, 40% vf to c sand, ang to subang, qtz, lithic, biotite, gneiss, granodiorite and volcanics loose, dry. - cemented at 75-76.5 ft, upward coarsening	
80		CC07	8	CL	**SANDY CLAY WITH GRAVEL (CL)** - grayish brn 10YR5/2, ang to subang gravel up to 1" (mm clasts), medium plasticity, soft, moist, massive.	bail and sample borehole OW-2D-80, collected OW-2D-80 @ 14:15 for analysis
				SM	**SILTY SAND WITH GRAVEL (SM)** - dk grayish brn 10YR4/2, 20% fines, 10% subang to ang gravel up to 1.5" (mm clasts), majority f sand, increasing clay with depth, moist to wet, silty cemented.	wet at 82-82.5 ft
85				SW	**SAND WITH GRAVEL AND SILT (SW)** - grayish brn 10YR5/2, 60% sand, 30% subang to subrnd gravel (mm clasts) up to 3/4" but most <1/2" , dry, moderately cemented.	at 8:22 pull core, driller notes tough drilling at 8:55
90		CC08	12	GC	**CLAYEY GRAVEL WITH SAND (GC)** - brn 7.5YR4/2, 40% fines, 20% f to c sand, ang to subrnd gravel up to 2.5" but most <1" (mm clasts), medium dense, moist. - clay matrix mottled with 5% red 10YR4/3 after 90 ft	rig down at 9:00, tightening parts and at 9:11 rig running again
95				GM	**SILTY GRAVEL WITH SAND (GM)** - brn 7.5YR3/3, 50% f sand, 25% c subang sand, gravel ang to subrnd up to 1" (mm clasts), <10% caliche mottling, clasts > weathered with depth, loose, dry to moist.	collect grain size sample from 93-94'
				CL	**SANDY CLAY WITH GRAVEL (CL)** - brn 7.5YR4/2, 25% c sand, ang to subang gravel up to 1.5" (mm clasts), dense, soft, moist, less clay with depth.	difficult to break core with putty knife
				SM	**SILTY SAND WITH GRAVEL AND CLAY (SM)** - grayish brn 10YR5/2, 15% fines, subang gravel <3/4" (mm clasts), highly weathered, medium dense.	
100				CL	**SANDY CLAY WITH GRAVEL (CL)** - brn 10YR5/3, 20% f to c sand, ang to subang gravel up to 1/4" (mm clasts), soft, wet, massive. - brn 10YR4/3, 15% f to c sand, trace caliche, trace red mottling, firm, moist to wet	pull rods at 9:38, core up at 9:47, push casing at 10:00
105						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 347.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,142.09	EASTING (CCS NAD 27 Z 5): 7,613,374.28	DATE STARTED: 11/22/2004	DATE COMPLETED: 12/05/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SANDY CLAY WITH GRAVEL (CL) - brn 10YR5/3, 20% f to c sand, ang to subang gravel up to 1/4" (mm clasts), soft, wet, massive.	
110		CC09	20	CL	**CLAY (CL)** - white 10YR8/1, <5% mm gravel, clay, and white powdery clasts up to 3", loose to moderately cemented, dry.	
				SM	**SILTY SAND WITH GRAVEL (SM)** - very pale brn 10YR8/2, 40% m to f sand, 20% subang gravel up to 3" (most<1"), 15% c sand, loose, dry.	grain size sample up to 3" from 110-112 ft
				SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk grayish brn 10YR4/2, 15% c sand, subang to subrnd gravel up to 1", dense, moist.	
				SM	**SILTY SAND WITH GRAVEL (SM)** - very pale brn 10YR8/2, 40% m to f sand, 20% subang gravel up to 3" (most<1"), 15% c sand, loose, dry.	
115				SC	**CLAYEY SAND WITH GRAVEL (SC)** - grayish brn 10YR5/2, ang gravel up to 1.5" (mm clasts), sand mostly fine grained, decreased clay with depth, dense, dry to moist.	collect grain size sample from 116-117 ft
				SW	**GRAVELLY SAND WITH CLAY (SW)** - grayish brn 10YR5/2, 40% c sand, 30% ang gravel up to 1" , 20% fines, increasing clay with depth, dense, moist, moderately cemented.	
120				CL	**SANDY CLAY WITH GRAVEL (CL)** - brn 10YR5/3, 20% c sand, 5% subang gravel up to 1" , less c sand with depth, plastic, firm (increasing firmness with depth), moist.	difficult to remove core from barrel, core wet on outside up to 128 ft drier at 123
125					- 6" layer of clayey gravel, ang to subang gravel up to 1/2" (mm clasts), loose, dry - moist, firm	
130		CC10	12		- same as above but more gravel, color dk grayish brn 10YR4/2	
				ML	**SILT WITH GRAVEL (ML)** - lt gray 5YR7/1, 10% ang to subang gravel up to 2" , loose, dry.	
				CL	**SANDY CLAY (CL)** - dk grayish brn 10YR4/2, 30% c sand, 10% f to m sand, moderately plastic, wet. - no gravel observed	no core recovery from 132-140 ft bgs, collect sample OW2D-132', driller notes productive zone
135						
140						

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 347.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,142.09	**EASTING (CCS NAD 27 Z 5):** 7,613,374.28	**DATE STARTED:** 11/22/2004 **DATE COMPLETED:** 12/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** 6" casing w/ 4" cont. core
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** M. Godwin

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				CL	**GRAVELLY CLAY (CL)** - brn 10YR5/3, 30% ang to subang gravel up to 3/4" (mm clasts), >20% fines, 10% c subrnd sand, medium dense, moist.	
				SP	**SAND (SP)** - pale brn 10YR7/2, 10% c sand, <10% fines, trace ang to subang gravel up to 3/4", dry, silty indurated.	
145				CL	**GRAVELLY CLAY (CL)** - dk grayish brn 10YR4/2, 20% f to c subang to subrnd sand, >20% fines, ang to subang gravel (mm clasts) up to 1.5" but most <1/2", dense, moist.	
				GW	**SANDY GRAVEL (GW)** - lt brnish gray 10YR6/2, 20% c subang to subrnd sand, 10-20% fines, ang to subang gravel up to 3", dry, silty cemented.	
150		CC11	19.5	SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 10YR4/3, 10-20% fines, m to f subang sand, subang gravel up to 1.5" but most <1/2", medium dense, moist.	
155				CL	**SANDY CLAY (CL)** - lt brnish gray 10YR6/2, 40% f sand, <10% ang to subang gravel up to 1/4", dry to damp, silty to moderately cemented, increased cementation with depth.	grain size sample from 154-155 ft
				SW	**GRAVELLY SAND WITH CLAY (SW)** - grayish brn 10YR5/2, 10-20% fines, 10% c subang sand, subang gravel up to 2.5" (mm clasts), medium to dense, dry to damp.	
160				CL	**SANDY CLAY (CL)** - lt gray to brn 10YR7/1, 50% fines, 30% f sand, <10% c sand, <10% subang gravel up to 3/4", firm, moderately cemented.	
165				SC	**CLAYEY SAND (SC)** - dk grayish brn 10YR4/2, ~20% fines, ~15% ang to subang gravel up to 1/4" (gets up to 2" with depth), c ang to subang sand, dense, damp, some dk green mottling. - more f gravel	
170		CC12	20		- lt gray 10YR7/2 to very pale brn 10YR7/3, f to c ang to subang sand, 5% ang to subang gravel up to 1" , dry to moist, silty to moderately cemented	
175					- very pale brn 10YR8/2, 10-20% fines, 10% ang gravel up to 1.5" (mm clasts), dry, silty cemented - dk gray 10YR4/1, 15% fines, <10% ang to subang gravel up to 1", damp, moderately cemented - very dense	

CH2MHILL

SHEET 6 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 347.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,142.09	**EASTING (CCS NAD 27 Z 5):** 7,613,374.28	**DATE STARTED:** 11/22/2004	**DATE COMPLETED:** 12/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
180				SW	**GRAVELLY SAND (SW)** - dk grayish brn 10YR4/2, 50% c sand, <10% fines, more fines with depth, ang to subang gravel and sand grains, very dense, damp, moderately cemented, weathered clasts.	difficult drilling
				SW	**SAND WITH SILT AND GRAVEL (SW)** - brn 7.5YR5/3, 10-15% fines, 10% ang to subang gravel up to 1.5" (mm clasts), c subang to subrnd sand, medium dense, moist to wet.	more cemented at 183 ft
185				SC	**CLAYEY SAND (SC)** - brn 7.5YR5/3 with a layer of 5YR5/2, 30% f to m sand, 20% c sand, 20% fines, subang to ang mm gravel to 3", loose, moist to dry.	
				CL	**SANDY CLAY (CL)** - brn 10YR4/4, 25% c ang to subang sand, >20% fines, <10% ang to subang gravel up to 2" but most <1", firm, damp.	grain size sample from 188-190 ft
190		CC13	19	SP	**SAND (SP)** - lt gray 10YR7/2, <10% c sand, trace subang gravel up to 1/2", dry, silty cemented. - brn 10YR4/3, 15% gravel up to 1" (mafic and MM clasts), c subang sand, clast supported, loose to medium dense, wet	grain size sample from 190-192 ft
195				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 7.5YR5/3, 50% c to f sand, 15% f gravel to c sand, ang to subang gravel up to 3", mm clasts, dense, damp, moderately cemented, moderately weathered.	no recovery from 199-200
200				SW	**SAND (SW)** - grayish brn 10YR5/2, 50% c ang to subang sand, <10% fines, 5% ang gravel up to 3/4" , loose, wet.	logged core from 200-220' based on second core run, core very wet from 200-208'
				SW	**GRAVELLY SAND (SW)** - grayish brn 10YR5/2, 40% ang to subang gravel up to 1/2" , <10% fines, mafic MM clasts, loose to moderately cemented, wet. - more clay, 10-20% fines	
205				GW	**SANDY GRAVEL (GW)** - dk gray 10YR4/1, 50% ang to subang gravel up to 1.5" (mm clasts), 35% c sand, <10% fines, clasts supported, medium dense, loose, wet. - gravel up to 2" at 209 ft	
210						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 347.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,142.09	EASTING (CCS NAD 27 Z 5): 7,613,374.28	DATE STARTED: 11/22/2004	DATE COMPLETED: 12/05/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC14	15			
215				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 10YR5/3, 10-20% fines, ang gravel up to 1" (mm clasts), clay matrix, firm, damp to moist. - 2" clay around gravel layer, ang to subang mm clasts (weathered) up to 1.5" - mottled, 40% lt yellowish brn 10YR6/4 and 15% dk gray 10YR4/1, intermittent gravel zones from 213-214.5 ft(weathered), ang, up to 1" -clay supported 1/2" to 1" thick	
220					- 2 ft recovery - not sure where from between 220 to 230 ft	
225				SW/SM	**GRAVELLY SAND WITH SILT (SW/SM)** - brn 10YR5/3, 40% ang to subang gravel, 30% c ang to subrnd sand, 20% f to m sand,10-20% fines, felsic and mafic mm clasts up to 1" , weathered clasts, medium dense, moist to wet.	
230		CC15	2			hard drilling, no recovery due to hard shaking to remove core, lost most
235						
240				SW/SC	**SAND WITH GRAVEL AND CLAY (SW/SC)** - brn 10YR5/3, 40% c subang to subrnd sand to f gravel, 10-20% fines, 5% c gravel up to 1.5" (most <1"), ang to subang, mm clasts (felsic and mafic), weathered, loose to medium dense, wet. - clayey sand with gravel (SC), same as above except >20% fines, less sand and gravel - same as 240', but 30% c sand to f gravel, more m sand	
245						

SHEET 8 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 347.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 546.7 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,142.09	**EASTING (CCS NAD 27 Z 5):** 7,613,374.28	**DATE STARTED:** 11/22/2004 **DATE COMPLETED:** 12/05/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** 6" casing w/ 4" cont. core
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** M. Godwin

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SAND WITH GRAVEL AND CLAY (SW/SC) - brn 10YR5/3, 40% c subang to subrnd sand to f gravel, 10-20% fines, 5% c gravel up to 1.5" (most <1"), ang to subang, mm clasts (felsic and mafic), weathered, loose to medium dense, wet.	
250		CC16	20	SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 10YR5/3, >20% fines, 15% c subang to subrnd sand (rest f to m), 10% ang to subang gravel mm clast up to 3" (mostly mafic), matrix supported, medium dense, moist.	difficult drilling - cobble
255					- pale yellow 2.5YR7/3, 10% c ang to subrnd sand, <10% ang to subang gravel (mm, mostly mafic) up to 1/2" , dry to damp, silty cemented,	lots of rig chatter
				SW/SM	**SAND WITH SILT AND GRAVEL (SW/SM)** - dk yellowish brn (10YR 4/4) mottled with gray 10YR5/1 with trace of reddish brn, 30% m to f sand, 25% c sand, ~15% f gravel, ~10% fines, 5% c ang gravel up to 3" (felsic MM), medium dense, silty cemented, moist.	
				SW/SC	**GRAVELLY SAND WITH CLAY (SW/SC)** - brn 10YR5/3, 15-25% gravel up to 3" (ang mm), ~15% c ang to subrnd sand, 10-20% fines, dense, moist.	
260				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 10YR5/3, 35% f to m ang to subrnd sand, >20% fines, 15% c sand, ang gravel up to 1" (mafic), dense, moist.	
				SW	**GRAVELLY SAND (SW)** - yellowish brn 10YR5/4, ~65% sand, 40% c ang to subrnd sand, 30% f ang to subang gravel up to 1" (mm clast - felsic and mafic), <10% fines, loose to medium dense, moist to wet.	
265					- 30-35% c sand	
				GW/GC	**SANDY GRAVEL WITH CLAY (GW/GC)** - brn 10YR5/3, ~40% f gravel, 30% c ang to subrnd sand, 10-20% fines, ~10% c ang to subang gravel up to 2" (mm clasts - mostly mafic), medium dense, moist.	
				SW/SC	**SAND WITH CLAY AND GRAVEL (SW/SC)** - dk grayish brn, 10-20% fines, 10-15% f gravel up to 1", 10% c sand (mainly f to m sand), medium dense, moist.	
270		CC17	20	SC	**CLAYEY SAND WITH GRAVEL (SC)** - pale brn 10YR6/3 and gray 10YR5/1 mottled 50/50, 35% f to m sand, >20% fines, 20% c ang to subrnd sand, 15% f ang to subang gravel, 5% ang gravel up to 1" (mm clasts), medium dense, damp.	
				CL	**SANDY CLAY WITH GRAVEL (CL)** - yellowish brn 10YR5/4, >50% fines, 40% f to c sand (10-15% c ang to subrnd sand), 15% c to f ang to subang gravel up to 1.5" (mm clasts), medium stiff, moist.	
275				SC	**CLAYEY SAND WITH GRAVEL (SC)** - yellowish brn 10YR5/4, >20% fines, 15% f to c ang to subrnd sand, 15% f to c ang to subang gravel up to 2" (mm clast), medium dense, moist.	
280				SW/SC	**SAND WITH CLAY, SILT AND GRAVEL (SW/SC)** - brn 10YR4/3, 20% f ang to subang gravel up to 1" (mm clast), 10-20% fines, 10% c subang to subrnd sand, medium dense, damp to moist.	

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 347.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,142.09	EASTING (CCS NAD 27 Z 5): 7,613,374.28	DATE STARTED: 11/22/2004	DATE COMPLETED: 12/05/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW/SM	**SAND WITH SILT AND GRAVEL (SW/SM)** - brn 10YR5/3, >50% ang to subrnd sand (35% c sand and rest f to m), 15% ang to subang gravel up to 1" (mm clast), 10-20% fines, loose to medium dense, moist to wet, weathered. - brn 10YR5/3, gravel and c sand increasing with depth	boring continues in hole 20 ft south ((280-340'), move 20' south of OW-2M(was OW-2D until but refusal at 260' with casing cored to 280')
285				SC	**CLAYEY SAND WITH GRAVEL (SC)** - dk grayish brn 10YR4/2, ~20% fines, 10% c sand, 10% m to f sand, 15% f to c ang to subang gravel up to 3" (mm clast-felsic and mafic), medium dense, moist. - 10YR4/2 to 4/3, silty cemented, less gravel with depth	
290		CC18	20	SW	**GRAVELLY SAND WITH SILT (SW)** - brn 7.5YR5/3, 40% c ang to subrnd sand, ~40% ang to subang gravel up to 1.5" (mm clast), up to 20% fines with depth, ~10% fines, ~10% m to f sand, medium dense, moist to wet.	
295				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 10YR4/3, 10-30% ang to subang gravel up to 3/4" (mm clasts) increased gravel with depth, ~20% fines, 20% c ang to subrnd sand (rest f to m sand), silty cemented, medium dense, moist to wet.	
				SW	**SAND WITH GRAVEL (SW)** - reddish brn 5YR4/4, 30-40% c ang to subrnd sand, 30% m sand (rest f sand), 25% ang to subrnd gravel up to 3/4" (mostly mafic mm clast), ~10% fines, loose to medium dense, wet.	
300				SW/SC	**SAND WITH CLAY AND GRAVEL (SW/SC)** - brn 10YR5/3, 30% c ang to subrnd sand, 20% ang to subang gravel up to 2" (mm clast), 20% m sand, 10% f sand, 10-20% fines, medium dense, wet.	
305				SW	**SANDY GRAVEL WITH SILT (SW)** - brn 10YR5/3, >50% ang to subang gravel up to 3" mostly mafic (mm clast), 40% ang to subrnd sand (25% c sand), ~10% fines, intermittent zones with up to 20% fines, trace cobble, grain supported, loose, wet.	
				SW/SC	**GRAVELLY SAND WITH CLAY (SW/SC)** - brn 10YR4/3, 40% c sand, 30% ang to subang gravel up to 1.5" (mm mostly mafic), 20% m to f sand, 10-20% fines (increased fines with depth), loose, wet.	
310		CC19	18	SW/SM	**SAND WITH SILT AND GRAVEL (SW/SM)** - brn to dk yellowish brn 10YR5/3 to 4/4, 10-20% fines, 15% ang to subang gravel up to 3/4" (mm clast), f to c sand, medium dense, moist to wet.	
				SW/SC	**GRAVELLY SAND WITH CLAY (SW/SC)** - brn 7.5YR4/3, 30% ang to subang gravel up to 2" (mm clast), 10-20% fines (increased clay), f to c sand, medium dense, moist to wet.	
315				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 7.5YR4/3, ~ 30% ang to subang gravel up to 1.5" (mm weathered clasts), f to m sand (~10% c sand), matrix supported, medium dense, moist (trace wet).	

SHEET 10 of 11	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: OW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 347.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.7 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,142.09	EASTING (CCS NAD 27 Z 5): 7,613,374.28	DATE STARTED: 11/22/2004	DATE COMPLETED: 12/05/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: 6" casing w/ 4" cont. core	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW/SC	**GRAVELLY SAND WITH CLAY (SW/SC)** - brn 7.5YR5/3 with 5-10% reddish brn 5YR4/4 (from weathered clast), 40% ang to subang gravel up to 1" (mm clast), 25% c ang to subrnd sand (rest f to m), 30% f ang to subang gravel up to 3/4" , 10-20% fines, loose to medium dense, moist to wet. - less gravel and more c sand with depth	
320				SC	**CLAYEY SAND WITH GRAVEL (SC)** - brn 7.5YR4/3, 40% f to m sand, >20% fines, 10% c ang to subrnd sand, 10% ang to subang gravel up to 1/2" (mm clast), matrix supported, silty cemented, medium dense, moist.	
325		CC20	18	GW	**GRAVEL WITH SAND AND SILT (GW)** - grayish brn 10YR5/2, 50-60% ang to subang gravel up to 3/4" , 30-50% sand (up to 40% c sand), ~10% fines, clast supported, loose, wet. - up to 3" past 325', gravel size increases with depth, mafic and felsic mm clast, coarsens with depth (sand and gravel but amount of fines increases - cobble layer (subang, mafic mm, >4") at 327.4 ft	
				GC	**CLAYEY SILTY GRAVEL (GC)** - lt brnish gray 10YR6/2, ~50% ang to subang gravel up to 2" (most <1"), 25% f to c sand, >20% fines, loose (soft), wet.	
330				CL	**SANDY CLAY WITH GRAVEL (CL)** - mottled brn to dk yellowish brn 10YR5/3 to 4/4 with 10% greenish gray 5/10GY, >50% fines, 30% sand (10% c ang to subang sand), 15% ang to subang gravel up to 2" most 1" or less (felsic, mafic and mm), increased sand with depth, stiff, moist.	
				SW/SC	**SAND WITH CLAY AND GRAVEL (SW/SC)** - brn 10YR5/3, 40% c sand, 15% f ang to subang gravel up to 3/4" (weathered mm mostly mafic), 10-20% fines, medium dense, moist.	
335				SC	**CLAYEY SAND WITH GRAVEL (SC)** - mottled brn 10YR5/3 to 4/3 with up to 20% reddish brn 5YR4/4 and up to 20% greenish gray 5/10GY,>20% fines, 25% ang to subang gravel up to 1" (most <1/2"), 10-15% f to c sand, weathered clast, matrix supported, medium to tightly cemented, dense, dry to damp, gravel size increases with depth up to 2", red and green colors increase with depth.	
340				SM	**SILTY SAND WITH GRAVEL (SM)** - brn 10YR4/3, 40% f to m sand, 25% ang to subang gravel up to 1.5", 10-20% fines, 15% c sand, medium dense, moist.	
345		CC21	7	CL	**SANDY CLAY (CL)** - mottled greenish gray 6/10GY and 15% reddish brn 5YR4/4, >50% fines, 20% f to m sand, 15% c sand, 15% ang to subang gravel up to 1" (mm, mafic), soft to med stiff, moist.	

Boring Terminated at 347 ft

ABBREVIATIONS

cc = continuous core run

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-2

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	347.0	WDC Exploration & Wells, Montclair, CA	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
546.7 ft. MSL	2,103,142.09	7,613,374.28	11/22/2004	12/05/2004

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Rotosonic	---	6" casing w/ 4" cont. core

LOCATION:	LOGGED BY:
East Mesa, Parcel No. 650-151-06	M. Godwin

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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	

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PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004 — **DATE COMPLETED:** 10/07/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–6		Box 1 2 3	10	SP	**POORLY GRADED SAND WITH GRAVEL (SP)** - yellowish brn 10YR5/4, 50% m sand, 15% c sand,10% f sand, 10% silt, 10% f gravel, 5% c gravel, ang, loose, dry.	each sleeve holding slightly more than 2
6–12				SW	**GRAVELLY SAND (SW)** - grayish brn 2.5YR5/2, 60% f subrnd sand,20% f ang gravel, 10% m to c subrnd sand, 10% c ang gravel, loose, dry. - no recovery from 10-11.5 ft	lost 2' off the bottom of core barrel while cooling
12–17		Box 3 4	5	SW	**WELL GRADED SAND (SW)** - lt olive brn 2.5YR5/3, 60% f sand, 30% m to c sand, 5% fines, 5% gravel up to 1", subang to ang.	
17–22		Box 5 6	5		- increase in gravel % to ~10% from 18-20 ft	
22–25		Box 6 7	3		- increase gravel % to 20% from 23-25 ft - metamorphic gravel	
25–30		Box 7 8	5			
29–31				ML	**SANDY SILT (ML)** - yellowish brn 10YR5/4, 50% silt, 20% f subang sand, 20% m subang sand, 10% subrnd gravel, qtz and mm.	
31–35		Box 9 10	6		**WELL GRADED SAND WITH GRAVEL (SW)** - grayish brn 2.5YR5/2, 40% f subrnd to subang sand, 30% c subrnd to subang sand, 20% ang gravel, 10% fines (silt).	

SHEET 2 of 9	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA		
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004	**DATE COMPLETED:** 10/07/2004	
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig		
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald		

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
40		Box 10 11	6	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - grayish brn 2.5YR5/2, 40% f subrnd to subang sand, 30% c subrnd to subang sand, 20% ang gravel, 10% fines (silt).	
		Box 12	4	SW	**WELL GRADED SAND (SW)** - yellowish brn 10YR5/4, 60% m sand, 20% f sand, 10% c sand, 10% gravel, trace silt (1%), subang.	
45		Box 13	4		**WELL GRADED SAND WITH GRAVEL (SW)** - grayish brn 2.5YR5/2, 40% f ang to subang sand, 20% m ang to subang sand, 15% c ang to subang sand, 20% ang to subang gravel, 5% silt.	
50		Box 14	4	SW	- qtz rich sand, metamorphic gravel, weathered granite	
55		Box 15 16 17	0			lost formation too tight and had to vibrate out
60				SC	**CLAYEY SAND (SC)** - olive brn, 60% f sand, 30% fines (silt and clay), 10% gravel.	
65		Box 18	4	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - grayish brn 2.5YR5/2, 40% f ang to subang sand, 20% m ang to subang sand, 15% c ang to subang sand, 20% ang to subang gravel, 5% silt. - caliche layer	light brown dry loose
70				SP	**POORLY GRADED SAND (SP)** - lt olive brn, 85% f sand, 10% silt, 5% c sand, trace gravel to 2".	

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 275.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 555.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,286.35	EASTING (CCS NAD 27 Z 5): 7,612,161.22	DATE STARTED: 09/26/2004	DATE COMPLETED: 10/07/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Truck-Mounted Rig	
LOCATION: West Mesa, Parcel No. 650-151-06			LOGGED BY: T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND (SW)** - lt olive brn 2.5YR5/3, 35% m subang sand, 30% f subang sand, 20% c subang sand, 10% ang gravel, 5% silt. - qtz, epidote sand, metamorphic gravel	
		Box 19 20	4	SC	**CLAYEY SAND (SC)** - olive brn, 60% f sand, 30% fines (silt and clay), 10% gravel.	
75		Box 20 21	5	SW	**WELL GRADED SAND (SW)** - grayish brn 2.5YR5/2, 30% m subang sand, 30% f subang sand, 25% c subang sand, 10% ang gravel, 5% silt. - caliche	
					- qtz, hornblende, metamorphic gravel	
80		Box 22 23	5			
85		Box 23 24	6		- caliche at 86 ft	core barrel wafers
90		Box 25 26	6		- yellowish brn 10YR5/4, 40% f subang sand, 25% c subang sand, 20% m subang sand	moisture increasing probably from running core barrel down
					- gneiss gravel	
95		Box 26 27 28	11		- lt olive brn 2.5YR5/3, 40% f subang sand, 30% m subang sand, 15% c subang sand, <1% fines	
100					- qtz, hornblende	
105						

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004 **DATE COMPLETED:** 10/07/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND (SW) - grayish brn 2.5YR5/2, 30% m subang sand, 30% f subang sand, 25% c subang sand, 10% ang gravel, 5% silt. - increase in f sand % to 60%, 5% m sand, 10% c sand, 5% silt, lots of secondary caliche cementation	
110		Box 29 30 31	8			
				SC	**CLAYEY SAND (SC)** - olive brn 2.5YR4/3, 65% f sand, 15% clay, 10% gravel, 5% m sand, 5% c sand, silty plastic.	
115						
120		Box 31 32 33	7			
				SP	**POORLY GRADED SAND (SP)** - lt olive brn 2.5YR5/3, 85% m ang to subrnd sand, 10% c ang to subrnd sand, 5% clay, trace of c ang to subrnd gravel, igneous and metamorphic gravel.	
125		Box 33 34 35	8			
130						
				CL	**CLAY (CL)** - olive brn 2.5YR4/3, 5% f sand, medium plasticity (rolls easily), soft-firm.	
135		Box 35 36 37	16			
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - lt olive brn 2.5YR5/3, 40% c sand, 25% m sand, 15% c gravel, 10% clay, 10% f sand.	
140						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004 **DATE COMPLETED:** 10/07/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				CL	**SANDY CLAY (CL)** - brn 10YR5/3, 15% m to c rnd to subrnd sand, trace gravel, low plasticity.	
145				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 25% c sand, 20% m sand, 20% f gravel, 20% c gravel, 10% fines, 5% f sand, subang to subrnd.	
					- metamorphics volcanics	
150		Box 38 39 40 41	10		- increase in fines to ~15%, 15% c gravel from 150-152 ft	
155					- debris flow deposits	
					- brn 10YR5/3, 60% c subrnd sand, 20% m subrnd sand, 15% subrnd to subang gravel, 5% f subrnd sand	
				SC	**CLAYEY SAND (SC)** - brn 10YR4/3, 40% f sand, 25% clay, 20% gravel, 10% m sand, 5% c sand.	
160		Box 41	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 60% m sand, 15% f gravel, 10% fines, 10% c sand, 5% c gravel, subrnd to subang.	core barrel outward migration of f
165						
				SC	**CLAYEY SAND (SC)** - brn 10YR4/3, 40% f sand, 25% clay, 15% m sand, 10% c sand, 10% f gravel.	
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 60% m sand, 15% f gravel, 10% fines, 10% c sand, 5% c gravel, subrnd to subang.	
170		Box 41	5	CL	**SANDY CLAY (CL)** - brn 10YR4/3, 75% clay, 20% sand, 5% gravel, silty plastic, wet (rolls easily when wet).	
					NO RECOVERY	lost core to 180' casing broke
175						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 275.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 555.9 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,286.35	EASTING (CCS NAD 27 Z 5): 7,612,161.22	DATE STARTED: 09/26/2004	DATE COMPLETED: 10/07/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Standard Truck-Mounted Rig	
LOCATION: West Mesa, Parcel No. 650-151-06			LOGGED BY: T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					NO RECOVERY	
				SC	**CLAYEY SAND (SC)** - lt olive brn 2.5YR5/3, 20% clay, 20% f subrnd sand, 20% m subrnd sand, 20% c subrnd sand, 10% subang gravel.	f gravel: 0.19 - 0.75" (4.8 = 18 mm) e gravel 0.75" - 2.8" (19-75 mm) cobble: 2.9 - 11.8" (75 - 300 mm)
				CL	**SANDY CLAY (CL)** - brn 10YR5/3, 60% clay, 20% f sand, 20% gravel, silty plastic.	
180				SC	**CLAYEY SAND (SC)** - lt olive brn 2.5YR5/2, 40% f subrnd sand, 20% m subrnd sand, 20% clay, 10% c subrnd sand, 10% f subang gravel. - matrix supported	
185				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - lt olive brn 2.5YR5/3, 50% m sand, 20% gravel, 10% fines, 10% c sand, 10% f sand, weakly cemented.	
190				CL	**SANDY CLAY (CL)** - brn 10YR5/3, 60% clay, 20% f sand, 20% ang gravel, silty plastic. - 192-194 ft : slough - meta gravels, qtz rich sands	
195		CC29	8	SM	**WELL GRADED SAND WITH GRAVEL (SM)** - dk greyish brn 2.5YR4/2, 30% m subang sand, 25% fines, 20% c subang sand, 10% f subang sand, 5% f to c gravel, qtz, metamorphic, moist. - same as above from 196-200 ft, 15% gravel, 10% cobble to 3"	
200				ML	**SANDY SILT (ML)** - dk greyish brn 2.5YR1/2, 60% silt, 30% f ang sand, 10% f ang gravel, moist.	
				GW	**SANDY GRAVEL (GW)** - 70% c gravel to cobble 1" to 3", 20% m ang sand, 10% clay/silt, gravel metamorphic (schist).	
205		CC30	12	SW/SM	**WELLL GRADED SAND WITH SILT AND GRAVEL (SW/SM)** - dk greyish brn 2.5YR4/2, few mottles of brn 7.5YR4/5 (~10%), 30% m ang to subang sand, 20% c ang to subang sand, 20% clay/silt, 15% f ang to subang gravel, 10% f ang to subang sand, 5% c ang to subang gravel, gravel are primarily gneiss with occasional schist, sand is qtz, metamorphic, moist.	stop drilling, bail 25 gallons and collect water sample
210						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004 **DATE COMPLETED:** 10/07/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
210–216				ML	**SANDY SILT WITH GRAVEL (ML)** - dk greyish brn to brn 10YR4/2 to 4/3, 50% silt/clay, 20% f ang to subang gravel, 20% c ang to subang sand, 10% m ang to subang sand, metamorphic, predominantly gneiss, qtz/epidote metamorphic sand, moist.	top 2 ft of cc appears to be slough
216–224	216–224	CC31	8	SM	**SILTY SAND (SM)** - brn 7.5YR4/2 to 4/3, 50% c ang to subang sand, 20% silt, 10% m ang to subang sand, 10% f ang to subang sand, 10% f ang to subang gravel, metamorphic, moist to wet. - silt percentage lowers from 219-221 ft	
224–227	224–236	CC32	10	GW	**WELL GRADED GRAVEL WITH SAND (GW)** - dk greyish brn 10YR4/2, 65% f gravel, 20% c sand, 10% c gravel, 5% m sand, ang to slightly subang, metamorphic, wet.	sand w/silt (SM)
227–236				SM	**SILTY SAND (SM)** - brn 10YR5/3 to 4/3, 50% c ang to subang sand, 25% m ang to subang sand, 15% silt, 5% f ang to subang gravel, 5% c ang to subang gravel, metamorphic, wet. - 5-10% silt from 229-230ft and 234-236 ft	
236–239	236–244	CC33	6	ML	**SANDY SILT WITH GRAVEL (ML)** - brn 7.5YR4/3 to 4/4 mottling of blueish grey 5/5B and reddish brn 5YR5/4 in top one foot, 60% silt, 20% c ang to subang sand, 10% m ang to subang sand, 10% f ang to subang gravel, metamorphic, moist.	
239–241				ML	**SILT (ML)** - brn 7.5YR, 5% f sand, <5% c sand, slightly plastic, slightly sticky, very few clast of indurated silty sand, dry (baked during drilling) with few slightly moist block of unbaked native material.	collect sample at 1640 for geotech analysis collected into foil sleeve
241–244				ML	**GRAVELLY SILT WITH SAND (ML)** - brn 7.5YR4/3 to 4/4, 55% silt, 20% c ang to subang gravel, 10% f ang to subang gravel, gravel up to 6-7 cm, 10% c ang to subang sand, 5% m ang to subang sand, metamorphic, moist.	
245						

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PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004 — **DATE COMPLETED:** 10/07/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
245–255				SW	**WELL GRADED SAND (SW)** - brn 7.5YR4/3 to 5/3, 60% c ang to subang sand, 20% m ang to subang sand, 10% f ang to subang sand, 5% silt/clay, 5% f ang gravel up to 7mm, metamorphic, moist to wet.	top 1 ft core from 243 to 253 appears to be slough
250					- top 1 foot gradational from gravelly silt with sand above, larger gravels at base but no percent increase	collect ziplock bag sample for grain size analysis
						bail and collect groundwater grab sample for tot Cr Cr16 cond pH at 0930 OW-3D hole open 230 to 253 ft
255	253–263	CC34	9.5	SM	**SILTY SAND (SM)** - brn 7.5YR4/3, 40% silt, 25% m ang to subang sand, 20% f ang to subang sand, 10% c ang to subang sand, 5% f ang to subang gravel up to 5 cm, metamorphic, moist to wet.	
257				SW/SM	**WELL GRADED SAND WITH SILT (SW/SM)** - brn 7.5YR4/3, 35% c ang to subang sand, 25% m ang to subang sand, 15-20% f ang to subang gravel, 10-15% silt, 10% f ang to subang sand, metamorphic, moist to wet.	
260						collect sample in foil sleeve for pore water analysis at 1517 OW-3D-258
263	263–269	CC35	6		- reddish brn 5YR5/4 to red 2.5YR5/6, 30% f sand, 25% silt/clay, 20% m sand, 15% c sand, 15% f gravel to 1 cm, large clast of indurated sand with gravel at 263 ft	
265						
267				ML	**SANDY SILT WITH GRAVEL (ML)** - brn 7.5YR4/3, 20% mottling yellowish red 5YR4/6, 45% silt, 25% f ang to subang gravel up to 2-4 cm, 20% f m ang to subang sand, 10% c ang to subang sand, metamorphic, moderate induration.	
270	269–275	CC36	5		- 10YR4/4 color and very homogenous silty sand texture, very loose and wet, core appears to be all worked	
275						

Boring Terminated at 275 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark

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SHEET 9 of 9	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 275.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 555.9 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,286.35	**EASTING (CCS NAD 27 Z 5):** 7,612,161.22	**DATE STARTED:** 09/26/2004	**DATE COMPLETED:** 10/07/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Standard Truck-Mounted Rig	
LOCATION: West Mesa, Parcel No. 650-151-06			**LOGGED BY:** T. McDonald	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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

SHEET 1 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004 **DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0–10	0–10		0	SP	**GRAVELLY SAND (SP)** - lt brnish gray (10YR6/2) 30% f sand, 30% m sand, 25% gravel up to 1", 10% c sand, 5% fines, subang, dry.	0-8' logged from conductor pipe
10–20	10–20	CC-1	5	SP	- coarser grained sand from 16' to 17'	
20–22	20–30	CC-2	6	SM	**SILTY SAND (SM)** - dk gray (10YR4/1) 30% m sand, 20% fines, 20% c sand, 15% f sand, 15% gravel up to 1/2", subang, dense, damp.	broke drill pipe tapered fishing tool (1 hr downtime)
22–35				SP	**POORLY GRADED SAND (SP)** - pale brn (10YR 6/3) 70% f-c sand, 20% gravel up to 2" in layers, 10% fines, subang, dry.	
30–35	30–35	CC-3	0			

CH2MHILL

SHEET 2 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004 / **DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC-3	10	SP	**POORLY GRADED SAND (SP)** - pale brn (10YR 6/3) 70% f-c sand, 20% gravel up to 2" in layers, 10% fines, subang, dry. - lt brnish gray (10YR 6/2) 50% sand, 40% gravel, subang, damp	
40		CC-4	9		- layer of silty cemented sand - decreased fines to 20%	
				GP	**SANDY GRAVEL (GP)** - grayish brn (10YR5/2) 55% subang gravel up to 2", 30% m c sand, 10% f sand, 5% fines, damp.	potential boulder
45				SW	**WELL GRADED SAND (SW)** - grayish brn (10YR 5/2) 30% m sand, 20% f sand, 20% c sand, 20% gravel up to 1/2", 10% fines.	
50		CC-5	10	SM	**SILTY SAND (SM)** - dk gray (10YR4/1) 40% f-m sand, 30% fines, 20% subang gravel up to 1/2", 10% c sand, damp.	
				SW	**GRAVELLY SAND (SW)** - 50% f-c sand, 40% subang to ang gravel up to 2",10% fines, gneiss, damp.	driller notes hard drilling layer of increased times @56'
55						
60		CC-6	5	SM	**SILTY SAND (SM)** - dk yellowish brn (10YR4/8) 50% f-c sand, 30% fines, 20% subrnd gravel up to 1/2", moist.	
				SG	**GRAVELLY SAND (SG)** - dk gray (10YR4/1) 50% f-c sand, 30% subrnd gravel up to 1.5", 20% fines, dense, damp.	
65				SW	**WELL GRADED SAND (SW)** - grayish brn (10YR5/2) 60% f-c sand, 20% fines, 20% subang gravel up to 1/2", mm, dry.	
70						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004 / **DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
75		CC-7	15	SP	**POORLY GRADED SAND (SP)** - brn (10YR4/3) 70% f-m sand, 20% fines, 10% subang gravel up to 1/2", silty cemented, dry. - dry crushed boulder	
80				SW	**WELL GRADED SAND (SW)** - brn (10YR4/3) 70% f-c sand, 15% fines, 15% ang to subang gravel, silty cemented, dry .	
85		CC-8	0	SM	**SILTY SAND (SM)** - grayish brn (10YR 5/2) 65% f-c sand, 25% silt, 10% ang to subang gravel, feldspar, wet. - becoming moderately indurated	hit water @ 80'
90				GW	**SANDY GRAVEL (SW)** - lt gray (10YR 7/2) 60% subrnd-subang gravel, 30% f-c sand, 10% fines, dry.	potential confining layer @ 86 Driller notes hard drilling
95				SW	**WELL GRADED SAND (SW)** - dk yellowish brn (10YR4/4) 75% m-c sand, 15% subang gravel up to 1/2", 10% fines, silty cemented, moist.	layer of silt @ 92 dry light gray (10YR 7/2)
100				SM	**SILTY SAND (SM)** - brn (7.5YR5/2) 60% f-c sand, 30% fines, 10% gravel, subang to ang, wet.	broken drill pipe/wash down casing to 100' to remove it lost 95-100' core
105		CC-9	10		- moderately cemented	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 350.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 549.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,998.32	EASTING (CCS NAD 27 Z 5): 7,613,185.55	DATE STARTED: 11/09/2004	DATE COMPLETED: 11/14/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Gefco SS-15K-HL	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: B. Shearer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**SILTY SAND (SM)** - brn (7.5YR5/2) 60% f-c sand, 30% fines, 10% gravel, subang to ang, wet.	
				SW	**WELL GRADED SAND (SW)** - dk yellowish brn (10YR4/4) 75% m-c sand, 15% fines, 10% subang gravel up to 1/2", silty cemented, moist to damp.	Grain size sample collected 11:00 11/10/04
110					- increasing subang gravel	water sample collected OW-D110 (12:20 11/10/04) build for 1 hr
				SM	**SILTY SAND (SM)** - brn (7.5YR4/3) 60% c sand, 30 fines, 10% m ang gravel up to 1/2", dense, wet.	
115		CC-10	10		- increase in grain size of sand	
120						
					- grayish brn (10YR 5/2) 60% m-c sand, 20% fines, 20% ang gravel up to 1/2", m dense, wet	
125						
					dk yellowish brn (10YR4/4), wet	
130		CC-11	0			
				SG	**GRAVELLY SAND (SG)** - brn (7.5YR4/4) 65% f-c sand, 30% ang gravel up to 6", 5% fines, damp.	
135						
				SW	**WELL GRADED SAND (SW)** - brn (7.5YR4/4) 75% m c sand, 15% fines, 10% m ang loose gravel up to 1/2", wet.	
140						

CH2MHILL

SHEET 5 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004	**DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SM	**SILTY SAND (SM)** - dk gray (10YR4/1) 65% m c sand, 30% fines, 5% subang gravel up to 1/4", m dense, wet. - layer of subrnd gravel - denser	
145						
				SG	**GRAVELLY SAND (SG)** - grayish brn (10YR5/2) 50% f-c sand, 35% subang gravel up to 3/4", 25% fines, damp. - cobble	
150		CC-12	20			
				SM	**SILTY SAND (SM)** - dk grayish brn (10YR5/2) 60% f-m sand, 25% fines, 15% subang to ang gravel up to 1/2", m dense, wet. - lt grayish brn 10YR6/2 70% f-m sand, 20% fines, 10% subang subrnd gravel up to 3/4", damp to dry	potentially a cobble pulverized drilling
155						
160						
				SW	**WELL GRADED SAND (SW)** dk grayish brn (10YR5/2) 50% c sand, 25-30% m sand, 5-10% f sand 10% gravel from 1/2" to 2 1/2", 5% silt, subang mm, wet.	
165		CC-13	10			
				SM	**SILTY SAND (SM)** - dk grayish brn (10YR4/2) 25% c sand, 25% mm gravel, 20% f sand, 15% m sand, 15% silt, subang from 1/4" to 2 1/2", moist.	grain size sample collected 11/11/04 11:00
170						boiled water sample collected OW-4D 170' 10:00
				GM	**SILTY GRAVEL (GM)** - gray (7.5YR5/11), 65% ang gravel up to 2 1/2", 30% silt, 15% f-m sand, v dense, damp.	
		CC-14	10	SM	**SILTY SAND (SM)** - brn (10YR4/4) 70% f-m sand, 20% fines, 10% subang gravel up to 1/2", dense, moist.	
				SW	**WELL GRADED SAND (SW) W/GRAVEL** - brn (10YR5/3) 60% m-c sand, 20% fines, 20% subang gravel, loose, wet.	
175						

SHEET 6 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004 / **DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC-14	0	SW	**WELL GRADED SAND (SW) W/GRAVEL** - brn (10YR5/3) 60% m-c sand, 20% fines, 20% subang gravel, loose, wet.	
180					- subtle color change	
185						
190		CC-15	18	SM	**SILTY SAND (SM)** - brn (7.5YR4/3) 60% f-m sand, 30% silt, 10% subang gravel up to 1/2", sand fining, mm, dense, wet.	
					- cored through ~1' of gneissic cobbles	
195					brn (7.5YR4/3) 50% f-c sand, 30% silt, 20% subang gravel, trace caliche, dense, mm, moist	
200						
205		CC-16	20			
210						

PROJECT NUMBER: 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004 / **DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SAND (SM) - brn (7.5YR4/3) 60% f-m sand, 30% silt, 10% subang gravel up to 1/2", sand fining, mm, dense, wet. - dk grayish brn (10YR4/2) 60% f-c grained sand, 20% silt 15-20% subang gravel, dry	
				ML	**SANDY SILT WITH GRAVEL (ML)** - 15% gravel 30% f c sand 55% silt .	
215		CC-16	20	SM	**SILTY SAND (SM)** - brn (7.5YR4/3) 50% f-c sand, 30% silt, 20% subang gravel, trace caliche, dense, mm, moist. - gray SG/S2 grayish green 10R4/8 red weathered mms	
220						
225					**WELL GRADED SAND** No loggable core, USCS type determined from washed grab sample.	refusal due to cobbles
230				SW		
235						
240						
		CC-17	10		**WELL GRADED SAND** brn 50% m sand, 20% c sand, 10-15% silt, 10-15% gravel, 5% f sand, traces of caliche, mm, dry. - brn 50% m sand, 20% c sand, 10-15% silt, 10-15% gravel, 5% f sand, traces of caliche, mm, dry	1225: grab sample for grain size analysis at 245'
245						

CH2MHILL

SHEET 8 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004	**DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC-17	10	SW	**WELL GRADED SAND** brn 50% m sand, 20% c sand, 10-15% silt, 10-15% gravel, 5% f sand, traces of caliche, mm, dry.	
250						
		CC-18	6	SM	**SILTY SAND (SM) WITH GRAVEL** - grayish brn (10YR5/2) 40% m sand, 15% gravel avg 3/4", 15% f sand, 15% c sand, 15% silt, subang, mm, moist. - brn (7.5YR4/2) 50% m sand, 20% c sand, 10-20% f sand, 10-20% silt, wet	
255				SP	**POORLY GRADED SAND (SP)** - brn (7.5YR4/2) gradually coarsening subang sand, 5% silt, mm, moist.	very hard drilling, cobbles or boulders shut down due to lightning
					No recovery - quartzite cobble / broken boulder.	
260						
		CC-19	19	SW	**POORLY GRADED SAND (SP)** - brn (7.5YR5/2) 50% m sand, 45% c sand, 5% silt, subang to ang, mm, wet.	grab sample for grain size analysis @ 253 ft
				SW	**WELL GRADED SAND (SW)** - brn (7.5YR 5/2) 65% c sand, 20% m sand, 5% f sand, 5% silt, 5% gravel, subang, mm, wet. - metamorphic cobble	fining upwards sequence 11/13/04: began drilling at 0640 0712: collected core
265						
				GW-GM	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM)** - brn (7.5YR5/2) 50% gravel from 1/2" to 2", 20% m sand, 20% c sand, 5% silt, 5% f sand, subang to ang, wet.	
270				SW	**WELL GRADED SAND (SW)** - brn (7.5YR 5/2) 65% c sand, 20% m sand, 5% f sand, 5% silt, 5% gravel, subang, mm, wet.	
275				SW-SM	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)** - brn (7.5YR4/3) 330% m sand, 25% c sand, 20% f sand, 10-15% gravel, 10-15% silt, subang-ang, weathered mm (gray 5F4/2, red 2.5YR4/8), dry. - caliche development	
280						

CH2MHILL

SHEET 9 of 11	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004 **DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND (SW) - brn (7.5YR4/3) 40% m sand, 20% c sand, 20% f gravel, 10% f sand, 10% silt ang to subang, weathered mm, wet .	
285						collecting core, drill bit melted
				SW		collected grab sample at 388 ft
290		CC-20	20			
						weathered red fanglomerate
295						
					- caliche development and increasing silt	
				SC	**CLAYEY SAND (SC)** - brn (7.5YR 4/3) 65% f c sand, 30% clay, 5% gravel, subang to ang, wet. - cemented unit burned by drilling	
300					**WELL GRADED SAND (SW)** dark reddish brn (2.5YR3/4) 40% m sand, 30% c sand, 10% gravel, 10% f sand, 5% silt, subang to ang, mm, wet.	strong color change to dark red-brown
305						
				SW		
310		CC-21	20			
						photo
315						

SHEET 10 of 11	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 350.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 549.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,998.32	**EASTING (CCS NAD 27 Z 5):** 7,613,185.55	**DATE STARTED:** 11/09/2004	**DATE COMPLETED:** 11/14/2004
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Gefco SS-15K-HL	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** B. Shearer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND (SW)** dark reddish brn (2.5YR3/4) 40% m sand, 30% c sand, 10% gravel, 10% f sand, 5% silt, subang to ang, mm, wet.	becoming SM > 315
320						
				SW	**WELL GRADED SAND (SW)** - reddish brn (2.5YR4/4) 30% m sand, 30% c sand, 20% f sand, 10% fines, 10% gravel.	
				SC	**CLAYEY SAND (SC)** - brn (7.5 YR 7/2) 30% m sand, 30% c sand, 15% clay, 15% f gravel, 10% f sand, mm, wet.	Sand with gravel
				ML	**SILT (ML)** greenish gray (GGCY5G5/1) stiff.	
325		CC-22	20	SC	**CLAYEY SAND (SC)** -brn, (7.5 YR 414), 15% gravel, 15% fines, 70% fine-coarse sand, 326-328 as logged 324-326, brn (7.5 YR 414), traces of 2.5 YR 314, dark reddish brn 327-328 indurated. - brn (7.5YR7/2) traces of (2.5YR3/4) - indurated	
330				SC	**CLAYEY SAND WITH GRAVEL(SC)** with gravel, (7.5 YR 414), 25% gravel, 15% clays, 60% fine to coarse sand, subangular, metamorphic, wet, avg grain size gravel: 2cm, stiff.	
				SW / SC	**WELL GRADED SAND WITH CLAY AND GRAVEL (SW-SC)** brn (7.5 YR 414), 10% fines, 20% gravel, 70% fine to coarse sand, subangular, metamorphic, wet, grayish green, weathered metamorphics.	
335		CC-23	10			
				SC	**CLAYEY SAND (SC)** dark reddish brn (2.5 YR 313), 15% clay, 60% m sand, 20% fine gravel.	
				SW	**WELL GRADED SAND WITH SILT AND GRAVEL (SW)** dark reddish brn (2.5 YR 313), 20% gravel, 10% silt, 65-70% fine to coarse sand, subangular, metamorphic.	reworked fanglomerate deeply weathered mm clasts (photo)
340						
				SC	**CLAYEY SAND WITH GRAVEL (SC)** dark reddish brn (7.5 YR 413), 15% gravel, 15% clay, 70% fine to coarse sand, subangular, metamorphic gravel 1-6 cm dry.	collected grab sample for grain size analysis @ 344 ft
345		CC-24	10			Miocene conglomerate bedrock at 346', hard drilling noted
				BR	**CONGLOMERATE (BR)** - dk reddish brn (1.5YR3/3) 35% m sand, 25% gravel, 20% f sand, 10% fines, subang, weathered metamorphic clasts, indurated, dry.	
350						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	OW-5

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 350.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 549.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,998.32	EASTING (CCS NAD 27 Z 5): 7,613,185.55	DATE STARTED: 11/09/2004	DATE COMPLETED: 11/14/2004
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Gefco SS-15K-HL	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: B. Shearer	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					Boring Terminated at 350 ft	

ABBREVIATIONS

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

SHEET 1 of 8	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 412.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,104.94	**EASTING (CCS NAD 27 Z 5):** 7,613,363.87	**DATE STARTED:** 12/13/2004	**DATE COMPLETED:** 12/16/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** S. Mellon	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0					**NO FORMAL LOG** -see boring log for well OW-2 completed ~50 ft north of IW-2	Conductor casing set to 10 ft bgs, wash casing to 200 ft bgs without collection of core or chips. hard chatter from 178-186 ft, viscosity = 33sec, density = 8.8 lbs/gal, pH=8 penetration rate from 180-2000' is 100 ft/hr
200					- began collecting chips at 200 ft at 10 ft intervals - metamorphic angular rock fragments, typical chip size 5mm	chatter from 200-210 ft, slow hard drilling, penetration rate from 200-220 ft is 33 ft/hr
205						
210						

CH2MHILL

SHEET 2 of 8	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 412.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 546.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,104.94	**EASTING (CCS NAD 27 Z 5):** 7,613,363.87	**DATE STARTED:** 12/13/2004 — **DATE COMPLETED:** 12/16/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** S. Mellon

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					NO FORMAL LOG	
					- ang to subang metamorphic rock chips, typical chip size ~3 mm	slow drilling but no chatter, possible circulation problems
215						
220					- ang to subang metamorphic rock fragments, typical chip size ~5 mm	slow drilling but no chatter, penetration rate from 220-240 ft is 46 ft/hr, not running sanders, sand = 2%
225						
230						
235						
240						penetration rate from 240-260' is 46 ft/hr, viscosity = 43 sec, density 9 lbs/gal, sand <0.5%, pH=8
245						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		HOLE DEPTH (ft): 412.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.5 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,104.94	EASTING (CCS NAD 27 Z 5): 7,613,363.87	DATE STARTED: 12/13/2004	DATE COMPLETED: 12/16/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: S. Mellon	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					NO FORMAL LOG	
250					- ang to subang metamorphic rock fragments, typical chip size ~3 mm	
255						
260					- typical chip size ~5 mm	improved pump circulation and penetration rate (~2100psi was 1300 psi); penetration rate from 260-280 ft is 100 ft/hr
265						
270					- typical chip size ~10 mm	
275						
280						

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 412.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,104.94	**EASTING (CCS NAD 27 Z 5):** 7,613,363.87	**DATE STARTED:** 12/13/2004	**DATE COMPLETED:** 12/16/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** S. Mellon	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: TYPE/ NUMBER	SAMPLE: RECOVERY (ft)	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.
					NO FORMAL LOG	
					- ang to subang metamorphic rock fragments, typical chip size ~15 mm	
285						
290						viscosity = 33 sec, density 9 lbs/gal, pH=8, sand <0.5%
295						chatter
300					- ang to subang metamorphic rock fragments, typical chip size 5-10 mm	
305						
310					- same as above, typical chip size ~3 mm	
315						

CH2MHILL

SHEET 5 of 8	**PROJECT NUMBER:** 326128.01.07.AR	**BORING NUMBER:** IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 412.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 546.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,104.94	**EASTING (CCS NAD 27 Z 5):** 7,613,363.87	**DATE STARTED:** 12/13/2004	**DATE COMPLETED:** 12/16/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** S. Mellon	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					NO FORMAL LOG	
320					- sediments felt too soft for good recovery	tripping out to set up split core barrel and kriss bit, attempting to core from 320 ft
325						
330			0.75		- typical chip size ~5 mm - core black green gray metamorphic rock. Rock types include gneiss, quartzite, some evidence of oxidation at joint faces, slim veins (>1 mm) various orientation	continuous coring started at 330 ft bgs. viscosity = 36 sec, density 9 lbs/gal, pH=8, sand <0.5%, 30 ft/hr
335			0.5		- black green metamorphic rock, salt and pepper look (metadiorite?), some oxidation at joints, some qtz veins (<1mm), minor felsic rock fragments	viscosity = 36 sec, density 8.9 lbs/gal, pH=8, sand <0.5%, 75 ft/hr
340			0.5		- chips ang to subang metamorphic rock fragments. Typical chip size ~5mm, core gneiss, black white rock, oxidation surfaces at some joints, minor felsic rock fragments	43 ft/hr
345			0.17		- core same, less felsic rock fragments	11 ft/hr
350						

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 412.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 546.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,104.94	**EASTING (CCS NAD 27 Z 5):** 7,613,363.87	**DATE STARTED:** 12/13/2004 **DATE COMPLETED:** 12/16/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** S. Mellon

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
			0.67		**CONGLOMERATE (BR)** - mixture of metamorphic rocks, consolidated reddish brown conglomerate, and silty sandstone, v hard metamorphic / felsic rock fragments, may be some megabreccia deposits. - chips same, typical chip size 3 mm, core is black white metamorphic rock, oxidation on some joint surfaces	switched to solid core barrel trying slower rotation
355			0.42			viscosity = 42 sec, density 8.8 lbs/gal
			0.58		- metamorphic rock, black green gray, 1 mm wide fractures veins (qtz filled) oblique to core axis	trying faster rotation
360			0		- chips same, typical chip size ~ 5mm	
			0			
365			0.38		- metamorphic rock with oxidation on some joint surfaces gneiss, 4 mm wide qtz vein	
370			0.33		- metamorphic rock black green gray, salt and pepper look (gneiss or metadiorite), 1 mm wide qtz filled vein parallel with core axis	viscosity = 37 sec, density 8.8 lbs/gal
			0			6.8 ft/hr
375			0.33		- same with oxidation on joint surface	5.8 ft/hr
			0.63		- same but with traces of consolidated alluvial material (c sand, red brn)	21 ft/hr
380			0.46	BR	- same but larger piece of consolidated alluvial material, well graded f sand to f gravel, grain supported	21.4 ft/hr
			0			
385						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	IW-2

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	412.0	WDC Exploration & Wells, Montclair, CA	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
546.5 ft. MSL	2,103,104.94	7,613,363.87	12/13/2004	12/16/2004

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Mud Rotary	---	WDC 30K

LOCATION:	LOGGED BY:
East Mesa, Parcel No. 650-151-06	S. Mellon

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
			0.13		**CONGLOMERATE (BR)** - mixture of metamorphic rocks, consolidated reddish brown conglomerate, and silty sandstone, v hard metamorphic / felsic rock fragments, may be some megabreccia deposits.	
			0		- metamorphic rock, salt and pepper look (metadiorite?) oxidation on joint surface	25 ft/hr
390			0			25 ft/hr
			0			19 ft/hr
395			0			viscosity = 39 sec, density 8.8 lbs/gal, pH=8, sand <0.5%
			0			
400			0.42		- mixture of broken up rock ~0.5" to 2" combination of metamorphic rock and consolidated alluvial material - grains supported	
405			0			
410						

Boring Terminated at 412 ft

ABBREVIATIONS

cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained

CH2MHILL

PROJECT NUMBER: 326128.01.07.AR

BORING NUMBER: IW-2

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 412.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 546.5 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,104.94	**EASTING (CCS NAD 27 Z 5):** 7,613,363.87	**DATE STARTED:** 12/13/2004 — **DATE COMPLETED:** 12/16/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** S. Mellon

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	IW-3

SOIL BORING LOG

PROJECT NAME:	HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
IM-3 Hydrogeologic Investigation, PG&E Topock	411.0	WDC Exploration & Wells, Montclair, CA	

SURFACE ELEVATION:	NORTHING (CCS NAD 27 Z 5):	EASTING (CCS NAD 27 Z 5):	DATE STARTED:	DATE COMPLETED:
551.4 ft. MSL	2,103,007.18	7,613,237.80	12/16/2004	12/18/2004

DRILLING METHOD:	WATER LEVEL (ft):	DRILLING EQUIPMENT:
Mud Rotary	---	WDC 30K

LOCATION:	LOGGED BY:
East Mesa, Parcel No. 650-151-06	E. Gray, M. Godwin

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0					**NO FORMAL LOG** -see boring log for well OW-5 completed ~50 ft west of IW-3	mud properties at 350 ft
			0.58			large cobbles? drilling rate 12 ft/hr
			0.42			
355					**CONGLOMERATE (BR)** - mixture of metamorphic rocks, consolidated reddish brown conglomerate, and silty sandstone, v hard metamorphic / felsic rock fragments, may be some megabreccia deposits. Brn 7.5YR4/3 with reddish brn 5YR5/4 mottling, 20% f to m sand, 20% c ang to subang gravel up to 1/4", mostly metadiorite fragments.	continuous coring started at 355 ft bgs lost circulation, bit plugged
			0.83			
360					- very hard consolidated material, "salt and pepper" look	drilling rate 24 ft/hr
						very hard
365						
370						
375						
380					- very uniform cuttings, all ang cuttings	
				BR		
385						

CH2MHILL

SHEET 2 of 3	PROJECT NUMBER: 326128.01.07.AR	BORING NUMBER: IW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 411.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 551.4 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,007.18	**EASTING (CCS NAD 27 Z 5):** 7,613,237.80	**DATE STARTED:** 12/16/2004	**DATE COMPLETED:** 12/18/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** E. Gray, M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					CONGLOMERATE (BR) - mixture of metamorphic rocks, consolidated reddish brown conglomerate, and silty sandstone, v hard metamorphic / felsic rock fragments, may be some megabreccia deposits. Brn 7.5YR4/3 with reddish brn 5YR5/4 mottling, 20% f to m sand, 20% c ang to subang gravel up to 1/4", mostly metadiorite fragments.	drilling rate 21 ft/hr
390						
395						
400						
405						
410						
					Boring Terminated at 411 ft	

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.AR	IW-3

SOIL BORING LOG

PROJECT NAME: IM-3 Hydrogeologic Investigation, PG&E Topock		**HOLE DEPTH (ft):** 411.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 551.4 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,007.18	**EASTING (CCS NAD 27 Z 5):** 7,613,237.80	**DATE STARTED:** 12/16/2004	**DATE COMPLETED:** 12/18/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** E. Gray, M. Godwin	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

CH2MHILL

SHEET 1 of 4	**PROJECT NUMBER:** 327061	**BORING NUMBER:** PE-01

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 105.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 467.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,550.25	**EASTING (CCS NAD 27 Z 5):** 7,616,345.31	**DATE STARTED:** 03/01/2005	**DATE COMPLETED:** 03/02/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Floodplain approx 450 ft. E of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					POORLY GRADED SAND (SP) - lt yellow brn 2.5YR6/3, 100% fine qtz rich sand, organics top 5'	Sonic boring continuously cored for logging. Selected core samples were preserved for future testing. Selected core samples also collected for USGS testing.
		CC1	7			
5						
					- minor fine gravel at ~6'	
						water level approx. 9 ft.
10					- trace clay at 10'	collect PE1-USGS-10, PE1-PW-10
		CC2	10			
15						
				SP	- lt olive brn 2.5YR5/3, 100% fine qtz rich sand	wet at 17 ft
20						collect PE1-USGS-20, PE1-PW-20, PE1-GS-20
		CC3	10			
25						
					- trace silt at 29'	
30					- trace organics	collect PE1-USGS-30, PE1-PW-30
		CC4	10			
35						PE1-34 Isoflow groundwater grab

CH2MHILL

SHEET 2 of 4	PROJECT NUMBER: 327061	BORING NUMBER: PE-01

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		HOLE DEPTH (ft): 105.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 467.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,550.25	EASTING (CCS NAD 27 Z 5): 7,616,345.31	DATE STARTED: 03/01/2005	DATE COMPLETED: 03/02/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): approx. 9 ft. bgs	DRILLING EQUIPMENT: Track Mounted Sonic	
LOCATION: Floodplain approx 450 ft. E of well TW-2D, MW-20 bench			LOGGED BY: B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND (SP)** - lt yellow brn 2.5YR6/3, 100% fine qtz rich sand, organics top 5'	sample
40		CC5	10			collect PE1-USGS-40, PE1-PW-40
45				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - 60% f-c gravel up to 5", 29% f-c sand, 1% fines.	PE1-44 Isoflow groundwater grab sample
					- gravel decrease to 45%, 54% f-c sand, 1% fines	Basalt, volcanics, metamorphic clasts
				SW	**WELL GRADED SAND SAND (SW)** - dk grayish brn 10YR4/2, 93% f-c sand, 5% f-m rnd to subrnd gravel up to 2", 2% fines	
50		CC6	10			collect PE1-USGS-50, PE1-PW-50
					- increased gravel, 89% f-c sand, 8% subrnd gravel up to 3", 3% fines	
					- 3" thick lens of plastic silty clay	
55					- decreased fines, 91% f-m sand, 8% f-m subrnd gravel, 1% fines	1" clay lens at ~56'
						1" clay lens at ~59'
60		CC7	10	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - yellow brn 10YR5/4, 63% f-c sand, 35% f-c gravel, 2% fines	collect PE1-USGS-60, PE1-PW-60, GS-60
					- decreased gravel, 88% f-c sand, 10% f-m gravel, 2% fines	
65						PE1-64 (Hex Cr)
						FeOx staining 65-67'
					- trace clay	
70					- increased gravel, 69% f-c sand, 30% well rnd to subang f-m gravel, 1% fines	metamorphic and volcanic rocks (reworked alluvial)

CH2MHILL

SHEET 3 of 4	PROJECT NUMBER: 327061	BORING NUMBER: PE-01

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 105.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 467.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,550.25	**EASTING (CCS NAD 27 Z 5):** 7,616,345.31	**DATE STARTED:** 03/01/2005 — **DATE COMPLETED:** 03/02/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: Floodplain approx 450 ft. E of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.)
	X	CC8	10		**WELL GRADED SAND WITH GRAVEL (SW)** - yellow brn 10YR5/4, 63% f-c sand, 35% f-c gravel, 2% fines - 85% f sand, 10% c sand, 5% gravel	collect PE1-USGS-70, PE1-PW-70
75				SM	**SILTY SAND (SM)** - 80% f sand, 20% fines (silt & trace clay), organics present	PE1-74.5 Isoflow groundwater grab sample fluvial floodplain deposit
	X	CC9	10	SP	**POORLY GRADED SAND (SP)** - 65% m sand, 30% c sand, 5% f gravel, trace silt	
80				SW	**WELL GRADED SAND (SW)** - 85% f-c sand, 8% f-m rnd to subrnd gravel, 7% fines	
				SW	**WELL GRADED SAND (SW)** - 80% f sand, 15% gravel to 3", 5% silt	
85				SW	**GRAVELLY SAND (SW)** - 30% f sand, 40% c sand, 20% rnd to subrnd gravel to 4", 10% fines	PE1-84 Isoflow groundwater grab sample slow, hard drilling at ~87.5
	X	CC10	10	SC	**CLAYEY SAND (SC)** - with 5% m gravel	
90				BR	**CONGLOMERATE (BR)** - dk reddish brn 2.5YR3/4, 70% fines, 15% sand, 15% gravel, hard, shattered, cemented, dry	Top Miocene Conglomerate at 89 ft
95						Installed PE-1 extraction well. See PE-1 completion log for construction details.
100					Boring Terminated at 97 ft	
105						

ABBREVIATIONS
cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained

CH2MHILL

SHEET 4 of 4	PROJECT NUMBER: 327061	BORING NUMBER: PE-01

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 105.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 467.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,550.25	**EASTING (CCS NAD 27 Z 5):** 7,616,345.31	**DATE STARTED:** 03/01/2005	**DATE COMPLETED:** 03/02/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Floodplain approx 450 ft. E of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					vc = very coarse-grained ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

CH2MHILL

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0					**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.
5						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.
10				SM		Pilot boring drilled with mud rotary; soil descriptions to 160' from drill cuttings.
15						
20					**POORLY GRADED GRAVEL (GP)** - m ang sand up to 1/4, trace fine sand and silt, freshly broken.	Drill chatter.
25				GP	- c. ang sand up to 3/8 gravel	
30					**CLAYEY SAND (SC)** 70-75% m-c ang sand, 15-20% lt brn clay, 10% f ang gravel to 1/4, some fine sand.	
				SC		
35						

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				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.	
40					**WELL-GRADED SAND (SW)** m-c ang sand, trace vf ang gravel.	
45						
50						
55						
60						
65						
70						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.	
75						
80					- orange streaking	
85						
90					- orange streaking	
95					- orange streaking	
100				SW	- orange streaking	
105					- orange and white streaking	

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.	
110					- orange and white streaking	
115					- orange and white streaking	
				SW		
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	

CH2MHILL

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL-GRADED SAND (SW) m-c ang sand, trace vf ang gravel.	
145					- orange and white streaking	
150					- 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
155					- trace vf ang gravel	Mud properties at 155' during borehole ream
160					- 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.
165						
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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
180				SW	**WELL GRADED SAND (SW)** - m-c ang sand, some vf ang gravel.	
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.	3 attempts for a total of 6' core.
190				SW	**WELL GRADED SAND (SW)** - m-c ang sand, trace vf ang gravel.	
195						
200				SW-SC	**WELL GRADED SAND WITH CLAY (SW-SC)** - 80% well-graded ang sand, 20% clay in layers.	
205				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.	
210					**WELL GRADED SAND (SW)** - orange streaks in cuttings, m-c ang sand, trace ang gravel to 3/16.	

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 INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND (SW)** - orange streaks in cuttings, m-c ang sand, trace ang gravel to 3/16.	
215					- red-orange clay	Loss of circulation briefly.
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.	- 41% gravel in core sample based on grain size analysis
225						
230				SW	**WELL GRADED SAND (SW)** - some ang gravel to 3/16.	
235						
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						

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

SOIL BORING LOG

PROJECT NAME:		HOLE DEPTH (ft):	DRILLING CONTRACTOR:	
PG&E Topock IM Investigation (Phase 5 2004)		312.0	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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					WELL GRADED SAND (SW) - slight red color, trace gravel to 3/16.	
250						
					- 15% fines, ang gravel	
				SW		
255					- 25% f ang gravel to 1/8	
260						
				CL	**SANDY CLAY (CL)** - (10YR 4/4), 60% fines, 40% well-graded ang sand, soft, medium plasticity, wet.	Large rock in shoe blocked collection of core. - C09 core contains dense, stiff clayey sand, red in color, not consolidated
265						
				SC	**<u>CLAYEY SAND (SC)</u>** wet, loose, 70% well-graded, angular sand, 30% fines. Becoming red, stiff to friable.	<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%
270						
					SANDY MUDSTONE - reddish (2.5YR 4/6), 70% fines, 30% f-m ang sand, consolidated.	Viscosity = 38 seconds Density = 9.3 lbs/gallon 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'
275						
280						

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: INTERVAL	SAMPLE: TYPE/NUMBER	SAMPLE: RECOVERY (ft)	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.
280–290				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).
285						
290				BR	**CLAYEY SANDSTONE** - medium brown, 70% well-graded ang sand, 30% fines.	
295						
300						
305						
310				BR	**SANDY MUDSTONE** - medium brown with white calcareous streaks, firm.	
312					Boring Terminated at 312 ft	Pilot boring terminated at 312' bgs.

ABBREVIATIONS

cc = continuous core run

CH2MHILL

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 INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					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	

SHEET 1 of 6	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: TW-2

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 180.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,633.34	**EASTING (CCS NAD 27 Z 5):** 7,615,861.57	**DATE AND TIME STARTED:** 03/30/2004	**DATE AND TIME COMPLETED:** 04/01/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: MW-20 Bench			**LOGGED BY:** J. Sarabia	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					No core	AM activities: rig-up, set conductor casing to 17' bgs with air rotary. P.M. activities: set up mud circulation system, drill direct 17'-40' bgs. 15:30 begin first core run
5						
10						
15						
20						
25						
30						
35						

CH2MHILL

PROJECT NUMBER: 315024.IM.02

BORING NUMBER: TW-2

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 180.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,633.34	**EASTING (CCS NAD 27 Z 5):** 7,615,861.57	**DATE AND TIME STARTED:** 03/30/2004 — **DATE AND TIME COMPLETED:** 04/01/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 30K Rig with 94-mm Punch Core
LOCATION: MW-20 Bench			**LOGGED BY:** J. Sarabia

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					No core	
40		CC124	0.75	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, well graded sand, c silt, f gravel up to 3/4, subang to ang.	
		CC125	0.5	ML	**SILT WITH GRAVEL (ML)** - brn 10YR4/3, sand fraction nearly absent.	very slow coring very slow - rig maxed out
		CC126	3.5	SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, 80% well graded c silt to f gravel, m gravel up to 2, ang.	hard coring
45		CC127	0.5			very hard coring
		CC128	2			
		CC129	0.5	SM	**SILTY SAND WITH GRAVEL (SM)** - brn 10YR4/3, well graded c silt to 0.75 gravel, subang to ang, slight plasticity.	
50		CC130	2.25			
		CC131	0.75		**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, c silt, gravel up to 1, subang to subrnd.	
		CC132	3.5			moderate to hard coring, core is less dense/consolidated-remains intact after extraction from core barrel
55		CC133	0.5			very hard coring
		CC134	1.5			
		CC135	0			very hard coring, obstruction at 57' - will try to drill through with bit drill ahead to try to get through obstruction
		CC136	1.5			attempt to core- no recovery hard coring
60					- 1/8 to 1 ang gravel, subrnd cobbles to 2.5	cannot core, will drill ahead and attempt to core at 62' bgs attempted to core at 62'bgs - too many rocks, will drill to 65' bgs
65						attempted to core at 65'bgs - too many rocks, will drill ahead to 67' bgs and attempt to core attempted to core at 67'bgs - too many rocks, will drill ahead to 70' bgs and attempt to core
70						

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	TW-2

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 180.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 497.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,633.34	EASTING (CCS NAD 27 Z 5): 7,615,861.57	DATE AND TIME STARTED: 03/30/2004	DATE AND TIME COMPLETED: 04/01/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: MW-20 Bench			LOGGED BY: J. Sarabia	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 10YR4/3, c silt, gravel up to 1, subang to subrnd.	attempted to core at 70'bgs - refusal, will drill ahead
						rig chatter significant in this zone, becomes progressively harder to drill with depth, and impossible to core (possible basal conglomerate)
75						
80						at ~79.5 bgs, rig chatter subsides (possible lith, contact), will attempt to core at 80'bgs
						attempted to core at 80' bgs, could not advance the core barrel - will continue to attempt to get core.
85						attempted to core - could not advance core, will drill forward and attempt to core when lithology changes or 90' bgs (which ever comes first)
90					**SILTY SAND WITH GRAVEL (SM)** - brn 10YR4/3, silt.	core barrel cannot be advanced (too many rocks/ cobbles. Will continue to drill direct with tricone bit and attempt to core every 3-5 feet.
95						continued strong rig chatter. Still unable to advance core barrel
100				GM		
105						

SHEET 4 of 6	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: TW-2

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)	**HOLE DEPTH (ft):** 180.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 497.0 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,633.34	**EASTING (CCS NAD 27 Z 5):** 7,615,861.57	**DATE AND TIME STARTED:** 03/30/2004	**DATE AND TIME COMPLETED:** 04/01/2004
DRILLING METHOD: Mud Rotary	**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: MW-20 Bench		**LOGGED BY:** J. Sarabia	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					SILTY SAND WITH GRAVEL (SM) - brn 10YR4/3, silt.	
110						
		CC137	2.75		**WELL GRADED SAND WITH GRAVEL (SW)** - reddish brn 2.5YR4/4, well graded c silt, gravel up to 2, subang to ang, massive.	lithology still causing rig chatter, but will attempt core run.
						partial core recovery; core color implies geologic contact
115						
		CC138	1.75	SW		poor core recovery, punch coring bit has been chewed up due to cobbles/rocks. Well put on another bit. Very hard coring
120						
		CC139	1			
		CC140	1.75			hard to very hard coring
		CC141	2			very hard coring
125						
		CC142	0.5		**SILTY SAND (SM)** - reddish brn 2.5YR4/4, increasing silts and clays, ang gravel clasts, variable mineralogy, massive.	very hard coring
		CC143	4			hard coring - good core recovery and competence (less very large stones/cobbles, more cohesion in lithology)
130						alternating moderate to hard coring
		CC144	2.5	SM		stones/cobbles stuck on both ends of returned core preventing better recovery
135						
		CC145	2			moderate to easy coring
		CC146	2			
140						moderate coring difficulty

SHEET 5 of 6	PROJECT NUMBER: 315024.IM.02	BORING NUMBER: TW-2

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		HOLE DEPTH (ft): 180.0	DRILLING CONTRACTOR: WDC Exploration and Wells, Montclair, CA	
SURFACE ELEVATION: 497.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,633.34	EASTING (CCS NAD 27 Z 5): 7,615,861.57	DATE AND TIME STARTED: 03/30/2004	DATE AND TIME COMPLETED: 04/01/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: Speedstar 30K Rig with 94-mm Punch Core	
LOCATION: MW-20 Bench			LOGGED BY: J. Sarabia	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		CC147	3		**CLAYEY GRAVEL WITH SAND (SC)** - dk reddish brn 2.5YR3/4, well graded vf sand to 0.125, 20% gravel up to 2.	
		CC148	3			very easy coring
145				SC		
		CC149	3			very hard coring
		CC150	2			very hard coring, probable geologic contact at 150' very dense/tough material
150		CC151	0.5		**SILTY SAND WITH GRAVEL (SC)** - dk reddish brn 2.5YR3/4, well graded vf sand, 20% gravel 0.125 up to 2.	extremely hard coring
		CC152	1.5		- dark red, geologic contact, dense, lithified, stiff, rock-like	extremely hard coring, will drill 2.5'
						drill ahead due to difficult or impossible coring
155		CC153	2			extremely hard coring
						extremely hard core refusal
		CC154	0.4			
						drill ahead due to core refusal, will attempt to core again at 162' bgs
160						
						very slow drill with abundant rig chatter
		CC155	0.3			extremely hard core refusal at 6
						drill ahead due to core refusal, will attempt to core again at 167' bgs
165				SM		
						lots of rig chatter, very slow drilling
		CC156	0.5			extremely hard core, refusal at 6
						drill ahead due to core refusal
170						
						extremely slow drilling, abundant rig chatter, will attempt core run at 172'
		CC157	0.25			attempted core run, refusal at 3, will drill ahead
175						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
315024.IM.02	TW-2

SOIL BORING LOG

PROJECT NAME: PG&E Topock IM Investigation (Phase 1 2004)		**HOLE DEPTH (ft):** 180.0	**DRILLING CONTRACTOR:** WDC Exploration and Wells, Montclair, CA
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,633.34	**EASTING (CCS NAD 27 Z 5):** 7,615,861.57	**DATE AND TIME STARTED:** 03/30/2004 / **DATE AND TIME COMPLETED:** 04/01/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** Speedstar 30K Rig with 94-mm Punch Core
LOCATION: MW-20 Bench			**LOGGED BY:** J. Sarabia

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
180					**SILTY SAND WITH GRAVEL (SC)** - reddish brn, 2.5YR3/4, well graded vf sand, 20% gravel 0.125 up to 2. / reddish brn 2.5YR 4/4, increasing silts and clays, ang gravel clasts, variable mineralogy, massive.	extremely hard drilling to 180' bgs

Boring Terminated at 180 ft

ABBREVIATIONS

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

PROJECT NUMBER: 326128.01.19.EW

BORING NUMBER: ***TW-3D***

SOIL BORING LOG

PROJECT NAME: PG&E Topock Interim Measures Extraction Well		**HOLE DEPTH (ft):** 157.0	**DRILLING CONTRACTOR:** Prosonic Corp., Phoenix, AZ
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 83):** Approx. 2,102,627.34	**EASTING (CCS NAD 83):** Approx. 7,615,874.57	**DATE STARTED:** 10/20/2005 09:00 — **DATE COMPLETED:** 10/24/2005 14:15
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Standard Rotosonic Rig	
LOCATION: MW-20 bench, approx. 13 ft. west and 6 ft. south of TW-2D		**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: PID (PPM)	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
0						- start coring at 9:00 AM 10/20/05
						Note: TW-3D pilot boring (7") diameter) continuously cored using sonic core barrel system. No analytical sampling conducted during drilling.
0–9					SW	**GRAVELLY SAND WITH SILT (SW)** - dk yellowish brn (10YR4/2 to 5/4), 65% poorly sorted f-m sand, 30% rnd quartz, limestone, and vesicular basaltic gravel up to 15 cm (minor portion reworked? subang mm clasts), 5% silt, moist.
						- dry
9–12					SP	**POORLY GRADED SAND (SP)** - dk yellowish orange (10YR7/4 to 6/6), 95% well sorted f sand, 5% gravel up to 1 cm, loose, moist
12–22					SW	**GRAVELLY SAND (SW)** - dk yellowish brn (10YR4/2), 55% sand, 40% rnd qtz, limestone, and jasper gravel up to 4-5 cm, 5% fines
						- 60% sand, no fines (coarsening downwards), rounded chert and limestone clasts up to 12 cm
22–27					GW	**WELL GRADED SANDY GRAVEL (GW)** - 10YR4/2, 60% rnd (fluvial) gravel up to 15 cm (diverse rock types), 40% sand
27–35					SW/GW	**GRAVELLY SILTY SAND (SW/GW)** - med brn (5YR4/4), 50% sand, 40% subang mm gravel with weathered rinds, 10% fines, weakly cemented

PROJECT NUMBER:	BORING NUMBER:
326128.01.19.EW	TW-3D

SOIL BORING LOG

PROJECT NAME: PG&E Topock Interim Measures Extraction Well		**HOLE DEPTH (ft):** 157.0	**DRILLING CONTRACTOR:** Prosonic Corp., Phoenix, AZ	
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 83):** Approx. 2,102,627.34	**EASTING (CCS NAD 83):** Approx. 7,615,874.57	**DATE STARTED:** 10/20/2005 09:00	**DATE COMPLETED:** 10/24/2005 14:15
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Standard Rotosonic Rig		
LOCATION: MW-20 bench, approx. 13 ft. west and 6 ft. south of TW-2D		**LOGGED BY:** J. Piper		

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: PID (PPM)	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
					SW/GW	**GRAVELLY SILTY SAND (SW/GW)** - med brn (5YR4/4), 50% sand, 40% subang mm gravel with weathered rinds, 10% fines, weakly cemented
40					SW/SM	**GRAVELLY SILTY SAND (SW/SM)** - med brn (5YR4/4), 45% sand, 40% gravel up to 5 cm, 15% fines, slightly cohesive - weakly cemented, dry to moist
45					SM/GM	**SILTY GRAVEL WITH SAND (SM/GM)** - 45% gravel up to 9 cm, 40% sand, 20% fines
50					SM	- saturated conditions encountered at 47 ft. **GRAVELLY SILTY SAND (SM)** - med brn (5YR4/4), 55% sand, 30% fines, 15% gravel up to 3 cm, slightly plastic
55						- 55% sand, 25% gravel up to 5 cm, 20% fines, coarsening downwards
60					SW	**GRAVELLY SAND (SW)** - 5YR4/4-3/4, 55% poorly sorted sand, 40% subang weathered mm gravel up to 15 cm, 5% fines - increasing sand and less fines, gravel up to 4 cm
65					SM	**GRAVELLY SILTY SAND (SM)** - 45% sand, 30% gravel up to 7 cm, 25% clayey fines
					SW	**SAND WITH GRAVEL AND SILT (SW)** - 60% poorly sorted f-c sand, 25% mm gravel, 15% fines
70					GW	**SANDY GRAVEL (GW)** - 5YR5/2 - 10YR6/2, 70% fluvial (and some reworked? mm) gravel up to 8 cm, 27% sand, 3% fines

PROJECT NUMBER:	BORING NUMBER:
326128.01.19.EW	*TW-3D*

SOIL BORING LOG

PROJECT NAME: PG&E Topock Interim Measures Extraction Well		**HOLE DEPTH (ft):** 157.0	**DRILLING CONTRACTOR:** Prosonic Corp., Phoenix, AZ	
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 83):** Approx. 2,102,627.34	**EASTING (CCS NAD 83):** Approx. 7,615,874.57	**DATE STARTED:** 10/20/2005 09:00	**DATE COMPLETED:** 10/24/2005 14:15
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Standard Rotosonic Rig		
LOCATION: MW-20 bench, approx. 13 ft. west and 6 ft. south of TW-2D		**LOGGED BY:** J. Piper		

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: PID (PPM)	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
					GW	**SANDY GRAVEL (GW)** - 5YR5/2 - 10YR6/2, 70% fluvial (and some reworked? mm) gravel up to 8 cm, 27% sand, 3% fines - 65% ang to subang mm gravel up to 3 cm, 35% sand
75						- 5YR4/4, 65% gravel up to 3 cm, 25% sand, 10% fines
					SW	- end of drilling on 10/20/05 **SAND (SW)** - 60% sand, 30% gravel up to 9 cm, 10% fines, gradational contact (grades finer) - start of drilling at 8:45 10/21/05
80					SM	**GRAVELLY SAND WITH SILT AND CLAY (SM)** - 55% sand, 25% gravel up to 5 cm, 20% fines
85					SW	**SAND (SW)** - 55% m-c sand, 25% gravel up to 13 cm, 20% fines (clay increasing with depth), becoming slightly plastic - 50% sand, 35% gravel, 15% fines
					GW	**SANDY GRAVEL (GW)** - 65% gravel up to 3 cm, 35% sand, 5% fines
90						
					GM/SM	**SILTY SAND AND GRAVEL (GM/SM)** - 5YR4/4, 40% sand, 40% mm gravel up to 13 cm, 20% fines
95					SW	**GRAVELLY SAND (SW)** - 52% well sorted m-c sand, 45% f gravel up to 2 cm, 3% fines - 62% gravel up to 15 cm, 35% sand, 3% fines
					GW	**GRAVEL WITH SAND (GW)** - 50% sand, 45% gravel up to 4 cm (90% of gravel is subang mm clasts, 10% is reworked? subrnd mm clasts), 5% fines
100						
105						

PROJECT NUMBER:	BORING NUMBER:
326128.01.19.EW	*TW-3D*

SOIL BORING LOG

PROJECT NAME: PG&E Topock Interim Measures Extraction Well		HOLE DEPTH (ft): 157.0	DRILLING CONTRACTOR: Prosonic Corp., Phoenix, AZ	
SURFACE ELEVATION: 497.0 ft. MSL	NORTHING (CCS NAD 83): Approx. 2,102,627.34	EASTING (CCS NAD 83): Approx. 7,615,874.57	DATE STARTED: 10/20/2005 09:00	DATE COMPLETED: 10/24/2005 14:15
DRILLING METHOD: Rotosonic		DRILLING EQUIPMENT: Standard Rotosonic Rig		
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DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: PID (PPM)	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
					GW	**GRAVEL WITH SAND (GW)** - 50% sand, 45% gravel up to 4 cm (90% of gravel is subang mm clasts, 10% is reworked? subrnd mm clasts), 5% fines - 57% gravel up to 4 cm, 40% sand, 3% fines - 50% sand, 40% gravel, 10% fines
110					SW/SM	**GRAVELLY SILTY SAND (SW/SM)** - 5YR3/4, 55% sand, 25% gravel up to 3 cm, 20% fines
115					SM	**SILTY SAND (SM)** - 65% sand, 25% fines (clayey), 10% gravel, slightly plastic - clayey - clayey
120					SW	**GRAVELLY SAND (SW)** - 60% gravel up to 4 cm, 25% well sorted m-c sand, 15% fines
125						
130					GW	**GRAVEL WITH SAND AND SILT (GW)** - 50% sand, 40% gravel up to 15 cm, 10% fines
					SM	**SILTY SAND (SM)** - 55% sand, 25% gravel (mm cobble), 20% fines
					SW	**SAND WITH GRAVEL AND SILT (SW)** - 5YR4/4, 60% sand, 25% gravel up to 4 cm, 15% silty fines - maximum clast size decreasing
135						
					SM	**GRAVELLY SILTY SAND (SM)** - 50% sand, 40% gravel up to 3 cm, 10% fines
					SW	**GRAVELLY SAND (SW)** - 45% sand, 40% gravel up to 3 cm, 15% fines
140						

PROJECT NUMBER: 326128.01.19.EW

BORING NUMBER: *TW-3D*

SOIL BORING LOG

PROJECT NAME: PG&E Topock Interim Measures Extraction Well		**HOLE DEPTH (ft):** 157.0	**DRILLING CONTRACTOR:** Prosonic Corp., Phoenix, AZ
SURFACE ELEVATION: 497.0 ft. MSL	**NORTHING (CCS NAD 83):** Approx. 2,102,627.34	**EASTING (CCS NAD 83):** Approx. 7,615,874.57	**DATE STARTED:** 10/20/2005 09:00 — **DATE COMPLETED:** 10/24/2005 14:15
DRILLING METHOD: Rotosonic		**DRILLING EQUIPMENT:** Standard Rotosonic Rig	
LOCATION: MW-20 bench, approx. 13 ft. west and 6 ft. south of TW-2D		**LOGGED BY:** J. Piper	

DEPTH BGS (feet)	SAMPLE: INTERVAL	SAMPLE: RECOVERY (ft)	SAMPLE: PID (PPM)	SAMPLE: SOIL SAMPLE	USCS CODE	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
					GW	**SANDY GRAVEL (GW)** - 50% gravel up to 12 cm, 45% sand, 5% fines, grading finer downwards
145					SM	**GRAVEL WITH SAND AND SILT (SM)** - 60% gravel up to 15 cm, 35% sand, 5% fines - becoming stiff - transition to weathered bedrock - stronger white CO3 cemented zones, mm clasts very weathered
150						- 45% sand, 45% gravel up to 12 cm, 10% fines, weathered bedrock with (mm clasts), stiff, competent, moist - drilling becomes harder below 150 ft.
155					BR	**BEDROCK (BR)** - consolidated Miocene conglomerate, 45% gravel up to 15 cm, 40% sand, 15% fines, competent, dry, dark reddish brown - shattered, moist - shattered, dry bedrock - End of boring 16:30 10/21/05 - Enlarged borehole to 10.7" for installing extraction well TW-3D. See TW-3D installation report.

Total Depth = 157 ft bgs

ABBREVIATIONS

brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
mm = metamorphic

CH2MHILL

As-built Construction
TW-3D Extraction Well

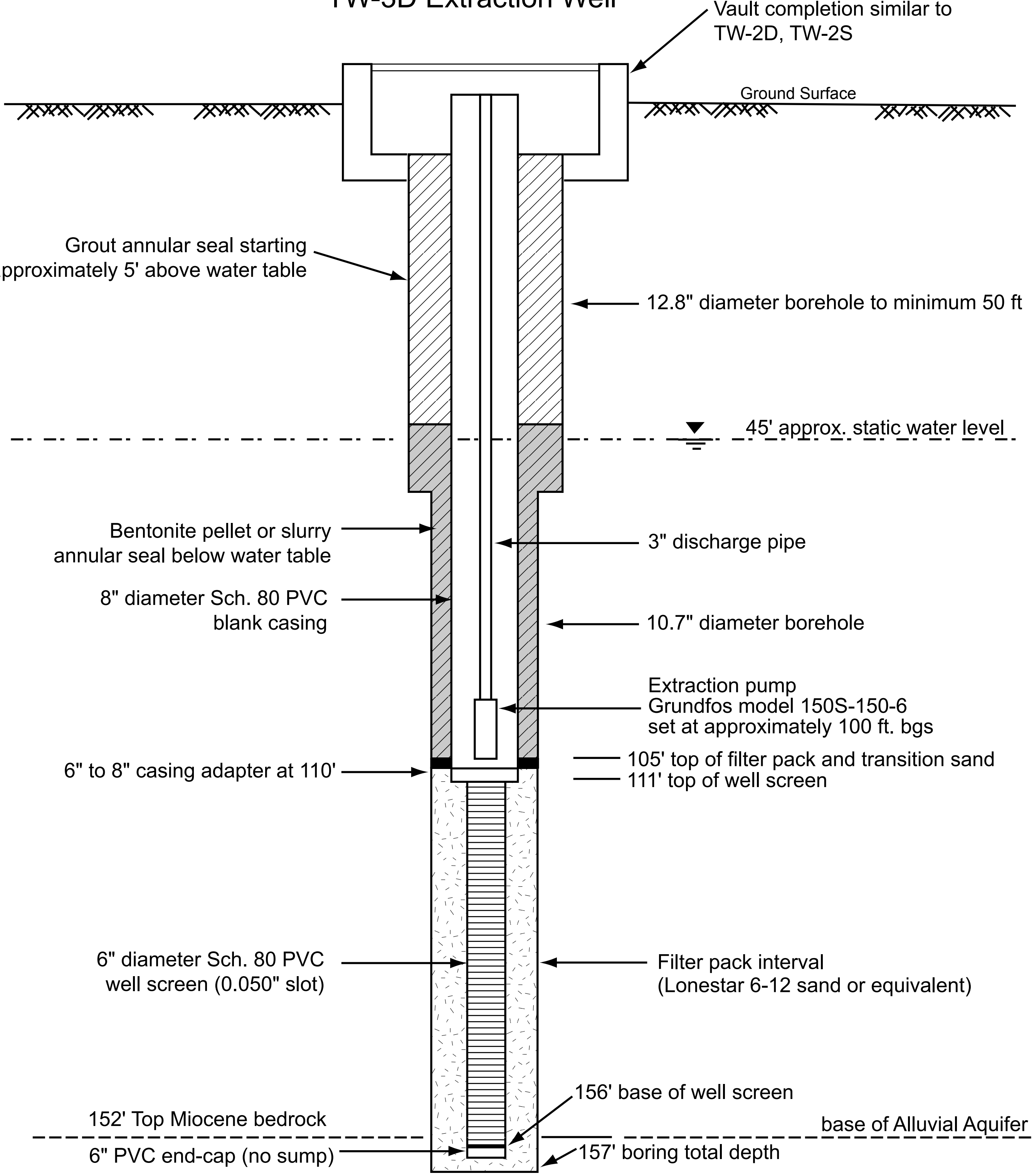


DIAGRAM NOT TO SCALE

Well screen selection reviewed with DTSC 10/21/05

Well TW-3D installed 10/26-27/05

FIGURE 3
WELL CONSTRUCTION DIAGRAM
TW-3D EXTRACTION WELL
IM NO. 3 GROUNDWATER EXTRACTION SYSTEM
PG&E TOPOCK COMPRESSOR STATION

CH2MHILL

326128.01.19.EW_Diagram Extraction Well_12/29/05_ccc_sfo

9-088 (December 1949)   18 of 18   CA

7N/24E-8B

82

Closed File

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

No. 7N/24E-6F1

OTHER NOS. PM-01

WELL LOG

<1st Park Moabi Supply Well>
believe abandoned 1986

State California County San Bernardino Subarea LCRP

Owner Moabi Park Marina, Needles, California   Park Moabi #1

Location 7 miles East of Needles, Calif. at Moabi Park Marina

Drilled by McBride Pump & Supply Co. Address Blythe, Calif.

Date March 1961 Casing diam. 10" double Land-surf. alt.

Source of data Drillers Log

(Enter type of well, perforations, yield, and drawdown at end of log)

CORRELATION	MATERIAL	THICKNESS (feet)	DEPTH (feet)
	Gravel, 3", to sand	22	22
	Gravel, 2", to 8" rock	22	44
	Clay	18	62
	Shale	8	70
	Clay, blue	32	102
	Clay, gray, w/rock	10	112
	Rock, gray solid	6	118
	Clay, gray, with rock	20	138
	Clay w/rock - softer	16	154
	Rock w/clay	36	190
	Perforations: 28-35, 4 perf. per row, 1 row per foot		
	35-42, 8 perf. per row, 1 row per foot		
	65-72, 8 perf. per row, 1 row per foot		
	72-180, 2 perf. per row, 1 row per foot		
	2 3/4 x 3/8, Mills		
	350 gpm 12 1/2' drawdown after 10 hrs.		
	Depth to water: 22 1/2'		

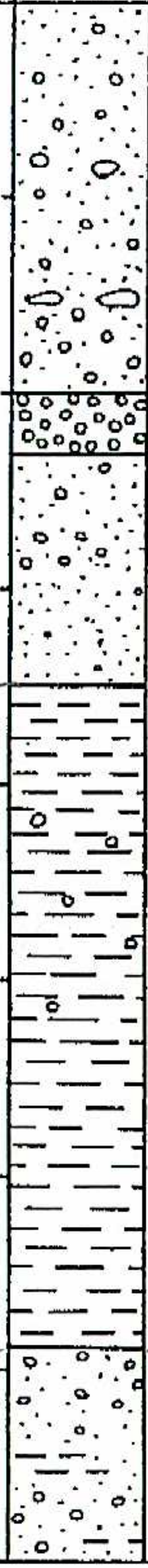
RECORD BY ______ DATE ______ SHEET ____ OF ____

51753

LITHOLOGIC LOG

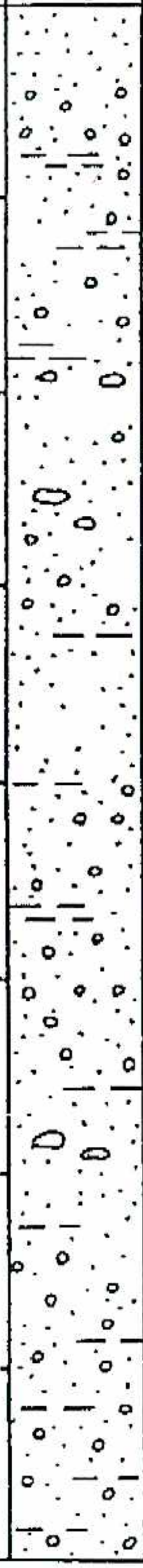
Drilled for Pk. Moabi
by Crandell & Assoc, July 1986

PARK MOABI
Well No. 3
Current Active Supply Well

Depth	Graphic Log	EC (umhos)	Description of Materials	
			SAND & GRAVEL	Brown, fine to coarse grained sand with fine angular gravel, gravels are meta-igneous composition
10				
Recent Wash Alluvial Qay				Gravel size increases
20				Gravel bed
30				Clays increase
C Top Bouse			CLAY	Brown, silty clay to clay, soft, with some very fine grained sand
40		1,700		
				Some fine gravels
50				
				Color changes to grey
60		1,600		Siltier, mottled tan and grey, decaying organic odor
Base? Bouse				White clay, caliche
70			SAND & GRAVEL	Brown and green, fine to coarse grained sand and fine angular gravels, gravels are predominately meta-igneous composition
		820		Color changes to black, collect water

LITHLOGIC LOG

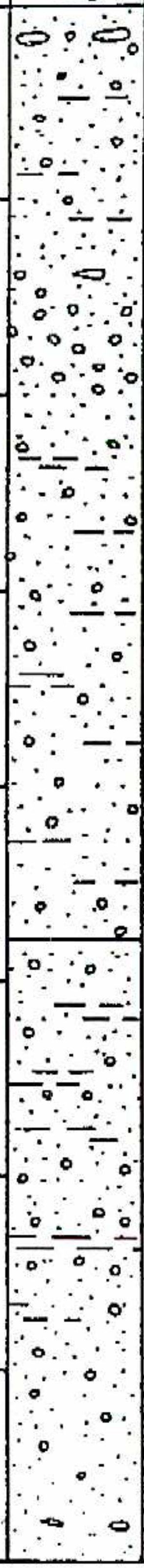
Well No. 3



Depth	Graphic Log	EC (umhos)	Description of Materials
TOP SCREEN 80'			Predominately coarse grained sand, brown
90		800	Siltier, sands increase
100		850	
110		590	
120		720	Gravels increase 12 gpm
130		690	Silty sand bed, very fine to medium grained
140		540	20 gpm
			Siltier
150		650	Clayier
		550	30 gpm, collect water sample

LITHOLOGIC LOG

Well No. 3

Depth	Graphic Log	EC (umhos)	Description of Materials	
				Silts increase
170		700		
				Gravels increase
180		550		33 gpm
				Clays increase
				Siltier, clays decrease
190		850		
Base SCREEN 200		590		43 gpm
~?~?~			?	
210		750	SAND & GRAVEL	Red sand and gravel, fine to coarse sand, fine angular gravel, some silts and clays, gravels are predominately volcanic and meta sediments
Top Miocene Conglomerate?				
220		610		Collect water sample
				White clay bed with some fine gravel
230		850		Clays decrease
		1,000		38 gpm

LITHLOGIC LOG

Well No. 3

Depth	Graphic Log	EC (umhos)	Description of Materials
250		1,100	Color changes to brown, meta-igneous gravels
			Total Depth: 250 ft., 60 gpm, collect water sample
260			

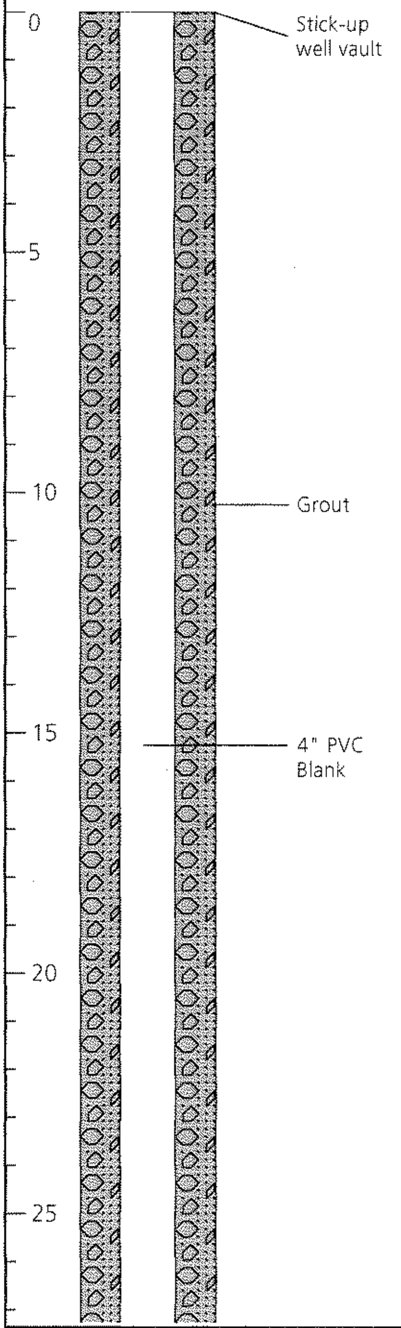
LOG OF BORING PTI-1S

PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.: RC000689.0001	Date Started: 28 January 2006
Logged by: J. Ely	Date Completed: 28 January 2006
Drilling Co.: Prosonic Corporation	Drilling Method: Sonic
Driller: Don Youngblood	Sample Method: Core
Well Permit #: 2006010006	Driller's License: C57-756217

WELL CONSTRUCTION

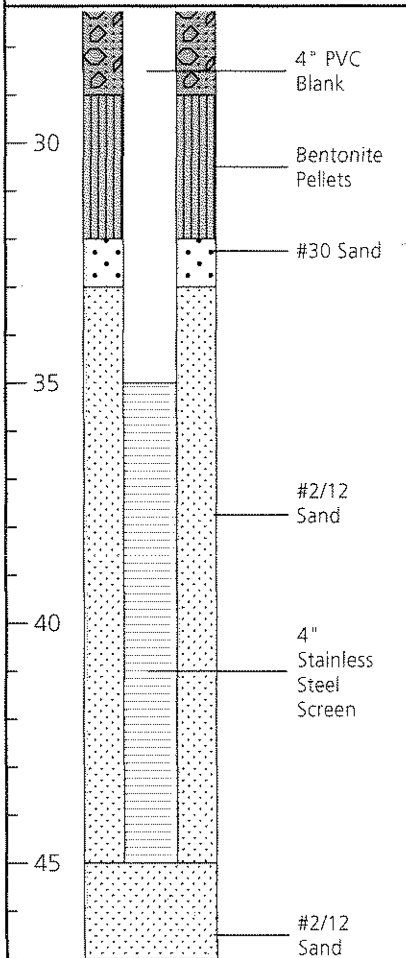
Boring Diameter (inches): 10 inches
Casing Diameter (inches): 4 inches



LITHOLOGIC DESCRIPTION

Depth	Headspace (ppm)	Blows/ft.	Sample	Key	Description
0					Poorly Graded Sand (SP), pale brown (10YR 6/3), 100% fine grained sand, very loose, dry.
					@ 11 ft bgs: changes to damp.
					@16 ft bgs: changes to pale brown and dark yellowish brown (10YR 4/4), 90% fine grained sand, 10% silt, damp.
					@ 17 ft bgs: changes to dark yellowish brown and dark grayish brown (10YR 4/2), wet.
					@ 20 ft bgs: dark grayish brown, 100% fine grained sand, medium dense.
					@ 22 ft bgs: changes to 10% silt.
					@ 23 ft bgs: changes to 10% clay.
					Silt and Clay (ML/CL), very dark gray (Gley 1 3/3), 60% silt, 30% clay, 10% fine grained sand, soft to medium stiff, high plasticity, wet.

LOG OF BORING PTI-1S
(Continued)



Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
					@ 27 ft bgs: changes to dark grayish brown (10YR 4/2).
30					
					@ 31 ft bgs: changes to 20% sand, stiff to very stiff.
					Silt with Sand (ML), dark grayish brown, 60% silt, 30% fine grained sand, 10% clay, medium dense, wet.
35					Poorly Graded Sand (SP), dark brown, 90% fine grained sand, 10% silt, loose to medium dense.
					Well Graded Sand (SW), dark grayish brown (10YR 4/2), 80% fine grained sand, 10% gravel (up to 10mm, angular to subangular), 5% silt, 5% clay, loose, wet.
40					@ 40 ft bgs: changes to medium dense.
					@ 43 ft bgs: changes to 10% silt, very wet, piece of wood chip.
45					@ 45 ft bgs: changes to 5% silt.
					End of Boring at 47 ft bgs.

LOG OF BORING PTI-1M

PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

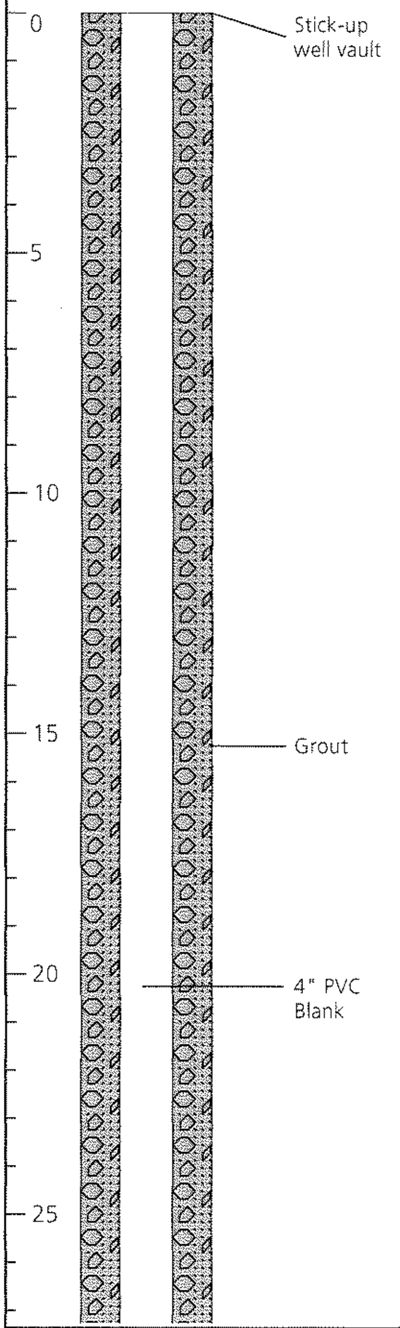
Project No.: RC000689.0001	Date Started: 26 January 2006
Logged by: J. Ely	Date Completed: 26 January 2006
Drilling Co.: Prosonic Corporation	Drilling Method: Sonic
Driller: Don Youngblood	Sample Method: Core
Well Permit #: 2006010007	Driller's License: C57-756217

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 10 inches

Casing Diameter (inches): 4 inches



Depth | Headspace (ppm) | Blows/ft. | Sample | Key

0 — Poorly Graded Sand (SP), pale brown (10YR 4/3), 100% fine sand, loose, dry.

@ 12 ft bgs: changes to pale brown and yellow brown (10YR 5/6), 90% fine grained sand, 10% silt, damp.

@ 14 ft bgs: changes to 5% silt.

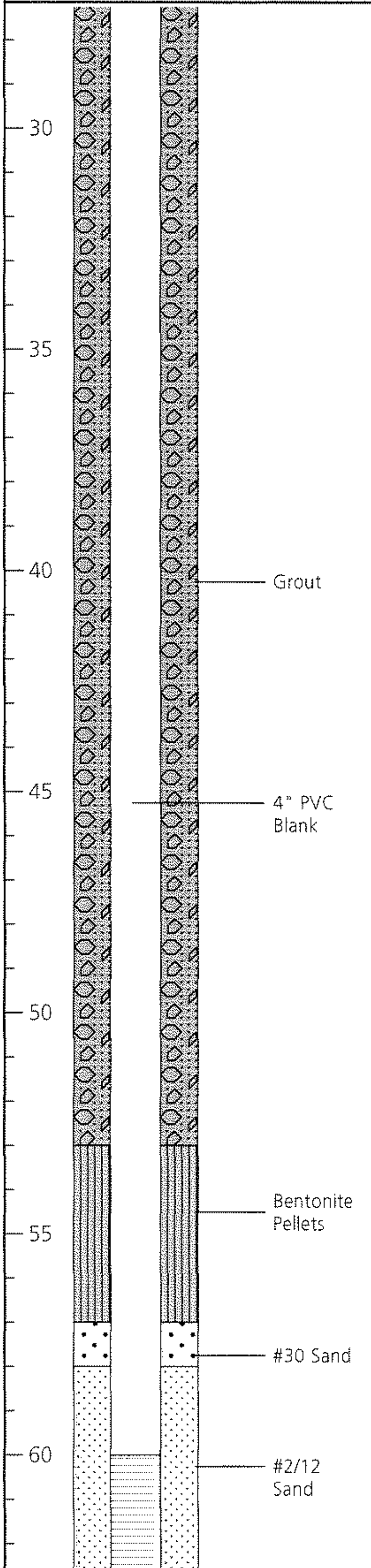
@ 17 ft bgs: changes to dark grayish brown (10 YR 4/2) and yellow brown.

@ 20 ft bgs: changes to wet.

@ 23 ft bgs: changes to dark grayish brown, grains are subangular to subrounded.

LOG OF BORING PTI-1M
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



Silt and Clay (ML/CL), 60% silt, 30% clay, 10% fine grained sand, soft, plastic to very plastic, wet.

@ 30 ft bgs: changes to 5% fine sand, low plasticity.

@ 32 ft bgs: changes to high plasticity.

@ 33 ft bgs: changes to 10-15% fine sand, low plasticity.

Poorly Graded Sand (SP), brown (10YR 4/3), 95% fine grained sand, 5% silt, subrounded to subangular, loose, wet.

@ 41 ft bgs: changes to 10% silt, medium dense.

@ 42.5 ft bgs: changes to 15% silt.

@ 43 ft bgs: chnges to 10% silt, 5% clay, medium dense.

Well Graded Sand with Silt (SW), dark grayish brown (10YR 4/2), 80% coarse to medium grained sand, subrounded, 10% fine sand, 5% silt, 5% clay, trace gravel (2mm-4mm), subangular, medium dense, loose, wet.

@ 49 ft bgs: increase fine sand.

@50 ft bgs: increase clay.

Clay (CL), dark gray (10YR 4/1), 80% clay 20% silt, high plasticity, stiff, moist/wet.

Poorly Graded Sand (SP), dark yellowish brown (10YR 4/4), 90% coarse gained sand, subangular, 10% gravel (2mm-10mm), subangular to rounded, very loose, saturated.

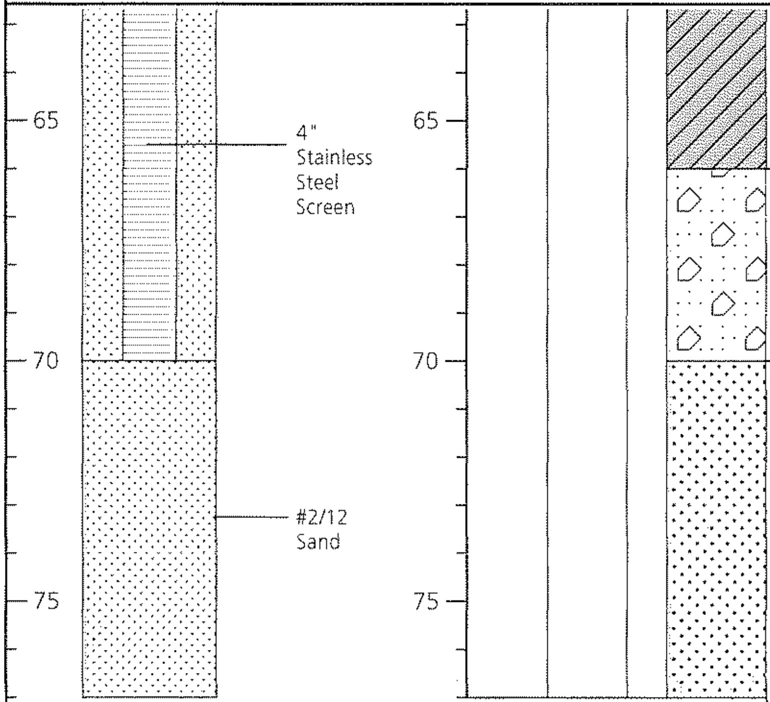
@ 56 ft bgs: increase gravel to 20% rounded and subangular.

Poorly Graded Sand with Gravel (GW), dark yellowish brown, 70% coarse grained subangular, 30% gravel and cobbles (2mm to 6-inches), angular to rounded.

Clay with Gravel (CL), brown (10YR 4/3), 70% clay, 15% fine sand, 10% gravel (2mm-10mm), 5% clay, trace cobbles (2 inches) angular to subrounded, medium dense.

LOG OF BORING PTI-1M
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION



Well Graded Gravel with Sand (GW), 80% gravel (2mm to 40mm, 80% rounded, 20% subangular), 15% sand, 5% silt and clay chunks, loose, wet.

@ 67 ft bgs; increase gravel.

@ 69 ft bgs: changes to 10% clay, slightly dense to dense.

Well Graded Sand with Gravel (SW), dark dusty red (2.5YR 2.5/2), 70% coarse grained sand, subrounded to subangular, 20% gravel (2mm to 10 mm), 5% cobbles, 5% silt, loose, wet.

@ 76 ft bgs: increase silt and clay.

End of Boring at 77 ft bgs.

LOG OF BORING PTI-1D

PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.:	RC000689.0001	Date Started:	24 January 2006
Logged by:	J. Ely	Date Completed:	26 January 2006
Drilling Co.:	Prosonic Corporation	Drilling Method:	Sonic
Driller:	Don Youngblood	Sample Method:	Core
Well Permit #:	2006010005	Driller's License:	C57-756217

WELL CONSTRUCTION

Boring Diameter (inches): 10 inches
Casing Diameter (inches): 4 inches

Stick-up well vault

Grout

4" PVC Blank

LITHOLOGIC DESCRIPTION

Depth	Headspace (ppm)	Blows/ft.	Sample	Key	Description
0					No recovery.
6					Poorly Graded Sand (SP), 95% fine grained sand, 5% medium sand, pale brown (10YR 6/3), subrounded, loose, dry.
8					@ 8 ft bgs; changes to 100% fine grained sand.
10					@10 ft bgs: changes to trace black and red grains.
13					@ 13 ft bgs; changes to moist.
15.5					@ 15.5 ft bgs: changes to yellowish brown (10YR 5/4), 90% fine grained sand, 10% silts, loose.
24					@ 24 ft bgs: changes to yellowish brown (10YR 4/4), 2% clay, wet.

LOG OF BORING PTI-1D
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
						Sandy silt (ML), dark yellowish brown (10YR 4/4), 85% fine sand, 10% silty, 5% clay, subangular grains, wet.
30	30					Silt (SM), 70% silt, 20% clay, 10% fine sands, dary gray (10 YR 4/1), subangular grains, wet.
						@ 32 ft bgs: changes to Silt with Sand (ML) 25% fine sand, subangular, micacious, saturated.
35	35					Poorly Graded Sand (SP), very dark grayish brown (10YR 4/2), 95% fine sand, 5% silt, subangular grains, saturated.
						Well Graded Sand with Silt (SW), very dark grayish brown (10YR 3/2), 90% sand, 10% silt, subangular grains, micacious, saturated.
40 — Grout	40					Poorly Graded Sand (SP), brown (10YR 5/3), 100% fine grained sand, subrounded to subangular, saturated.
						Clay with Sand (CL), dark gray (10YR 4/1), 85% clay, 15% fine grained sand, plastic, moist to saturated.
45 — 4" PVC Blank	45					Poorly Graded Sand (SP), dark grayish brown (10YR 4/2), 90% fine grained sand, 10% silt, subangular, moist.
						Well Graded Sand with Gravel (SW), 85% coarse grained sand, 15% gravel, subangular to subrounded, saturated, one piece of gravel at 4 inches in diameter.
50	50					Poorly Graded Sand (SP), dark yellowish brown (10YR 4/4), 95% fine sand, 5% silt, subangular, loose, saturated.
						@ 52 ft bgs: changes to trace organics.
						@ 54 ft bgs: changes to trace gravel.
55	55					Well Graded Sand (SW), 85% fine grained sand, 5% silt, 5% clay (in chunks), 5% gravel, up to 22mm, subrounded, loose, saturated.
						@ 58 ft bgs: changes to 10% gravel.
60	60					
						Clay with Gravel (CL), brown (10YR 5/3), 70% clay, 20% gravel (subrounded), 10% fine grained sand, medium to high plasticity, soft to medium soft, saturated.

LOG OF BORING PTI-1D
(Continued)

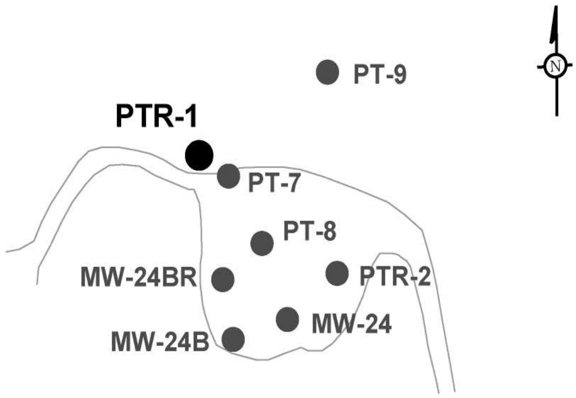
WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
						@ 64 ft bgs: some angular gravel (volcanics) and some rounded gravel.
	65					@ 65 ft bgs: increased rounded gravel.
						Well Graded Gravel with Sand (GW), 80% gravel (2mm-40mm, mostly rounded to subangular), 15% coarse grained, subangular sand, 5% clay (chunks), loose, damp.
						@ 69 ft bgs: changes to 15% clay, gravel is rounded to angular.
Grout	70					
4" PVC Blank						
	75					@ 75 ft bgs: changes to 5% clay.
						@77 ft bgs: changes to dark yellowish brown (10YR 4/4), 20% to 15% clay, max clast size: 3 inches.
	80					Pooly Graded Sand (SP), 90% coarse grained sand, 5% silt, 5% gravel (2mm) angular to subrounded, saturated.
						Well Graded Gravel with Sand (GW), 80% gravel (2mm-40mm), subangular to angular, 10% coarse grained sand, 10% silt/clay, medium dense to dense (increasing with depth).
	85					
Bentonite Pellets						Sand with Gravel (SC), dark yellowish brown (10YR 4/4), 60% coarse sand, 30% gravel (angular to subrounded), 10% silt/clay, dense, saturated, slight cementation.
	90					
#30 Sand						
	95					
#2/12 Sand						@ 97 ft bgs: changes to loose.

LOG OF BORING PTI-1D
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
4" Stainless Steel Screen						Poorly Graded Sand (SP), dark brown (10YR 3/3), 95% coarse graded sand, 5% silt, angular to subangular, loose, saturated.
	100					Poorly Graded Gravel (GP), brown (10YR 4/3), 90% gravel (5mm, subrounded to subangular), 5% silt, 5% clay, loose, saturated.
						Well Graded Gravel (GW), clay amount increases to 10-20%, gravel size increases up to 3 inches.
	105					
#2/12 Sand						Well Graded Sand with Gravel (SW), 70% coarse grained subangular to subrounded sand, 20% gravel, subangular to angular, up to 10mm, 10% clay, loose, saturated.
	110					
						@ 111 ft bgs: changes to 10% gravel.
						@114 ft bgs: changes to dark brown (10YR 3/3), 20% gravel, 10% clay, dense to very dense, some slightly cemented.
	115					
	120					
#2/12 Sand	125					
						Poorly Graded Gravel (GP), very dark gray (10YR 3/1), fine grained gravel, angular to subangular, loose, saturated, trace coarse gravel.
	130					@ 130 ft bgs: changes to coarse gravel and trace cobbles.
						@ 133 ft bgs: changes to brown (10YR 4/3).

LOG OF BORING PTI-1D
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
135	135					Note: Possible bedrock, broken conglomerate.
						End of boring at 137 ft bgs.



LOG OF BORING PTR-1

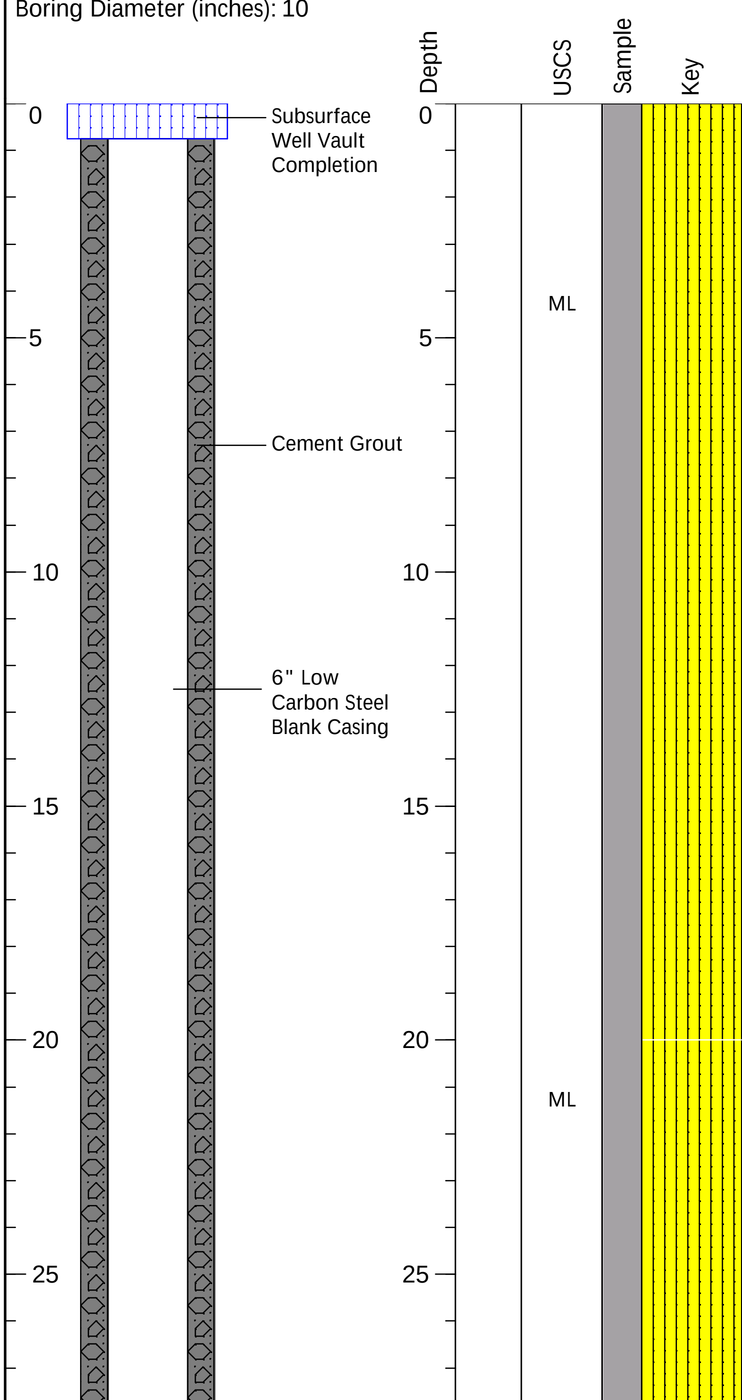
PG&E Topock Site
Needles, California

Project No.:	RC000689.0004	Date Started:	24 April 2007
Logged by:	Brett Bardsley	Date Completed:	2 May 2007
Drilling Co.:	WDC	Drilling Method:	Rotosonic/Mud Rotary
Drillers:	Rivera, West, Sakioka, Villegas	Sample Method:	4" x 6" Core Rod
Well Permit #2007040409		Driller's License:	C57-283326

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 10



Sandy Silty with Gravel; light gray (10YR 7/2); 60% silt, 20% fine to coarse subangular gravel; 20% medium to coarse grained sand; trace subangular cobbles up to 3.2 inches in length.

@ 2 feet: largest cobble was approxiamtely 4 inches.

@ 4 feet: amounts of medium grained sand increases.

@ 8 feet: amount of fine gravel increases.

@ 10 feet: all gravel is fine.

@ 18 feet: fine and coarse subangular gravel present.

@ 20 feet: changes to 65% silt; 20% medium to coarse grained sand; 15% fine subangular gravel; dry.

@ 22 feet: changes to 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel.

@ 24 feet: changes to 60% silt; 20% medium to coarse grained sand; 20% fine to coarse subangular gravel; trace cobbles up to to 3.5 inches.

LOG OF BORING PTR-1
(Continued)

Depth	USCS	Lithologic Description
28–35	ML	
35–46	ML	@ 35 feet: wet. @ 36 feet: changes to greenish gray (GLEY2 6/1); dry. @ 37 feet: changes to light gray (10YR 7/2); dry.
46–48	CL/ML	Silty Clay with Gravel; brown (7.5YR 4/2); 75% silt and clay; 15% fine subangular gravel; 10% medium to coarse grained sand; low plasticity; moist.
48–62	ML	Sandy Silt with Gravel; 60% silt; 20% medium to coarse grained sand; 20% fine to coarse subangular gravel; trace cobbles up to 3.5 inches.
62–64	ML	@ 62-64 feet: more cobbles present, between 3 and 3.5 inches in length.

WELL CONSTRUCTION: Cement Grout; 6" Low Carbon Steel Blank Casing

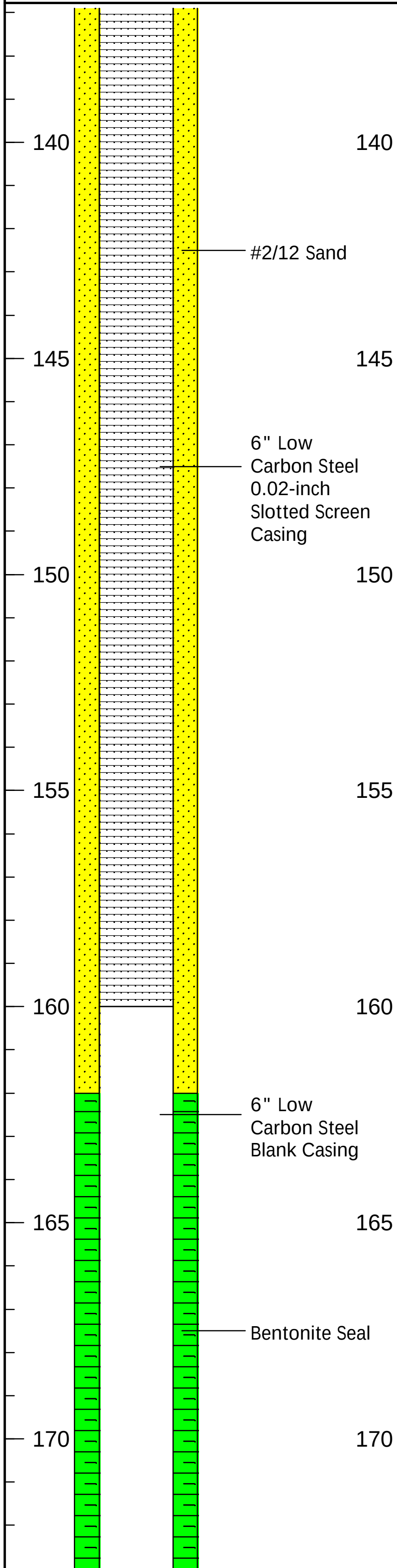
LOG OF BORING PTR-1
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
65	65	ML			@ 66 feet: changes to Gravelly Silt; 60% silt, 30% fine to coarse subangular gravel; 10% fine to coarse grained sand; non-plastic; dry.
					@ 68 feet: changes to Sandy Silt with Gravel; 60% silt; 20% medium to coarse grained sand; 20% fine to coarse subangular gravel.
70	70				
Cement Grout					
75	75				
6" Low Carbon Steel Blank Casing					
80	80				
		ML			
85	85	CL			Gravelly Clay; very dark grayish brown (10YR 3/2); 60% clay; 35% fine subangular gravel; 5% medium to coarse grained sand; low plasticity; stiff; moist.
		ML			Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt; 20% medium to coarse grained sand; 20% fine to coarse subangular gravel; non-plastic; dry.
					@ 88 feet: moderately cemented layers; stiff.
90	90				@ 90 feet: trace cobble up to 3.5 inches.
95	95				
		ML			
100	100	SM			Silty Sand with Gravel; very dark grayish brown (10YR 3.2); 20% silt; 60% fine to coarse grained sand; 20% fine subangular gravel; non-plastic; moist.

LOG OF BORING PTR-1
(Continued)

WELL CONSTRUCTION	Depth	USCS	LITHOLOGIC DESCRIPTION
		SM	
	105	CL	Gravelly Clay; very dark grayish brown (10YR 3/2); 75% lean clay; 20% fine subangular gravel; 5% medium to coarse grained sand; low plasticity; moist.
Cement Grout		ML	Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt; 20% medium to coarse grained sand; 20% fine grained gravel; non-plastic; dry.
		CL	Gravelly Clay; very dark grayish brown (10YR 3/2); 75% clay; 20% fine subangular gravel; 5% medium to coarse grained sand; low plasticity; moist.
		ML	Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt; 20% medium to coarse grained sand; 20% fine grained gravel; non-plastic; moderately cemented; very stiff; dry.
6" Low Carbon Steel Blank Casing	110, 115	CL	Lean Clay with Sand; dark grayish brown (10Y 4/2); 90% clay; 10% medium to coarse grained sand; trace fine subangular gravel; low plasticity; weak to moderately cemented; stiff; wet.
Bentonite Seal	120	ML	Sandy Silt; dark grayish brown (10Y 4/2); 90% silt; 10% medium to coarse grained sand; trace fine subangular gravel; non-plastic; weak cementation; stiff; wet
	125	SM	Silty Sand with Gravel; dark grayish brown (10YR 4/2); 30% silt; 60% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; weak cementation; stiff; wet.
#2/12 Sand		CL	Lean Clay with Sand; dark grayish brown (10Y 4/2); 85% lean clay; 10% fine to coarse grained sand; low plasticity; wet.
		SM	Silt Sand with Gravel; dark grayish brown (10Y 4/2); 60% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; non-plastic; wet.
	130	CL	Lean Clay with Gravel; dark gray (2.5Y 4/1); 90% lean clay; 10% fine subangular gravel; low to medium plasticity; soft; wet.
6" Low Carbon Steel 0.02-inch Slotted Screen Casing		ML/CL	Clayey Silt; very dark gray (2.5Y 3/1); 55% silt; 45% clay; trace subangular gravel; low to no plasticity; moderately cemented layers; stiff; moist.
	135	ML	Silt with Gravel; dark grayish brown (2.5Y 4/2); 85% silt; 10% fine subangular gravel; non-plastic; moist. @ 136 feet: changes to 80% silt; 10% fine to coarse subangular gravel up to 3.5 inches; 5% coarse grained sand; weak to moderate cementation; stiff.

LOG OF BORING PTR-1
(Continued)



Depth	USCS	Lithologic Description
	ML	
	CL	Lean Clay with Gravel; dark grayish brown (2.5Y 4/2); 85% clay; 10% fine to coarse subangular gravel; 5% medium to coarse grained sand; low plasticity; moist.
140	ML	Gravelly Silt; dark grayish brown (2.5Y 4/2); 80% silt; 20% fine to coarse subangular gravel; non-plastic; moderate cementation; very stiff; moist. @ 144 feet: changes to weak cementation; wet.
145	CL	Sandy Clay; dark clay (5Y 4/1); 70% clay; 25% medium to coarse grained sand; 5% fine subangular gravel; low plasticity; weak cementation; medium stiff; wet.
150	SM	Silty Sand with Gravel; dark gray (5YR 4/1); 60% fine to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; trace of cobbles; non-plastic; wet.
	ML	Sandy Silt with Gravel; dark gray (5Y 4/1); 60% silt; 30% fine to medium grained sand; 10% fine to coarse subangular gravel; non-plastic; stiff; wet.
155	SM	Silty Sand with Gravel; brown (10YR 4/3); 60% medium to coarse grained sand; 30% silt; 10% fine subangular gravel; non-plastic; moist. @ 158 feet: chages to wet. @ 159 feet: thin zone of lean clay (~3 inches).
160	ML	Silt with Sand; very dark grayish brown (10YR 3/2); 90% silt; 10% coarse grained sand; non-plastic; moderate cementation; moist. @ 162 feet: changes to dark reddish brown (2.5YR 3/4); moderate cementation; hard; medium dry strength.
165	GM	Fine Silty Gravel; subangular gravel with some silt; moist.
	ML	Silt with Sand; very dark grayish brown (10YR 3/2); 90% silt; 10% coarse grained sand; no plasticity; moderate cementation; moist. @ 167 feet: changes Sandy Silt with Gravel; light gray (10YR 7/1); 60% silt; 20% coarse grained sand; 10% fine subangular gravel; non-plastic; weak cementation; stiff; dry. @ 169 feet: changes to moderate cementation.
170	CL	Lean Clay with Gravel; dark grayish brown (10YR 3/2); 95% clay; 5% medium to coarse grained sand; medium plasticity; wet.
	ML	Silt; dark grayish brown (10YR 3/2); 95% clay; 5% coarse grained sand; no plasticity; moderate cementation; very stiff; moist.

LOG OF BORING PTR-1
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION

#2/12 Sand

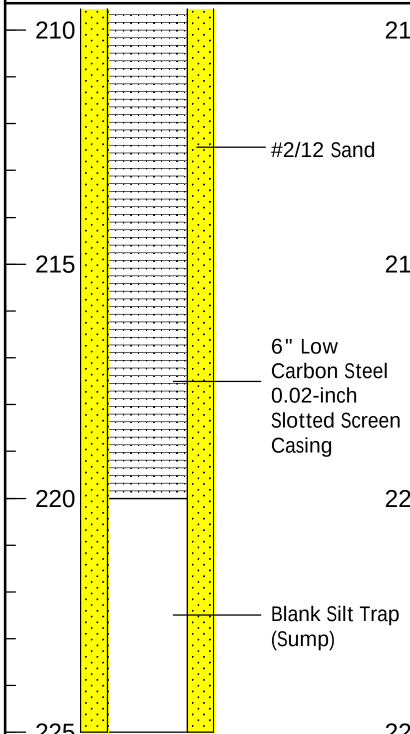
6" Low Carbon Steel 0.02-inch Slotted Screen Casing

Depth: 175, 180, 185, 190, 195, 200, 205

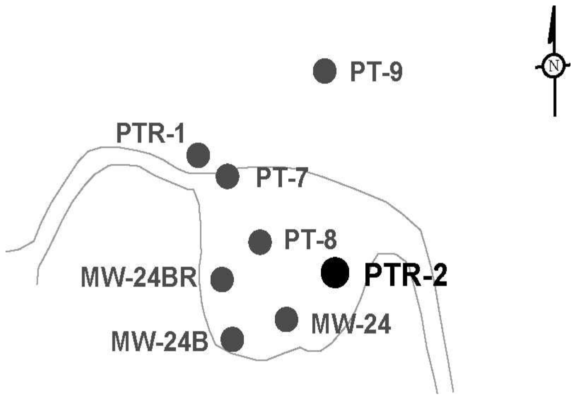
USCS	Lithologic Description
ML	
CL	Lean Clay with Gravel; dark grayish brown (10YR 4/2); 95% clay; 5% fine subangular gravel; medium plasticity; weak to moderately cemented; stiff to very stiff; wet.
ML	Silt with Gravel; dark reddish brown (5YR 3/2); 90% silt; 10% fine subangular gravel; non-plastic; weak cementation; stiff; wet. @ 179 feet: changes to Gravelly Silt; dark reddish brown (5YR 3/4); 70% silt; 25% fine subangular gravel; 5% medium to coarse grained sand; non-plastic; moist.
SM	Silty Sand with Gravel and Cobbles; dark reddish brown (5YR 3/4); 55% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; 5% cobbles up to 3.5 inches; wet.
CL	Lean Clay; medium plasticity.
SM	Silty Sand with Gravel and Cobbles; very dark grayish brown (2.5Y 3/2); 55% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; 5% cobbles up to 3.5 inches; wet.
CL	Lean Clay; medium plasticity.
SM	Silty Sand with Gravel and Cobbles; dark grayish brown (2.5Y 3/2); 55% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; 5% cobbles; wet.
ML	Sandy Silt with Gravel; light brownish gray (10YR 6/2); 60% silt; 30% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; moist. @ 190 feet: changes to wet. @ 191 feet: chages to moist.
CL	Gravelly Clay; light brownish gray (10YR 6/2); 80% clay; 20% fine subangular gravel; low to medium plasticity; wet.
ML	Gravelly Silt; light brownish gray (10YR 6/2); 70% silt; 25% fine subangular gravel; 5% coarse grained sand; non-plastic; moist.
SM	Silty Sand with Gravel; dark reddish brown (5YR 3/4); 55% medium to coarse grained sand; 30% silt; 15% fine subangular gravel; non-plastic; wet.
CL	Gravelly Clay; brown (10YR 4/3); 80% clay; 20% fine subangular gravel; medium plasticity; wet.
SP	Poorly Graded Sand; dark reddish gray (10R 4/1); 95% medium to coarse grained sand; 5% silt; wet. Occasional 1-2 inch layers of Sandy Silt; dark reddish gray (10R 4/1); 80% silt; 20% fine to coarse grained sand.
CL	Lean Clay with Sand; dark red (10YR 3/6); 90% clay; 10% coarse grained sand; medium plasticity; wet.

LOG OF BORING PTR-1
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



Depth	USCS	Sample	Key	Lithologic Description
210				Boring logged to 210 feet bgs
215				
220				
225				End of boring at 225 feet bgs



LOG OF BORING PTR-2

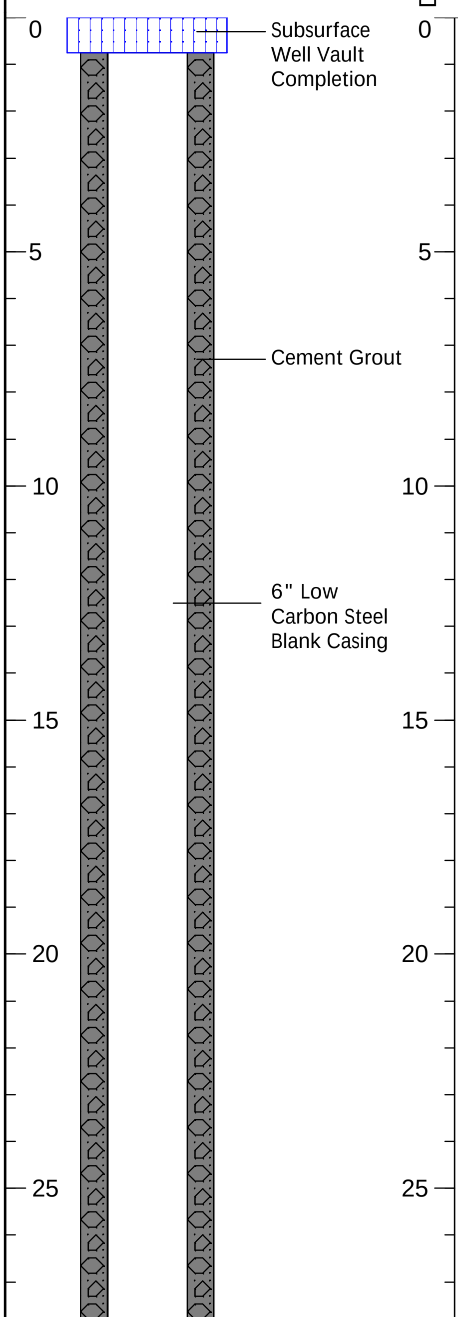
PG&E Topock Site
Needles, California

Project No.:	RC000689.0004	Date Started:	22 May 2007
Logged by:	B. Bardsley/ B. Evans	Date Completed:	2 June 2007
Drilling Co.:	WDC	Drilling Method:	Rotosonic/Mud Rotary
Drillers:	Rivera, West, Sakioka, Villegas	Sample Method:	4" x 6" Core Rod
Well Permit #2007040410		Driller's License:	C57-283326

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 10



USCS	Sample	Key	Lithologic Description
ML			Silt with Gravel; pale brown (10YR 6/3); 90% silt, 10% fine subangular gravel; non-plastic; very soft; dry.
			@ 4 feet: changes to Gravelly Silt; pale brown (10YR 6/3) and light gray (10YR 7/1); 60% silt; 30% fine to coarse subangular gravel; 10% medium to coarse grained.
			@ 6 feet: changes to Sandy Silt with Gravel; light gray (10YR 7/1); 70% silt; 20% fine to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; very soft; dry.
			@ 8 feet: changes to pale brown (10YR 6/3).
			@ 12 feet: changes to Silt with Gravel; light gray (10YR 7/2); 90% silt; 10% fine subangular gravel; trace medium to coarse grained sand; non-plastic; very soft; dry.
			@ 14 feet: changes to Sandy Silt with Gravel; light gray (10YR 7/1); 70% silt; 20% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; very soft; dry.
			@ 16 feet: changes to coarse subangular gravel.
ML			@ 18 feet: changes to fine subangular gravel and has weakly cemented and hard 1-inch layers.
CL			Lean Clay with Sand; dark reddish gray (2.5YR 4/1); 90% lean clay; 10% fine to coarse grained sand; low plasticity; very soft; moist.
ML			Silt with Sand; dark reddish gray (2.5YR 4/1); 90% silt; 10% fine to coarse grained sand; non-plastic; weak cementation; hard; dry.
			@ 23 feet: Sandy Silt with Gravel; light reddish gray (2.5YR 7/1); 70% silt; 20% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; soft; dry.
			@ 25 feet: 2-inch layer that is weakly cemented; very stiff; friable.
			@ 26.5 feet: changes to 60% silt; 20% fine to coarse grained sand; 20% fine to coarse subangular gravel.

LOG OF BORING PTR-2
(Continued)

WELL CONSTRUCTION — Depth — USCS — Sample — Key — LITHOLOGIC DESCRIPTION

Well construction: Cement Grout; 6" Low Carbon Steel Blank Casing

Depth scale: 30, 35, 40, 45, 50, 55, 60

USCS	Lithologic Description
ML	@ 29 feet: changes to 70% silt; 20% fine to coarse grained sand; 10% fine to coarse subangular gravel. @ 32 feet: 2-inch layer that is weakly cemented; very stiff.
SM	Silty Sand with Gravel; dark reddish gray (2.5YR 4/1); 70% fine to coarse grained sand; 20% silt; 10% fine subangular gravel; moist.
ML	Sandy Silt with Gravel; light reddish gray (2.5YR 7/1); 50% silt; 30% fine to coarse grained sand; 20% fine to coarse subangular gravel; non-plastic; very soft; dry. @ 37 feet: changes to Silt with Sand; 90% silt; 10% fine to coarse grained sand. Contains weakly cemented 1-inch layers; friable; very stiff.
SM	Silty Sand; red (2.5YR 4/8); 80% fine to coarse grained sand; 20% silt; trace fine subangular gravel; dry. Contains weakly cemented layers up to 3-inches; friable; very stiff. @ 41 feet: increasing to 10% fine to coarse subangular gravel. @ 43 feet: larger percentage of material is light reddish gray (2.5YR 7/1). @ 45 feet: changes to Silty Sand with Gravel; dark reddish gray (2.5YR 4/1); 70% fine to coarse grained sand; 20% silt; 10% fine to coarse subangular gravel; dry.
ML	Sandy Silt with Gravel; light reddish gray (2.5YR 7/1); 60% silt; 30% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; very soft; dry. Contains weakly cemented layers; very stiff; friable.
SM	Silty Sand with Gravel; very dark grayish brown (10YR 3.2); 20% silt; 60% fine to coarse grained sand; 20% fine subangular gravel; no plasticity; moist.
SP	Poorly Graded Sand with Gravel; dark reddish gray (2.5YR 3/1); 85% medium to coarse grained sand; 15% fine subangular gravel; moist.
ML	Silt with Sand; light reddish gray (2.5YR 7/1); 90% silt; 10% medium to coarse grained sand; moderately cemented; friable; non-plastic; very stiff; dry. @ 55 feet: Sandy Silt with Gravel; dark reddish gray (2.5YR 4/1); 60% silt; 30% fine to coarse grained sand; 10% fine to coarse gravel; non-plastic; moist.
SM	Silty Sand with Gravel; reddish gray (2.5YR 5/1); 50% fine to very coarse grained sand; 30% coarse subangular gravel; 20% silt; non-plastic; dense; moist.
ML	Sandy Silt with Gravel; weak red (2.5YR 5/2); 60% silt; 30% fine to medium coarse grained sand; 10% fine to medium grained subangular gravel; non-plastic; dense; dry.
CL	Lean Clay with Gravel; dark grayish brown (10YR 4/2); 80% lean clay; 10% fine subangular gravel; 10% fine grained sand; low plasticity; moist.
ML	Sandy Silt with Gravel; reddish gray (2.5YR 6/1); 70% silt; 20% fine to coarse grained sand; 10% subangular gravel; dense; crumbly; dry.

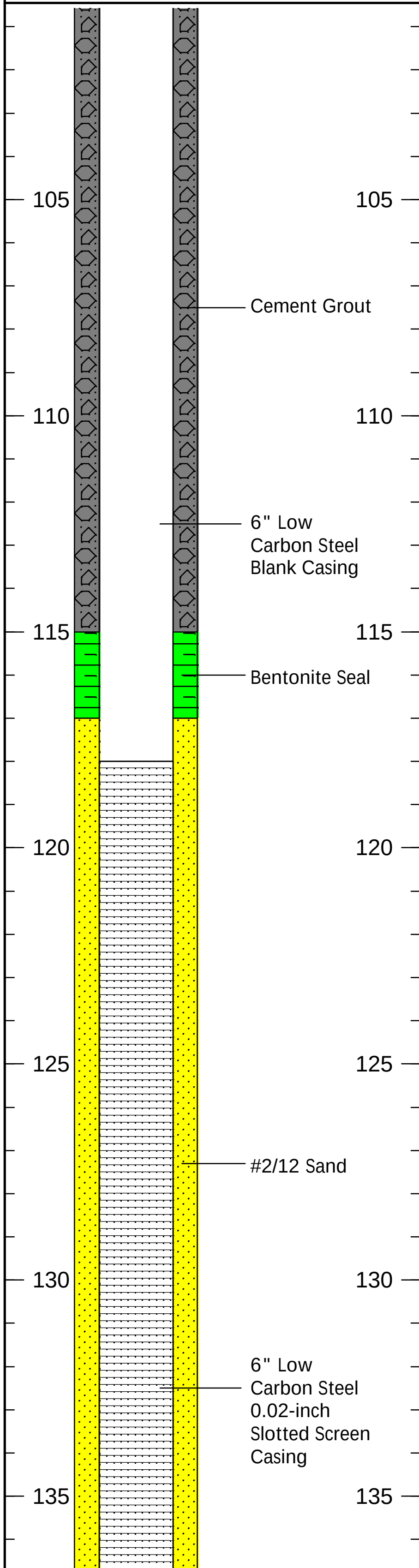
LOG OF BORING PTR-2
(Continued)

WELL CONSTRUCTION: Cement Grout; 6" Low Carbon Steel Blank Casing

Depth	USCS	LITHOLOGIC DESCRIPTION
65	ML	@ 65 feet: light reddish gray (2.5YR 7/1); solid pieces very dense; brittle; hard. Increased amount of gravel; dark greenish gray (GLEY1 4/1); crystalline.
69.5	CL	Sandy Clay; dark reddiah gray (2.5YR 4/1); 70% clay; 30% medium to coarse grained sand; trace subangular gravel; low plasticity; moist.
70	SM	Silty Sand with Gravel; dark reddish gray (2.5YR 3/1); 50% fine to coarse grained sand; 30% silt; 20% fine to medium subangular gravel; loose with dense pieces; dry.
72.5	ML/SM	Sandy Silt with Gravel; weak red (2.5YR 4/2); 50% silt; 30% fine to coarse grained sand; 20% fine to coarse subangular gravel; non-plastic; dense to soft; dry-moist. Contains some white cemented layers (0.25 to 1-inch thick). @ 75 feet: light brownish gray (10YR 6/2); 50% fine to coarse grained sand; 30 to 40% silt; 10 to 20% angular to subangular gravel; dense; dry. Sand and gravel are dark greenish gray, crystalline. Contains cemented white material.
80	CL	Clay with Gravel; greenish gray (GLEY1 6/1); 80 to 90% powdery clay; 10 to 20% fine to very coarse subangular gravel; cobbles up to 3-inch diameter; loose; dry.
81	ML	Sandy Silt with Gravel; light reddish grey (2.5YR 7/1); 50% silt; 30 to 40% fine to very coarse grained subangular sand; 10 to 20% fine to coarse sand; loose with hard brittle pieces; dry; heavily cemented with white material. @ 83 feet: decreasing gravel; increasing sand; moist.
85	CL	Silty Sand with Gravel; dark grayish brown (10YR 4/2); 70% clay; 20% fine to coarse subaungular to angular gravel; 10% fine to coarse grained sand; loose; moist.
86	ML	Sandy Silt with Gravel; reddish grey (2.5YR 6/1); 60 to 70% silt; 20% fine to coarse grained sand; 10 to 20% fine to coarse subangular-angular gravel; non-plastic; loose; dry to moist. @ 87 feet: becoming dark grayish brown (10YR 4/2); wet.
91	CL	Lean Clay with Gravel; dark grayish brown (10YR 4/2); 80% clay; 20% fine to coarse angular-subangular gravel; medium plasticity; medium stiff; moist to wet.
93	ML	Sandy Silt with Gravel; reddish gray (2.5YR 6/1); 70% silt; 20% fine to coarse angular to subangular gravel; 10% fine to coarse sand; loose with harder cemented pieces; moist.
98	CL	Lean Clay with Gravel; light brownish gray (10YR 6/2); 90% powdery clay; 10% fine to coarse angular to subangular gravel; medium plasticity; dry.
100		Sandy Silt with Gravel; reddish grey (2.5YR 6/1); 60 to 70% silt; 20% fine to coarse

LOG OF BORING PTR-2
(Continued)

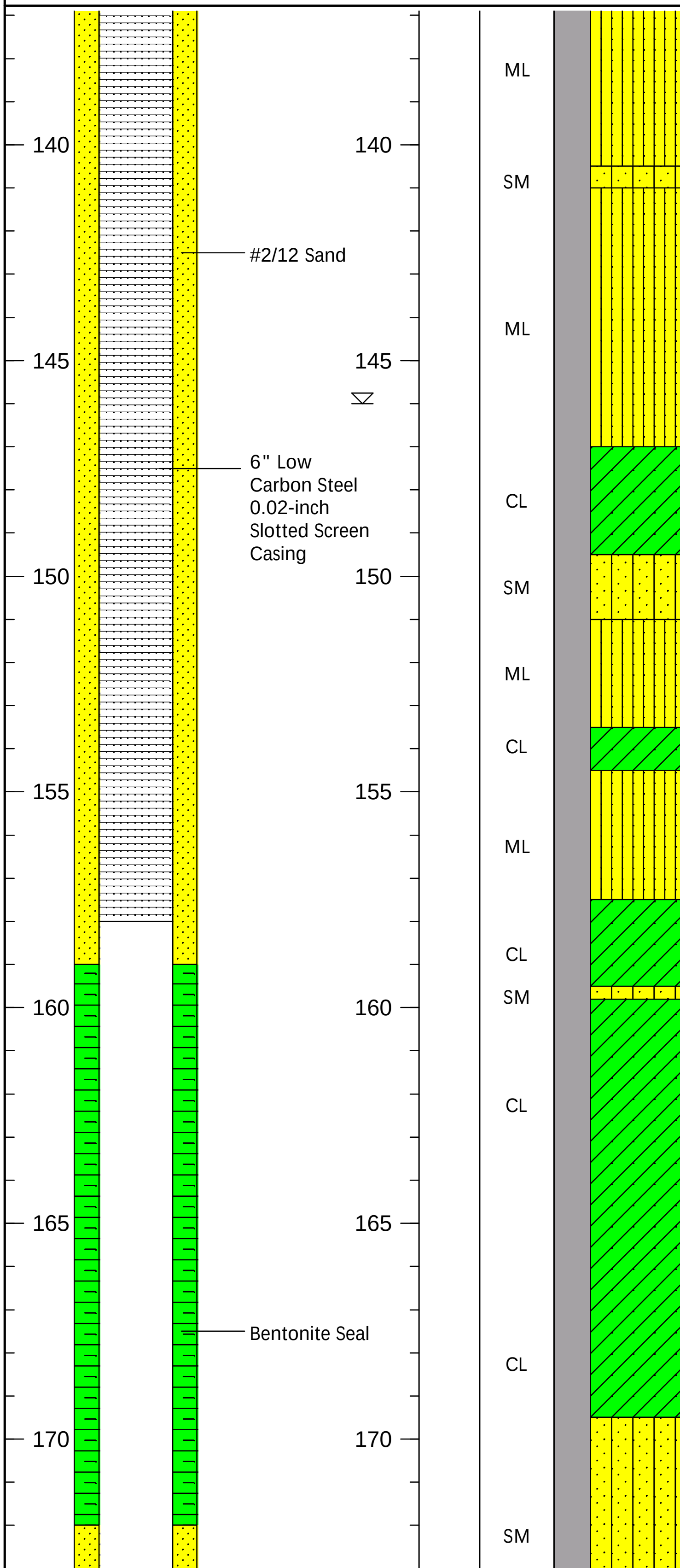
WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



USCS	LITHOLOGIC DESCRIPTION
ML	grained sand; 10 to 20% fine to coarse subangular to angular gravel; non-plastic; loose; dry to moist.
CL	Lean Clay; dark grayish brown (10YR 9/2); 80% clay; 10% fine to coarse sand; 10% fine to coarse angular to subangular gravel; medium plasticity; wet.
ML	Sandy Silt with Gravel; light brownish gray (10YR 6/2); 60% silt; 20% fine to coarse grained sand; 20% fine to coarse angular to subangular gravel; non-plastic; loose with cemented pieces; dry. @ 105 feet: clay increases; slightly plastic; moist to wet.
SM	Silty Sand with Gravel; dark reddish grey (5YR 4/2); 50% fine to very coarse grained sand; 40% silt; 10% fine to coarse angular to subangular gravel; very well graded; stiff; moist to wet.
ML	Sandy Silt with Gravel; dark reddish gray (5YR 4/2); 60-70% silt; 20-30% fine to coarse grained sand; 10% fine to coarse angular to subangular gravel; well graded gravel; stiff; moist to wet. @ 111 feet: changes to Sandy Silt; dark grayish brown (10YR 4/2); 70% silt; 30% fine to coarse grained sand; trace fine gravel; well graded; non-plastic; sporadic cementing; stiff; moist. @ 113 feet: increasing gravel.
SM	Silty Sand with Gravel; dark grayish brown (10YR 4/2) mottled with reddish brown (2.5YR 4/3); 50% fine to very coarse grained sand; 40% silt; 10% fine to very coarse angular to subangular gravel; well graded; minor cementing; stiff; moist.
ML	Sandy Silt with Gravel; reddish brown (5YR 4/3); 60 to 70% silt; 20 to 30% fine to coarse grained sand; 10% fine to coarse angular to subangular gravel; well graded; firm; stiff; very moist.
SM	Silty Sand with Gravel; reddish brown (5YR 4/3); 50 to 60% fine to coarse grained sand; 40 to 50% silt; 10% fine to very coarse angular to subangular gravel; well graded; minor cementing; very stiff; dense; very moist. @ 119.5 feet: interbedded silt layers 0.8 to 1-inch thick; grayish brown (10YR 5/2). @ 122 feet: varying percentages of silt and sand.
ML	Sandy Silt to Silty Sand with Gravel; varying percentages; very moist; interbedded silt layers.
SM	Silty Sand with Gravel; reddish brown (5YR 4/3); 50 to 60% fine to very coarse grained sand; 30 to 40% silt; 10% fine to coarse subangular gravel; very well graded; medium stiff; loose; wet.
GW	Sand and Gravel; multicolored grains; 60 to 70% medium to very coarse sand; 30 to 40% fine to very coarse subangular gravel; well graded coarse mix; loose; wet.
ML	Sandy Silt with Gravel; reddish brown (5YR 4/3); 60% silt; 30% medium to very coarse grained sand; 10% fine to coarse angular to subangular gravel; moderately stiff; wet. @ 132.8 feet: variable percentages of sand and silt; 30 to 90% gravel and cobbles.
SM	Silty Sand; grayish brown (10YR 5/2); 60-70% medium to very coarse grained sand; 20% silt; 10 to 20% fine to very coarse angular to subangular gravel; well graded with gravel; loose to medium stiff; loose; wet.
ML	Silty Sand with Gravel; grayish brown (10YR 5/2); 60 to 70% medium to very coarse grained sand; 20% silt; 10 to 20% fine to very coarse angular to subangular gravel; slightly plastic; medium stiff; sticky; wet.

LOG OF BORING PTR-2
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



USCS	Lithologic Description
ML	@ 135 feet: Sandy Silt with Gravel; dark grayish brown (10YR 4/2); 60% silt; 20% fine to very coarse subangular to subrounded gravel; 20% fine to coarse sand; very stiff; dense; moist.
SM	Silty Sand with Gravel; dark grayish brown (10YR 4/2); 60% fine to medium coarse grained sand; 30% silt; 10% fine to very coarse angular to subangular gravel; moderately graded; moderately stiff and dense; moist.
ML	Sandy Silt with Gravel; dark grayish brown (10YR 4/2); 60% silt; 20% fine to very coarse subangular to subrounded gravel; 20% fine to coarse sand; very stiff; dense; moist. @ 141.5 feet: changes to light brownish gray (10YR 6/2); 50% silt; 50% fine to very coarse angular gravel and rock fragments; loose; dry. @ 142.5 feet: changes to brown (7.5YR 4/3); 60% silt; 30% fine to very coarse angular/subangular gravel; 10% fine to coarse sand; very stiff and dense; moist. @ 145 feet: 40% coarse angular gravel; moist.
CL	Sandy Clay with Silt and Gravel; dark grayish brown (10YR 4/2); 40% clay; 30% silt; 20% fine to coarse grained sand; 10% fine to very coarse gravel; slighty plastic; soft; sticky; moist to wet. @ 149 feet: increasingly more silty and dense.
SM	Silty Sand with Gravel; dark grayish brown (10YR 4/2); 50% medium to very coarse grained sand; 30% silt; 20% fine to very coarse angular to subangular gravel; very stiff; very dense; moist. @ 150 feet: some white cementation.
ML	Sandy Silt with Gravel; grayish brown (10YR 5/2); 70% silt; 20% fine to coarse angular to subangular gravel; non-plastic; firm; very dense; moist; cemented with white material.
CL	Clay with Gravel; greenish gray (GLEY1 6/1); 80% powdery clay; 20% fine to very coarse angular gravel; loose; dry.
ML	Sandy Silt with Gravel; gray (10YR 5/1) mottled with brown (10YR 5/3); 70% silt; 10 to 20% fine to very coarse sand; 10 to 20% fine to very coarse angular to subangular gravel; non-plastic; very firm; dense; moist to dry. Some silt layering: 3 1-inch thick silt light brownish gray (10YR 6/2).
CL	Sandy Silty Lean Clay; grayish brown (10YR 5/2) mottled with dark red (10YR 3/6); 70% clay; 20% fine to coarse sand; trace fine to very coarse angular gravel; medium plasticity; slightly soft; moist to wet.
SM	Silty Sand with Gravel; grayish brown (10YR 5/2); 60% fine to very coarse grained sand; 20% silt; 20% fine to coarse angular to subangular gravel; well graded; loose with cemented pieces; moist to dry.
CL CL	Clay with Gravel; greenish gray (GLEY1 6/1); 80% powdery clay; 20% fine to very coarse angular gravel; loose; moist. @ 160.5 feet: changes to Sandy Clay with Gravel; dark reddish gray (5YR 4/2); 60% clay; 15% fine to coarse grained sand; 15% fine to coarse angular to subangular gravel; 10% silt; medium plasticity; soft; very moist to wet. Sand and gravel percentages vary in clay matrix. @ 163 feet: changes to Sandy Clay; 20 to 30% silt; non-plastic; firm with brittle pieces; moist to dry. @ 164 feet: Sandy Clay with Gravel; brown (7.5YR 4/2); 60 to 70% clay; 15% fine to coarse grained sand; 15% fine to very coarse angular to subangular gravel; medium plasticity; firm; densely packed sand and gravel in silt matrix; very moist to wet. @ 166-167 feet: sand and gravel percentages increasing to 25%; color changes to reddish brown (5YR 4/3).
SM	Clayey Sand with Gravel; reddish brown (5YR 4/3); 60% fine to coarse grained sand; 20% fine to coarse angular to subangular gravel densely packed in a 20% clay matrix; very firm; hard; very dense; moist. Secondary cementation with white material. @ 171 to 175 feet: interbedded silt layers; 100% silt; brown (7.5YR 4/3); 0.5-inch thick and less; 2-4-inch spacing; sand and gravel percentages varying; some mottling caused by reddish brown (5YR 4/4) clay.

LOG OF BORING PTR-2
(Continued)

Depth	USCS	Lithologic Description
176	SM	@ 176 feet: changes to dark reddish brown (2.5YR 3/4); 60% fine to very coarse sand; 30% clay; 10% fine to coarse subangular gravel; low plasticity; soft; wet.
179		@ 179 feet: changes to 50% sand; 40% clay; moderately plastic.
180		@ 180 feet: varying percentages of sand, clay and gravel; soft; sticky.
183		@ 183 feet: Sandy Clay with Gravel; 60% clay; 20% fine coarsed grained sand; 20% fine to very coarse angular to subangular gravel; medium plasticity.
184		@ 184 feet: 60% fine to very coarse sand; 30% clay; 10% fine to coarse subangular gravel; low to medium plasticity.
187	SM	@ 187 feet: 80% sand; 20% clay; 10% gravel; slightly loose.
190		@ 190 feet: changes to grayish brown (10YR 5/2); 70 to 80% medium to coarse sand; 15 to 20% clay; 5 to 10% fine to very coarse subangular gravel; moderately graded; loose.
191–195	CL	Sand and Clay with Gravel; grayish brown (10YR 5/2); 60 to 70% clay; 20 to 30% fine to very coarse sand; 10 to 20% fine to very coarse angular-subangular gravel; moderately plastic; medium soft; wet. @ 192-192.5 feet: zones of cemented sand.
195–202	ML	Sandy Silt with Gravel; grayish brown (10YR 5/2); 70% silt; 20% fine to coarse sand; 10% fine to very coarse aungular to subangular gravel; slightly plastic; soft; moist; cemented sand zones throughout.
199	ML	@ 199 feet: changes to reddish brown (5YR 4/3); 70% silt; 15% fine to coarse grained sand; 15% fine to very coarse angular to subangular gravel; non-plastic; very hard; moist-dry. Dense silt matrix with sand and gravel.
202		@ 202 feet: changes to moist and decreasing hardness.
202–207	SM	Silty Sand with Gravel; reddish brown (5YR 4/3); 50% fine to coarse grained sand; 30% silt; 20% fine to very coarse angular to subangular gravel; non-plastic; very hard; dense; moist; secondary cementation. @ 203 feet: 60% sand; 20% silt; very cemented; hard; brittle; dry to moist. @ 204.5 feet: reddish brown (2.5YR 4/1); 50% fine to coarse grained sand; 35% silt; 15% fine to very coarse angular to subangular gravel; slightly plastic; moderately soft; moist to wet. @ 206 feet: extremely dense; hard; dry to moist; very compacted silt, sand and gravel mix.
207–	ML	Sandy Silt with Gravel; reddish brown (2.5YR 3/4); 50% silt; 30% fine to coarse grained sand; 20% fine to coarse aungular to subangular gravel; non-plastic; firm; hard; moist to very moist.

WELL CONSTRUCTION (175–209 ft): #2/12 Sand; 6" Low Carbon Steel 0.02-inch Slotted Screen Casing

Depth scale: 175, 180, 185, 190, 195, 200, 205

LOG OF BORING PTR-2
(Continued)

WELL CONSTRUCTION — Depth — USCS — Sample — Key — LITHOLOGIC DESCRIPTION

Well construction labels: #2/12 Sand; 6" Low Carbon Steel 0.02-inch Slotted Screen Casing; Blank Silt Trap (sump)

Depth	USCS	Lithologic Description
210	SM	Silty Sand with Gravel; reddish brown (2.5YR 3/4); 50% medium to very coarse grained sand; 40% silt; 10% fine to very coarse subangular gravel; well graded; soft; loose; wet; sticky.
	ML	Sandy Silt with Gravel; reddish brown (2.5YR 3/4); 50% silt; 30% fine to coarse grained sand; 20% fine to coarse aungular-subangular gravel; non-plastic; hard; moist to very moist. @ 211.3 feet: reddish brown (5YR 4/3); 60% silt and clay; 20% fine to coarse grained sand; 20% fine to coarse subangular to subrounded gravel; slightly plastic; moderately soft; wet; sticky.
215	SM	Silty Sand with Gravel; reddish brown (5YR 4/3); 70% fine to coarse grained sand; 20% silt; 10% fine to coarse gravel; well graded; soft; loose; wet; sticky.
	ML	Silty Sand with Gravel; reddish brown (5YR 4/3) and yellowish red staining (5YR 4/6); 50% silt; 20% fine to coarse grained sand; 25% fine to coarse angular to subangular gravel; non-plastic; hard; dense; moist. @ 216.5 feet: pieces of weathered bedrock; dry to moist.
		Bedrock; broken pieces conglomerate; dry.
220		Boring logged to 220 feet bgs
		End of boring at 223 feet bgs

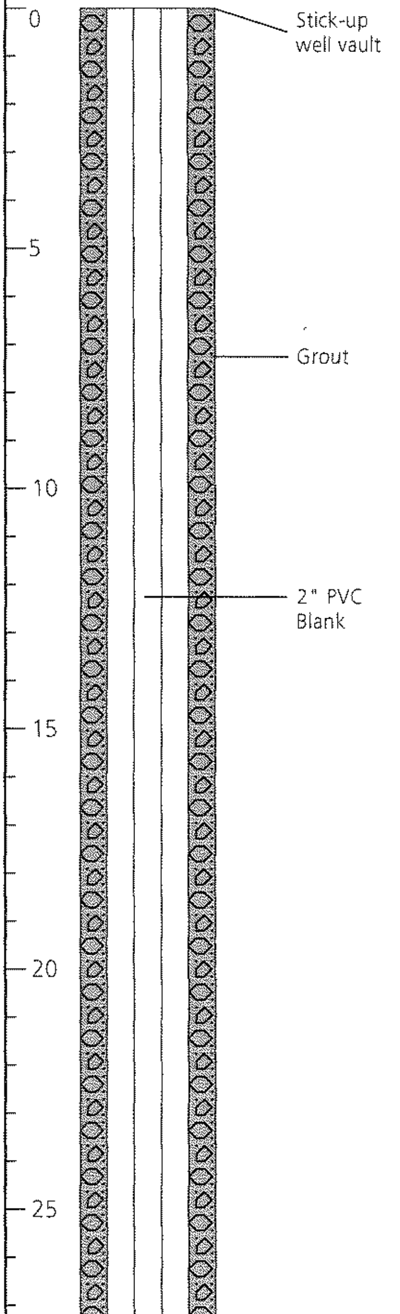
LOG OF BORING PT-1

PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.: RC000689.0001	Date Started: 31 January 2006
Logged by: J. Ely	Date Completed: 31 January 2006
Drilling Co.: Prosonic Corporation	Drilling Method: Sonic
Driller: Don Youngblood	Sample Method: Core
Well Permit #: 2006010013	Driller's License: C57-756217

WELL CONSTRUCTION

Boring Diameter (inches): 10 inches
Casing Diameter (inches): 2 inches

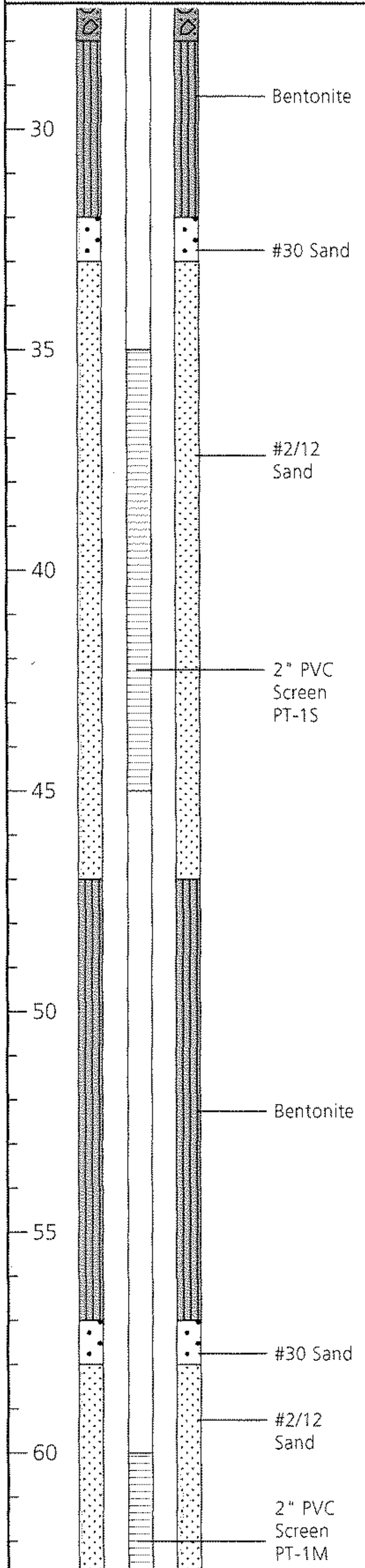


LITHOLOGIC DESCRIPTION

Depth	Headspace (ppm)	Blows/ft.	Sample	Key	Description
0					Poorly Graded Sand (SP), pale brown, (10YR 6/3), 100% fine grained sand, loose, dry.
10.5					@ 10.5 ft bgs: changes to yellowish brown (10YR 5/6), damp.
17					@ 17 ft bgs: changes to dark yellowish brown (10YR 3/4).
20					@ 20 ft bgs: changes to very dark grayish brown, wet.
22					@ 22 ft bgs: changes to 95% fine grained sand, 5% silt.

LOG OF BORING PT-1
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



Depth	Lithologic Description
	Silt and Clay (ML/CL), very dark gray, 60 to 70% silt, 25% clay, 5 to 10% fine grained sand, medium stiff, medium plasticity.
	@ 31 ft bgs: wood char found.
	@ 33 ft bgs: trace organics
	Well Graded Sand (SW), very dark grayish brown (10YR 3/2), 70 to 80% fine grained sand, 20 to 30% silt, medium dense, wet.
40	Silt with Clay (ML), 50% silt, 50% clay, plastic, medium stiff, wet.
	Poorly Sorted Sand (SP), 100% coarse grained sand.
	Well Graded Sand (SW), very dark brown (10YR 2/2), 80% fine grained sand, 20% silt, wet.
	@ 44 ft bgs: changes to 10% clay
	@ 44.5 ft bgs: changes to 0% clay
	@ 47 ft bgs: changes to brown (10YR 4/3), 85% fine grained sand, 10% silt, 5% clay, trace gravel, very loose, wet.
	@ 52 ft bgs: changes to medium dense.
	@ 55 ft bgs: changes to very loose
	No Recovery from 57 to 67 ft bgs. Large rock stuck in drill bit.

LOG OF BORING PT-1
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION

#2/12 Sand

2" PVC Screen PT-1M

Bentonite

#30 Sand

#2/12 Sand

2" PVC Screen PT-1D

Depth: 65, 70, 75, 80, 85, 90, 95

Well Graded Gravel (GW), dark reddish brown (5YR 3/3), 80% coarse to fine gravel, 10% cobbles, 10% fine grained sand, subangular to subrounded, loose, wet.

Pooly Graded Gravel with Sand (GP), 80% coarse to fine gravel, 15% coarse sand, 5% silt, 5% cobbles, very angular to very rounded.

@ 75 ft bgs: changes to 20% coarse sand, dense.

@ 81 ft bgs: changes to 10 to 15% clay, trace cobbles, very angular to subrounded.

@ 83 ft bgs: changes to loose.

@ 84 ft bgs: changes to medium dense, 6-inch layer of 40% clay.

@ 86 ft bgs: changes to 5% cobbles.

@ 89 ft bgs: changes to medium dense to loose.

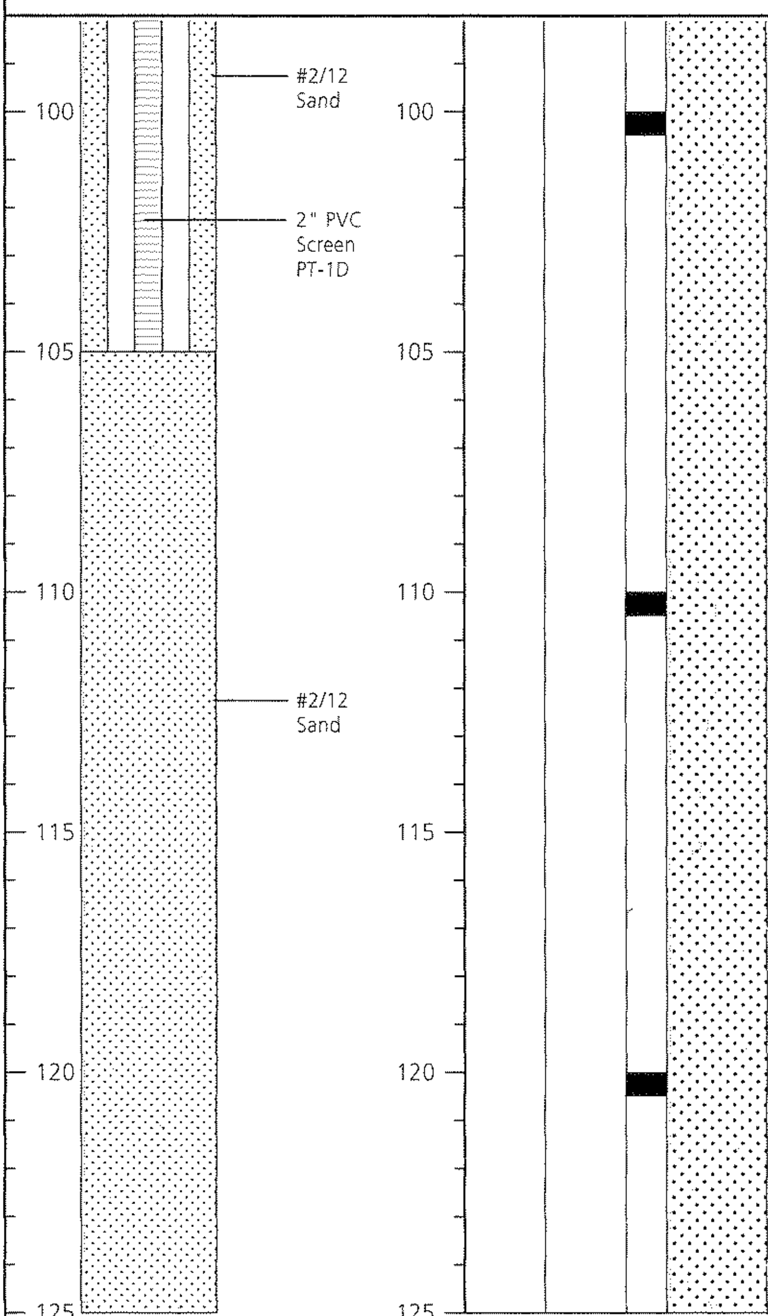
@ 90 changes to dark reddish brown (5YR 3/3), 10% very angular to subrounded cobbles, coarse grained, angular sand.

Well Graded Sand with Gravel (SW), 80%% coarse grained sand, 18% gravel (very angular), 1% cobbles (~3 inches), 1% silt, loose.

@ 97.5 ft bgs: changes to 10% clay, loose to medium dense.

LOG OF BORING PT-1
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 101 ft bgs: changes to 5% clay, very loose to loose.

@ 104 ft bgs: changes to 10% clay, loose.

@ 106 ft bgs: changes to medium dense.

@ 109 ft bgs: changes to very dark grayish brown (10YR 3/2), 70% coarse sand, 25% gravel, very angular, loose.

@ 111.5 ft bgs: one cobble, 7 inches.

@ 113 ft bgs: changes to very loose.

@ 117 ft bgs: changes to 5 inch cobbles and fine to coarse gravel.

@ 123 ft bgs: changes to dark reddish brwon (2.5YR 3/3), clast size varies, dense, slightly cemented, very angular, possible bedrock.

End of Boring at 125 ft bgs.

LOG OF BORING PT-2

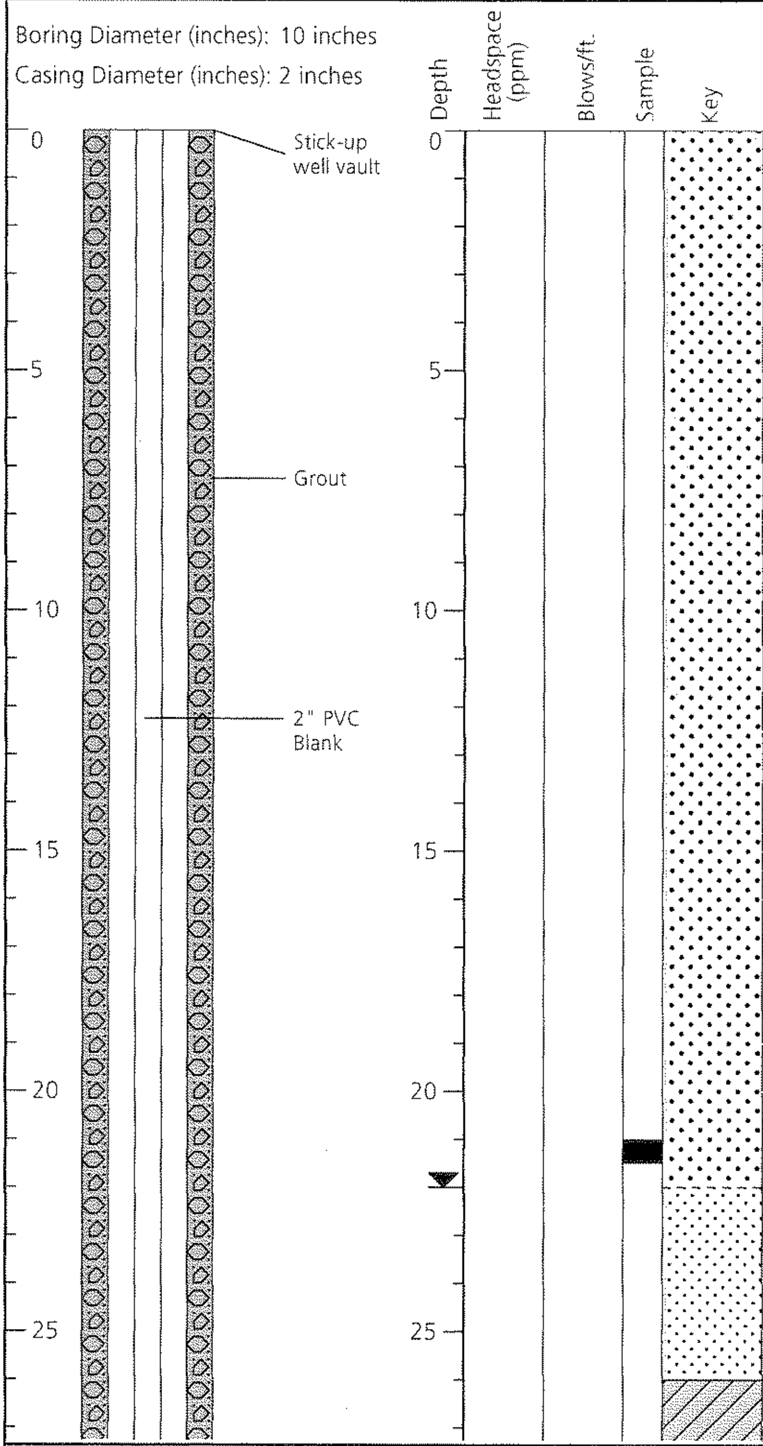
PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.:	RC000689.0001	Date Started:	7 February 2006
Logged by:	J. Ely	Date Completed:	8 February 2006
Drilling Co.:	Prosonic Corporation	Drilling Method:	Sonic
Driller:	Don Youngblood	Sample Method:	Core
Well Permit #:	2006010012	Driller's License:	C57-756217

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 10 inches
Casing Diameter (inches): 2 inches



Poorly Graded Sand (SP), 100% fine grained sand, very loose, dry, trace roots.

@ 12.5 ft bgs: changes to yellowish brown (10YR 5/4), damp.

@ 15 ft bgs: changes to 90% fine grained sand, 10% silt.

@ 16 ft bgs: changes to 100% fine grained sand.

@ 19 ft bgs: changes to dry.

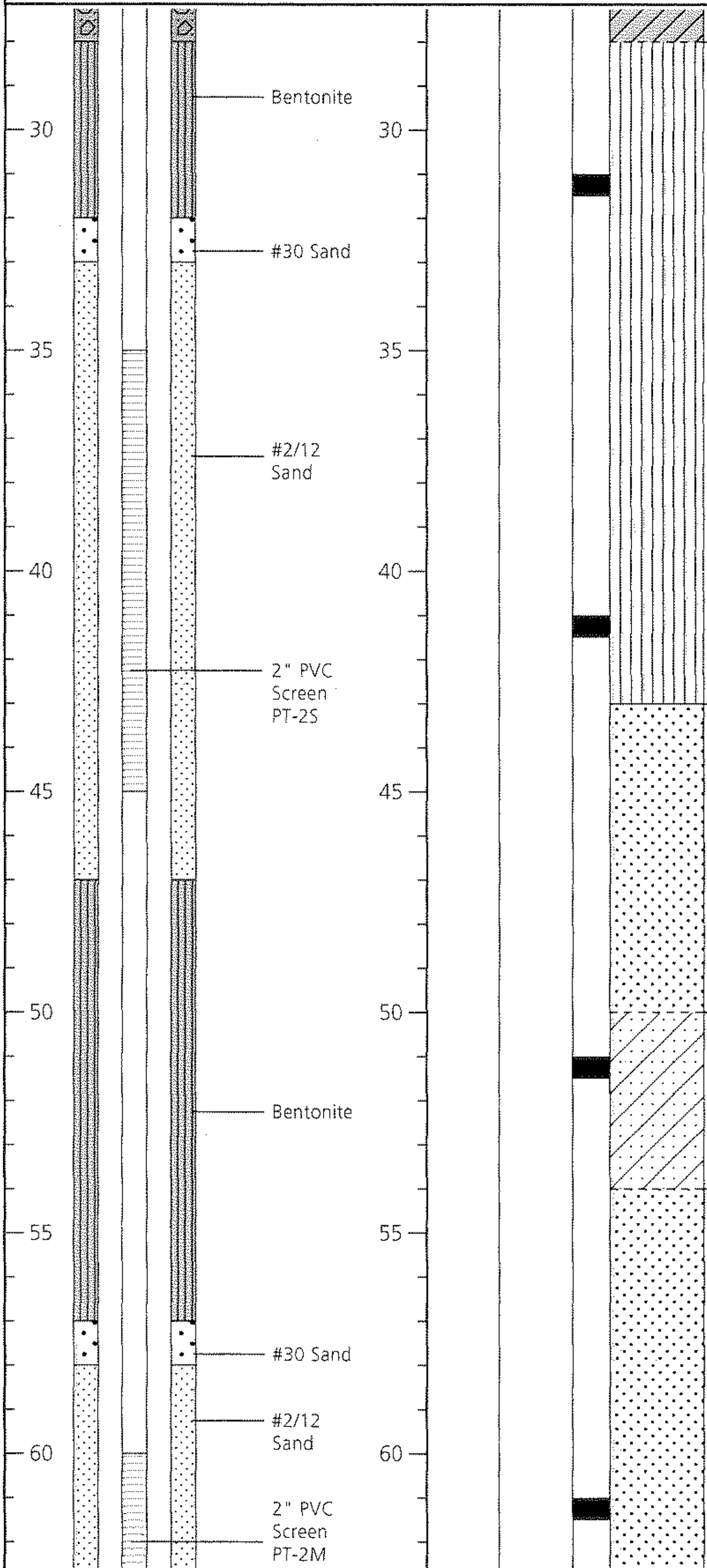
@ 20 ft bgs: changes to dark yellowish brown (10YR 4/4), moist.

Well Graded Sand (SW), dark yellowish brown (10YR 4/4), 85% fine grained sand, 10% silt, 5% clay, very loose, damp.

Clay (CL), dark gray (10YR 4/1), 80% clay, 10% fine grained sand, 10% silt, very stiff, high plasticity, moist.

LOG OF BORING PT-2
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION



Silt and Clay (ML/CL), dark gray (10YR 4/1), 45% clay, 45% silt, 10% fine grained sand, stiff, medium plasticity, wet.

@ 31 ft bgs: changes to Silt (ML), very dark grayish brown (10YR 3/2), 70% silt, 25% clay, 5 % fine grained sand, soft to medium stiff, low plasticity, wet.

@ 35 ft bgs: changes to 1% mica particles.

@ 40 ft bgs: changes to grayish brown (10YR 5/2), to yellow brown (10YR 5/4), 15% fine grained sand, 1% rounded gravel.

Well Graded Sand with Silt and Gravel (SW), dark reddish brown (2.5 YR 3/3), 75% fine to coarse grained sand, rounded to very angular, 15% gravel (up to 20mm) angular to very angular, 10% silt and clay, very loose, wet.

@ 48 ft bgs: changes to Well Graded Sand and Gravel (SW), medium dense, wet.

Well Graded Sand with Clay (SC), 20% clay.

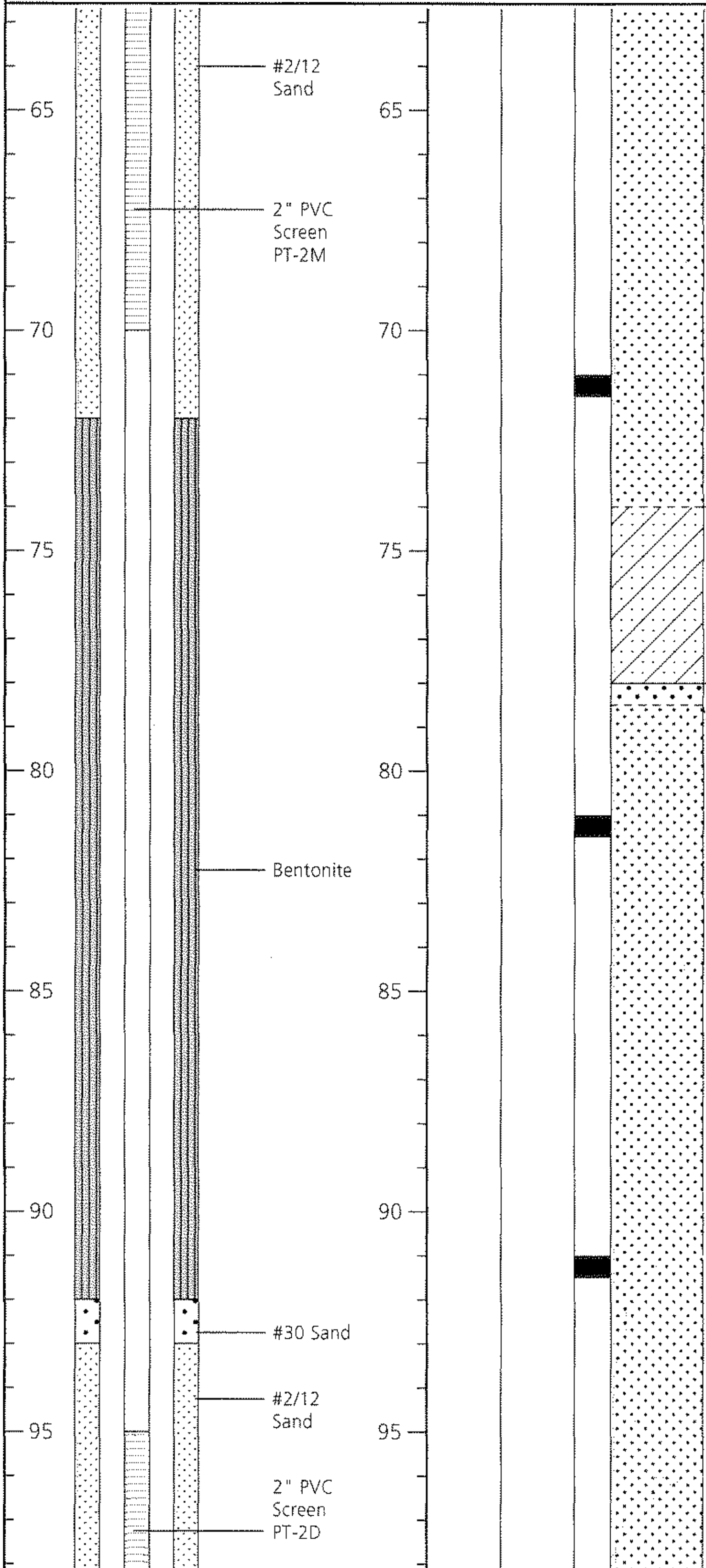
@ 52 ft bgs: changes to very dense, moist.

Well Graded Sand with Clay (SW), reddish brown, 10% clay, coarse sand, angular gravel, very dense, moist.

@ 59 ft bgs: changes to very angular gravel (up to 10mm), cobbles up ot 4 inches, medium dense to loose, wet.

LOG OF BORING PT-2
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 63 ft bgs: changes to dark reddish brown (2.5YR 3/3), 5% silt and clay, loose.

@ 68 ft bgs: changes to 70% coarse sand, 20% subrounded to very angular gravel, 5% very angular to subrounded cobbles.

@ 70 ft bgs: changes to 10% clay, medium dense.

Clayey Sand with Gravel (SC), dark reddish brown, 65% coarse grained sand, 15% clay, 15% silt, 5% cobbles, subrounded to very angular, dense, nonplastic, wet.

Poorly Graded Sand (SP), dark brown (7.5YR 3/3), 100% coarse grained sand, very loose.

Well Graded Sand with Clay and Gravel (SW), dark reddish brown (5YR 3/3), 75% coarse grained sand, 15% gravel, 10% clay, medium dense, wet.

@ 82 ft bgs: 1% gravel, very angular, loose.

@ 84 ft bgs: 10 to 15% gravel, medium dense.

@ 87 ft bgs: changes to medium dense to dense.

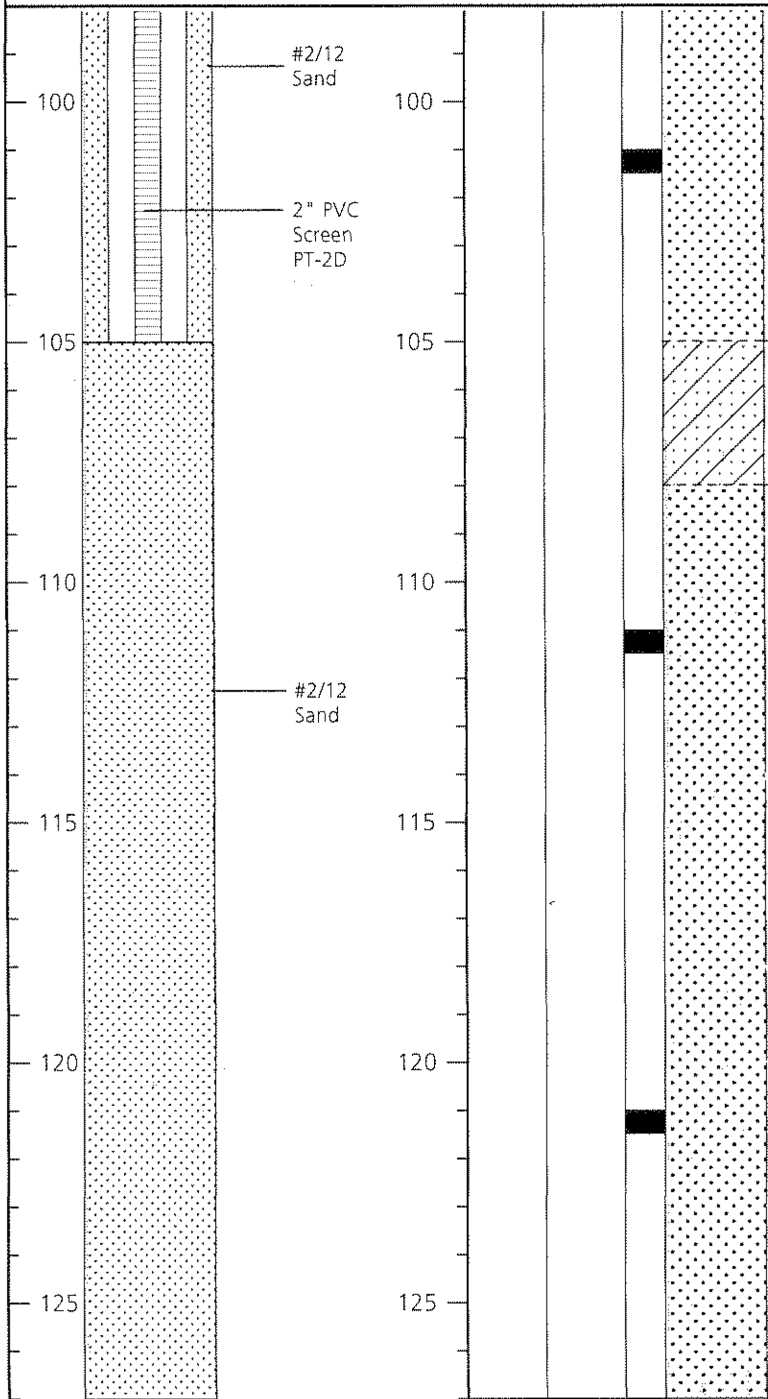
@ 90 ft bgs: changes to dark reddish gray (2.5 YR 3/1) and dark reddish brown (2.5YR 3/3), 80% sand, 15% gravel, 5% clay, subrounded to very angular, very loose, wet.

@ 91 ft bgs: changes to 5% gravel, medium dense.

@ 96 ft bgs: changes to dark reddish brown (2.5YR 3/3), 15% gravel (up to 3 inches), very angular, loose.

LOG OF BORING PT-2
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 100 ft bgs: 1 cobble, 6 inches in diameter

@ 103 ft bgs: changes to 5% gravel, medium dense.

Clayey Sand with Gravel (SC), strong brown (2.5YR 4/6), 70% sand, 15% gravel (20mm), 15% clay, medium dense, no to low plasticity, wet.

Well Graded Sand and Gravel (SW), 80% coarse grained sand, 15% gravel (2mm to 6mm), 5% clay, trace cobbles (up to 2 inches).

@ 109 ft bgs: changes to dark reddish brown (5YR 3/3) and dark brown (7.5YR 3/3), no cobbles, very dense, moist, possible cementation.

@ 114 ft bgs: changes to loose.

@ 118 ft bgs: changes to cemented

@ 120 ft bgs: changes to dark brown (7.5YR 3/3), loose, possible bedrock.

@ 132 ft bgs: changes to moist.

End of Boring at 127 ft bgs.

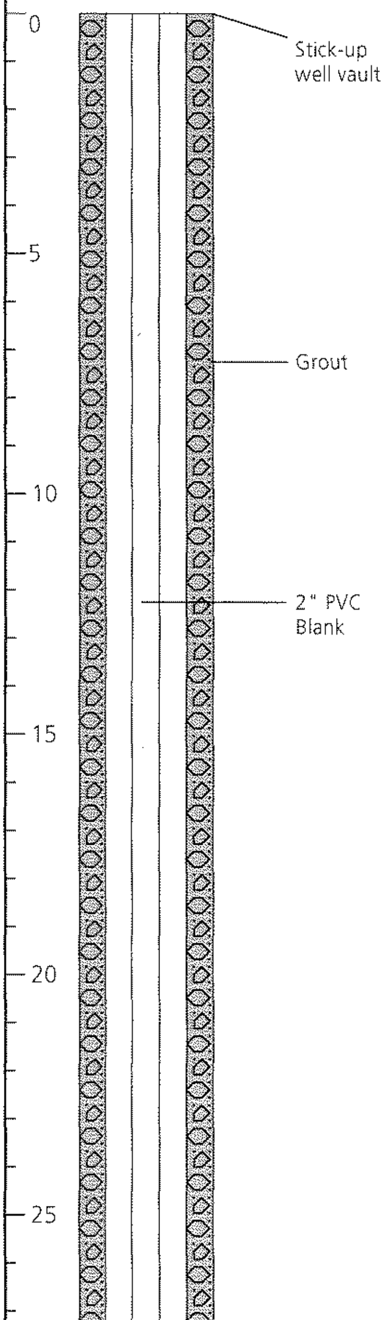
LOG OF BORING PT-3

PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.: RC000689.0001	Date Started: 13 Feb 2006
Logged by: J. Ely	Date Completed: 14 Feb 2006
Drilling Co.: Prosonic Corporation	Drilling Method: Sonic
Driller: Don Youngblood	Sample Method: Core
Well Permit #: 2006010011	Driller's License: C57-756217

WELL CONSTRUCTION

Boring Diameter (inches): 10 inches
Casing Diameter (inches): 2 inches



LITHOLOGIC DESCRIPTION

Depth	Headspace (ppm)	Blows/ft.	Sample	Key	Description
0					Poorly Graded Sand (SP), pale brown (10YR 6/3), 100% fine grained sand, very loose, dry.
11					@ 11 ft bgs: changes to pale brown and brown (10YR 5/3).
13					@ 13 ft bgs: changes to trace organics.
15					@ 15 ft bgs: changes to damp.
18					@ 18 ft bgs: changes to trace silt, silt is dark grayish brown (10YR 3/2).
22					@ 22 ft bgs: changes to dark grayish brown, 20% silt.
25					Silt (ML), very dark grayish brown (10YR 3/2), 80% silt, 10% clay, 10% fine grained sand, medium stiff, low to medium plasticity, wet.

LOG OF BORING PT-3
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION

Bentonite

#30 Sand

#2/12 Sand

2" PVC Screen PT-3S

Bentonite

#30 Sand

#2/12 Sand

2" PVC Screen PT-3M

Depth: 30, 35, 40, 45, 50, 55, 60

@ 28 ft bgs: changes to 20% clay, 5% sand, medium to high plasticity.

@ 31 ft bgs: changes to 10% clay, medium plasticity, soft.

@ 35 ft bgs: changes to laminated clay and silt layers (5mm thick).

Well Graded Sand with Silt (SW), dark grayish brown (10YR 4/2), 90% fine grained sand, 10% silt, loose, wet.

Poorly Graded Sand (SP, brown (10YR 4/3), 95% fine grained sand, 5% silt, loose, wet.

Clay with Sand (CL), brown (10YR 4/3), 75% clay, 25% fine grained sand, very stiff, high plasticity, wet.

Well Graded Sand (SW), 90% coarse grained sand (subrounded to subangular), 10% gravel (2mm to 10mm, subrounded), very loose, wet.

@ 50 ft bgs: changes to 0 to 5 % gravel.

@ 54 ft bgs: changes to Well Graded Sand with Gravel (SW), 80% coarse grained sand (subrounded to subangular), 15% gravel and cobbles (up to 3 inches, very rounded to very angular), 5% clay chunks, loose, wet.

Clayey Sand wth Gravel (SC), brown (10YR 4/3), 65% coarse grained sand (subrounded to subangular), 20% gravel (2mm to 20mm, very rounded to very angular), 15% clay, loose, wet.

Silt with Gravel (ML), dark yellowish brown (10YR 4/4), 70% silt, 10% fine grained sand, 20% gravel, 1% cobbles, very angular to very rounded, up to 4 inches (flat), very stiff, high plasticity.

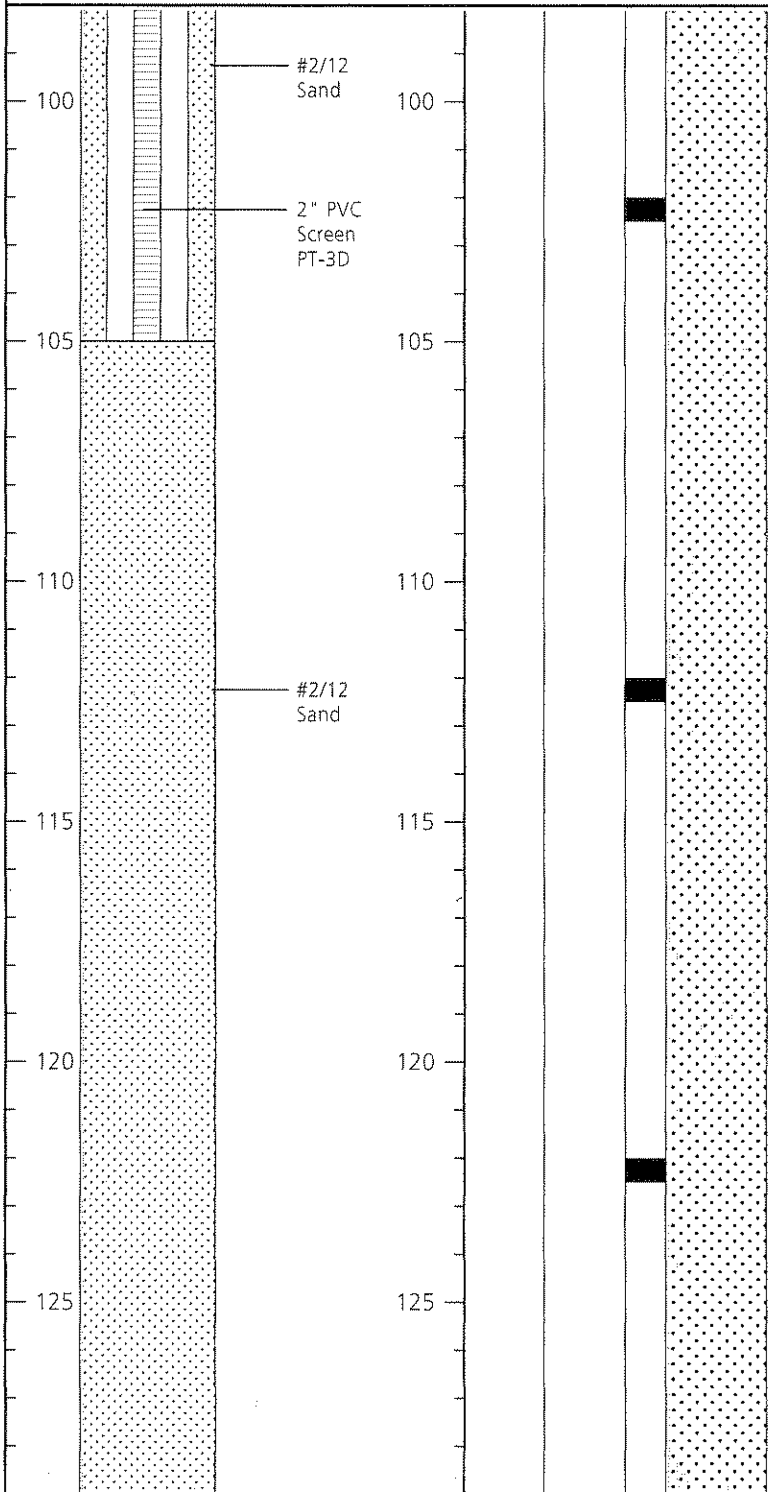
LOG OF BORING PT-3
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
#2/12 Sand; 2" PVC Screen PT-3M	63–69					@ 63 ft bgs: Large rock stuck in the drill bit. No recovery from 63 to 69 ft bgs.
	69					Well Graded Sand with Gravel (SW), dark reddish brown (5YR 3/4), 50% coarse, angular sand, 40% angular gravel, 5% subrounded to angular cobbies, 5% clay, medium dense, wet.
Bentonite	75					@75 ft bgs: changes to 5 to 10% clay, dense.
	76					@ 76 ft bgs: changes to medium dense to loose, trace cobbies.
	80					@ 80 ft bgs: changes to very stiff, increased clay, slightly cemented.
	83					@ 83 ft bgs: changes to dark reddish brown, 5% clay, gravel is 2mm to 10mm, loose.
	87					@ 87 ft bgs: changes to 10% clay.
	89					@ 89 ft bgs: cobbles up to 3 inches, angular.
#30 Sand	92					Gravel (GW), dark reddish brown (2.5YR 3/4), 90% gravel, 5% sand, 5% clay, loose, wet.
#2/12 Sand	93					Well Graded Sand with Gravel (SW), dark reddish brown (2.5YR 3/3), 60% coarse grained angular sand, 30% angular gravel, 10% clay, loose to medium dense.
2" PVC Screen PT-3D	96					@ 96 ft bgs: gravel size increase to 2 inches.

Depth scale: 65, 70, 75, 80, 85, 90, 95

LOG OF BORING PT-3
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 99 ft bgs: changes to 95% sand, 5% clay.

@ 102 ft bgs: changes to 60% sand, 30% gravel, 10% clay, very angular, loose.

@ 104 ft bgs: changes to medium dense to dense.

@ 107 ft bgs: gravel and cobbles up to 3 inches.

@ 109 ft bgs: changes to very dusky red (10YR 2.5/2).

@ 111 ft bgs: gravel decreases in size.

@ 115 ft bgs: changes to medium dense.

@ 117 ft bgs: changes to very dense, slightly cemented.

@ 119 ft bgs: changes to dark reddish brown (2.5YR 2.5/3).

@ 121 ft bgs: changes to dusky red (10YR 3/4), very dense, cemented, possible top of bedrock.

End of Boring at 129 ft bgs.

LOG OF BORING PT-4

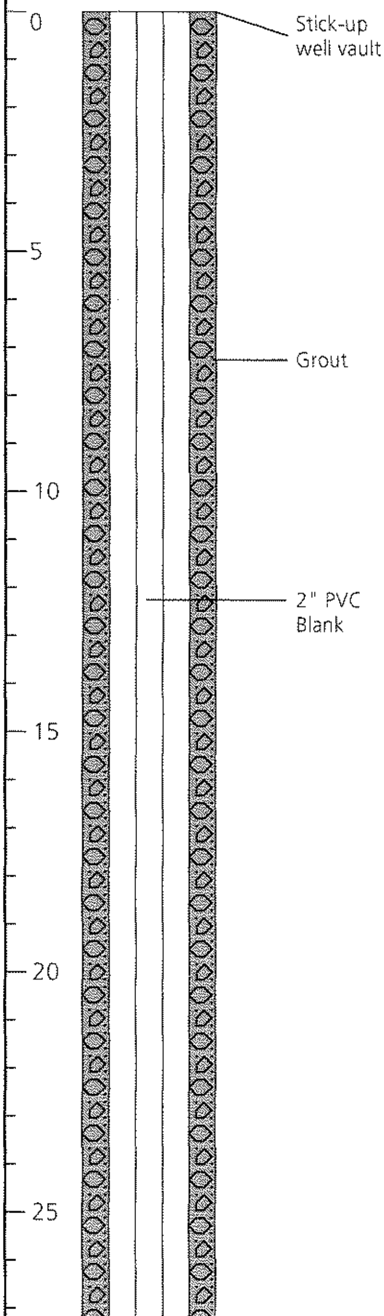
PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.: RC000689.0001	Date Started: 11 Feb 2006
Logged by: J. Ely	Date Completed: 12 Feb 2006
Drilling Co.: Prosonic Corporation	Drilling Method: Sonic
Driller: Don Youngblood	Sample Method: Core
Well Permit #: 2006010010	Driller's License: C57-756217

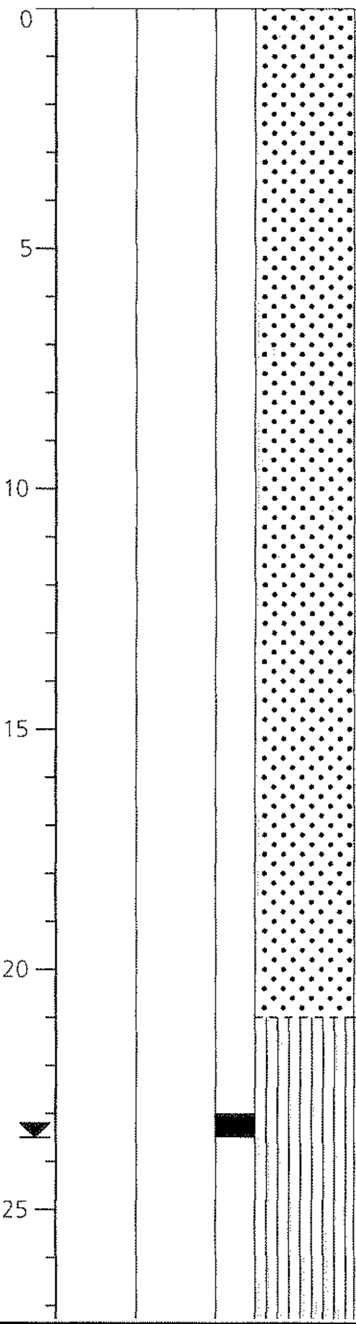
WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 10 inches
Casing Diameter (inches): 2 inches



Depth | Headspace (ppm) | Blows/ft. | Sample | Key



Poorly Graded Sand (SP), pale brown (10YR 6/3) to brownish yellow (10YR 6/6), 100% fine grained sand, very loose, dry.

@ 11 ft bgs: changes to very slightly damp trace roots.

@ 14 ft bgs: changes to brownish yellow (10YR 6/6).

@ 16 ft bgs: changes to light yellowish brown (10YR 6/4).

@ 18 ft bgs: dark yellowish brown (10YR 3/4), 5% silt.

@ 20 ft bgs: very dark gray (10YR 3/1), 10% silt. Gradational change to ML.

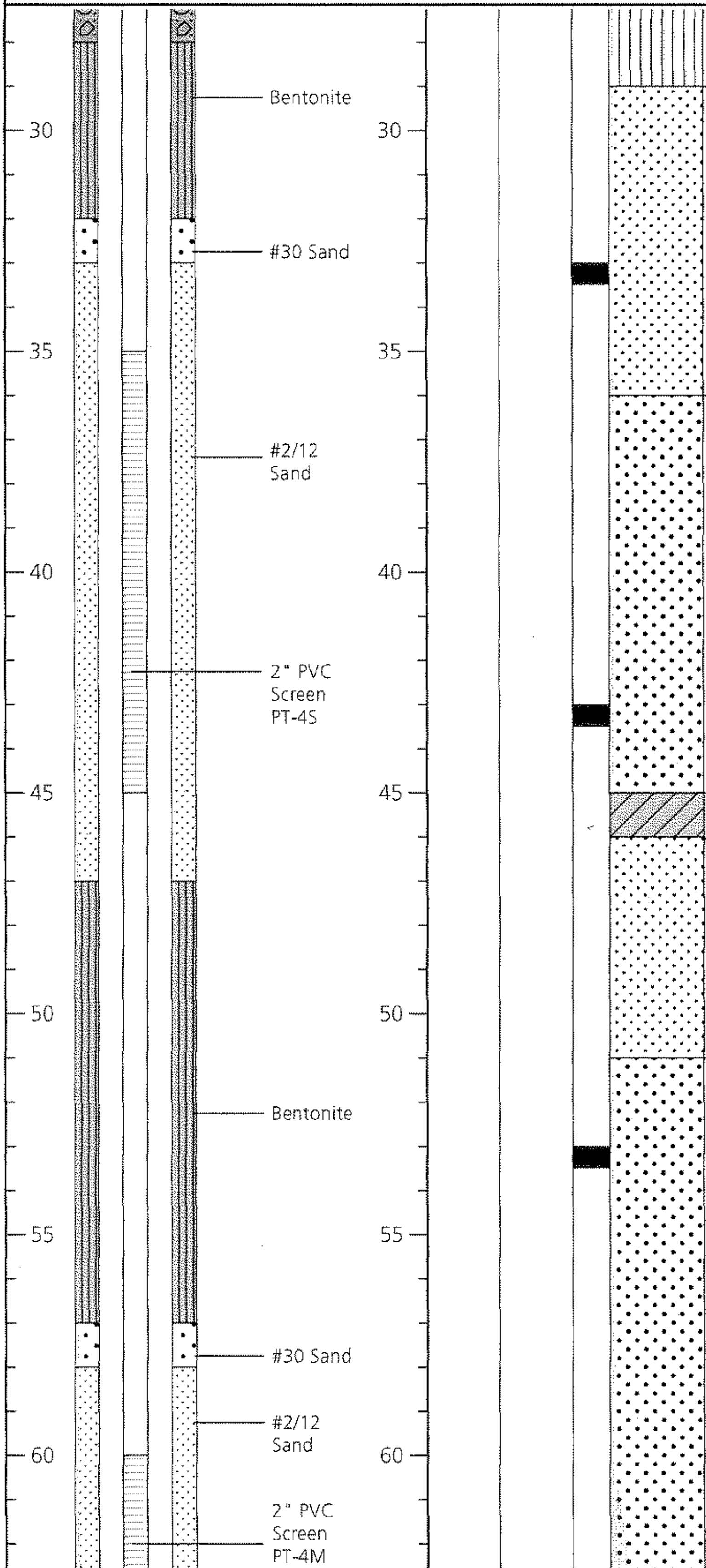
Silt with Sand (ML), very dark gray (10 YR 3/1), 70% silt, 30% very fine sand, very soft, moist, non-plastic.

@ 23 ft bgs: changes to very dark brown (10 YR 2/2).
@ 23.5 ft bgs: changes to Silt and Clay (ML/CL), very dark brown (10 YR 2/2), 45% silt, 45% clay, 5% very fine sand, medium stiff, wet, high plasticity.

@ 26 ft bgs: changes to 90% silt, 10% clay.

LOG OF BORING PT-4
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 27 ft bgs: changes to 60% silt, 40% fine sand, very dark brown, medium to stiff, wet, low plasticity.

Well Graded Sand with Silt (SW/SM), very dark grayish brown (10 YR 3/2), 90% fine grained sand, 10% silt, trace clay, yellowish brown (5/4 10YR), loose, wet.

@ 32 ft bgs: changes to medium to coarse sand (gradational).

@ 34 ft bgs: changes to 5% silt, 5% clay (chunks).

Poorly Graded Sand (SP), dark grayish brown (10YR 4/2), 95% fine to medium grained sand, 5% silt, medium dense, wet.

@ 40 ft bgs: changes to 0% silt, loose to medium dense.

@ 44 ft bgs: changes to very wet.

Clay with Sand (CL), very dark gray (10YR 3/1), 70% clay, 30% fine sand, medium stiff to stiff, medium to high plasticity.

Well Graded Sand (SW), dark grayish brown (10YR 4/2), 70% fine grained sand, 25% coarse grained sand (subrounded to subangular), 5% silt, medium dense, wet.

@ 49.5 ft bgs: changes to 70% coarse sand, 25% fine sand, 5% silt, trace gravel.

Poorly Graded Sand (SP), dark grayish brown, 95% medium coarse grained sand, subrounded-subangular, 5% gravel, very wet, loose.

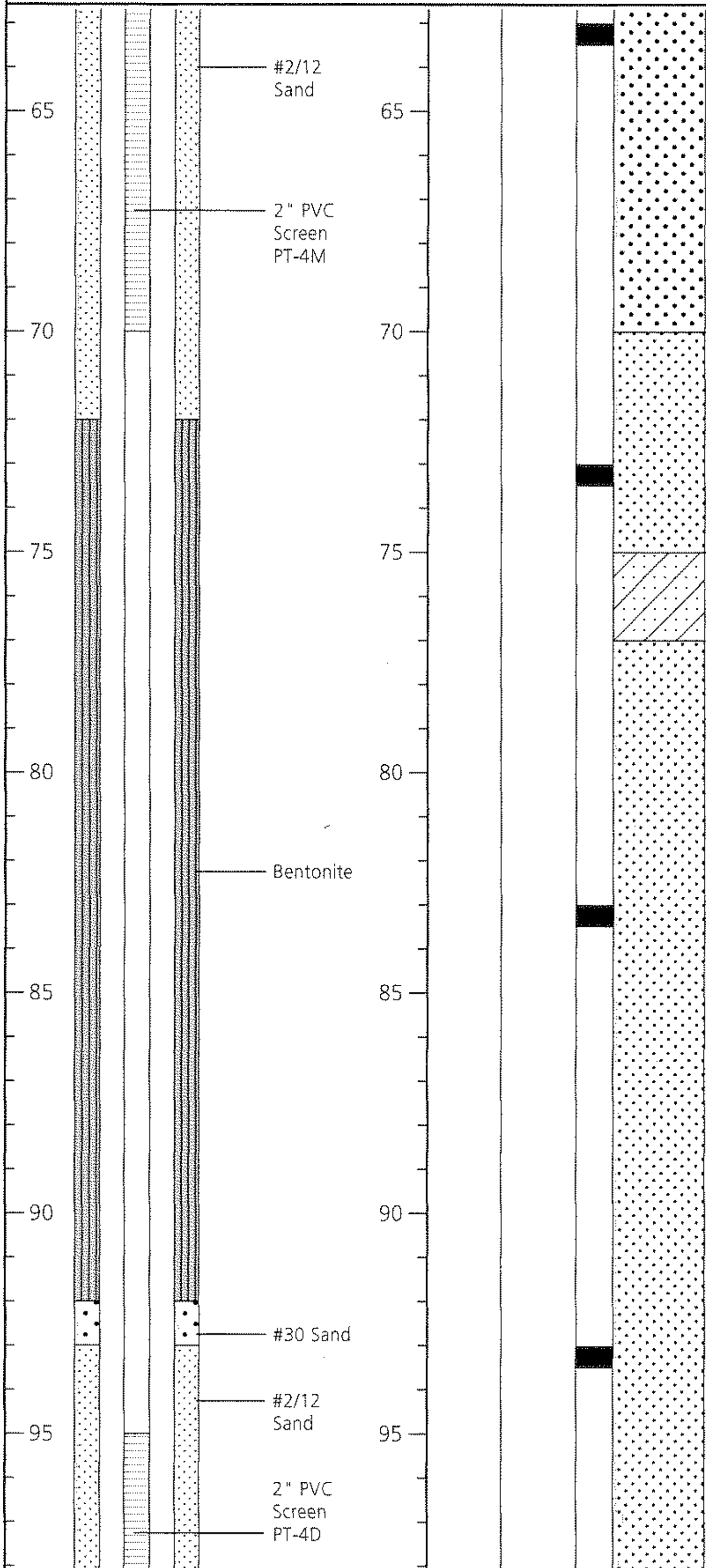
@ 57 ft bgs: changes to 95% fine sand, 5% coarse gravel, medium dense, very wet.

@ 61 ft bgs: changes to very loose.

LOG OF BORING PT-4
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key

LITHOLOGIC DESCRIPTION



@ 63 ft bgs: changes to dark grayish brown to very dark grayish brown, 50% fine sand, 50% coarse sand, trace gravel.

@ 67 ft bgs: changes to 70 to 80% fine grained sand, 20 to 30% coarse grained sand, very wet.

Well Graded Sand with Gravel (SW), dark grayish brown (10YR 4/2), 60% sand (subrounded), 35% gravel (2mm to 10mm, subrounded to subangular), 5% clay/silt, loose, damp.

@ 74 ft bgs: increased clay amount.

Clayey Sand with Gravel (SC), dark reddish brown (5YR 3/2), 45% coase sand, 35% gravel and cobbies (subrounded to very angular), 30% clay, loose to medium dense, moist, non-plasctic.

Well Graded Sand with Clay and Gravel (SW), dark reddish brown (5YR 3/2), 50% coarse sand, 35% gravel (subrounded to angular), 10% clay, 5% cobbles, medium dense, wet.

@ 79 ft bgs: changes to well graded sand with gravel, 5% clay to sand and gravel.

@ 84 ft bgs: changes to 10% clay, loose to medium dense.

@ 87 ft bgs: changes to 5% clay.

@ 89 ft bgs:changes to 10 to 15% clay, medium dense to dense.

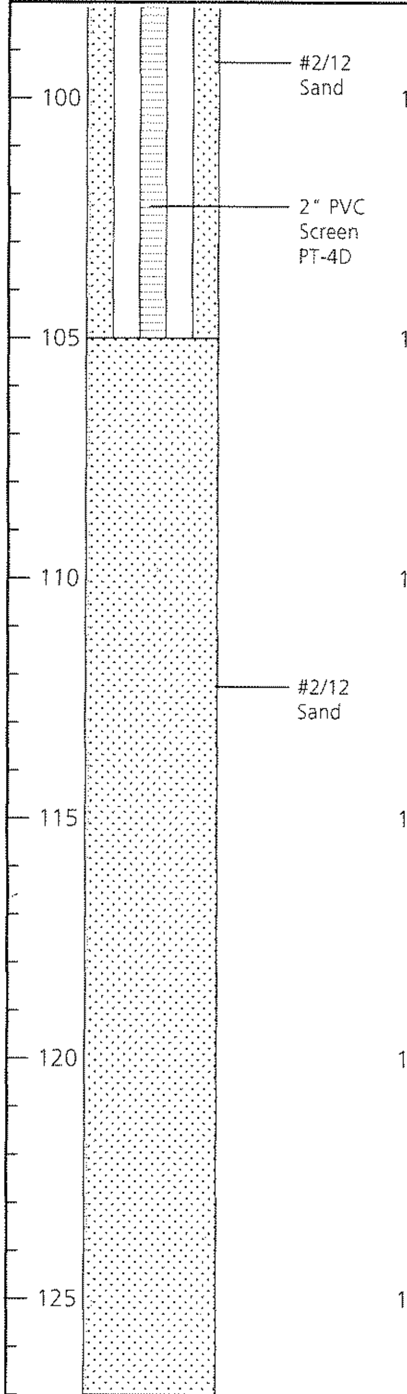
@ 92 ft bgs: changes to dark reddish brown, 5% clay, gravel/cobble size increases (~2 inches).

@ 94 ft bgs: changes to loose, medium dense.

@ 97 ft bgs: changes to 0 ot 15% clay.

LOG OF BORING PT-4
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 100 ft bgs: changes to 5% clay, loose.

@ 101 ft bgs: changes to 80% coarse sand, 15% gravel (2mm to 10mm angular), 5% clay, loose, wet.

@ 103 ft bgs: gravel size increases (~15 to 20mm).

@ 107 ft bgs: Well Graded Sand, very dark gray (7.5YR 3/1) and black (7.5YR 2.5/1), 85% coarse sand, angular 15%, angular gravel (2mm to 10mm), loose to medium dense.

@ 112 ft bgs: changes to 80% sand, 20% gravel, trace silt, loose.

@ 115 ft bgs: changes to medium stiff to stiff (for ~6 inches).

@ 118 ft bgs: changes to dusky red (10YR 3/3), 90% coarse sand, 10% gravel, trace clay, angular sand, gravel (up to 15mm), very dense, slightly damp.

End of Boring at 127 ft bgs.

LOG OF BORING PT-5

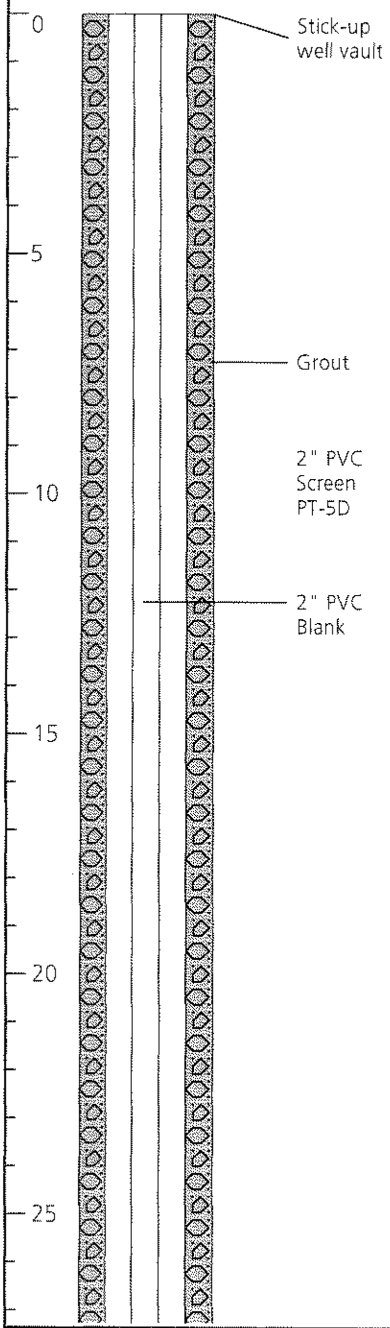
PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.:	RC000689.0001	Date Started:	9 Feb 2006
Logged by:	J. Ely	Date Completed:	10 Feb 2006
Drilling Co.:	Prosonic Corporation	Drilling Method:	Sonic
Driller:	Don Youngblood	Sample Method:	Core
Well Permit #:	2006010009	Driller's License:	C57-756217

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

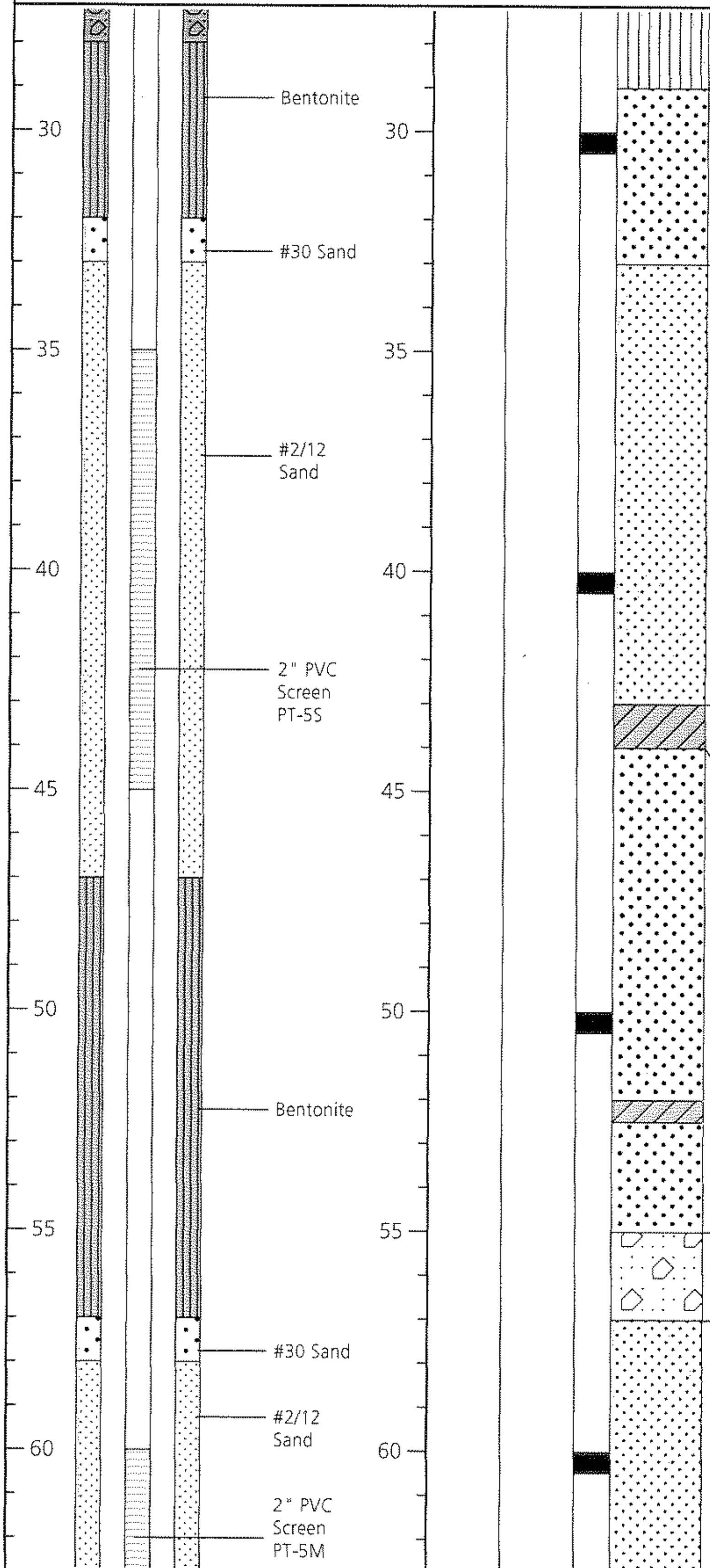
Boring Diameter (inches): 10 inches
Casing Diameter (inches): 2 inches



Depth	Headspace (ppm)	Blows/ft.	Sample	Key	Description
0					Poorly Graded Sand (SP), pale brown (10YR 6/3), 100% fine sand, very loose, dry.
12					@ 12 ft bgs: changes to pale brown and grayish brown (10YR 5/2).
15.5					@ 15.5 ft bgs: changes to slightly damp.
17					@ 17 ft bgs: changes to dark grayish brown (10YR 3/2), moist.
18					Clay (CL), very dark grayish brown, 90% clay, 10% silt, very plastic, wet.
19					Poorly Graded Sand (SP), very dark grayish brown, 100% fine sand, loose, wet.
21					Silt (ML), dark grayish brown (10YR 3/2), 80% silt, 15% clay, 5% fine sand, plastic, soft, wet.
23					@ 23 ft bgs: changes to very high plasticity.
25					@ 25 ft bgs: changes to 70% silt, 30% clay, non-plastic.
27					@ 27 ft bgs: changes to very dark gray and black (10YR 4/2), trace organics

LOG OF BORING PT-5
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION



(roots), medium soft.

Poorly Graded Sand (SP), dark grayish brown (10YR 4/2), 95% fine grained sand, 5% silt, loose, wet.

Well Graded Sand with Silt (SW), dark grayish brown (10YR 4/2), 90% fine sand, 5% silt, 5% clay, loose, wet.

@ 37 ft bgs: changes to the 5% clay (chunks), very loose.

Sandy Clay (CL), very dark grayish brown (10YR 3/2), 80% clay, 20% fine sand, plastic, wet.

Poorly Graded Sand (SP), dark grayish brown (10YR 4/2), 90% fine grained sand, 9% silt, 1% gravel (10mm rounded).

@ 48 ft bgs: increases to coarse grained sand, subrounded, yellowish brown (10YR 5/4).

@ 52 ft bgs: 6-inch layer of Sandy Clay (CL).

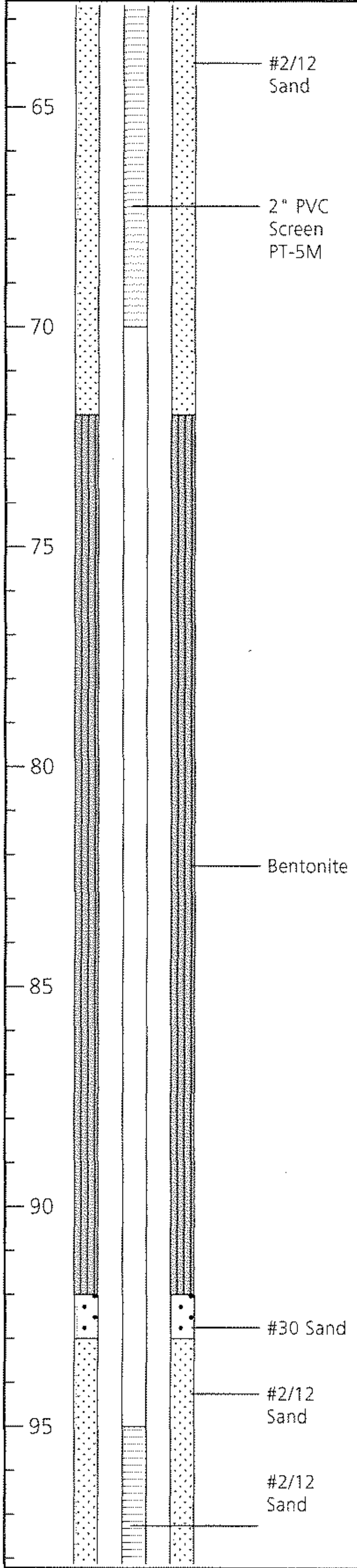
Well Graded Gravel with Sand (GW), brown (10YR 4/3), 50% sand (subrounded to subangular), 30% gravel, 15% cobbles (subrounded to subangular, up to 5 inches), 5% silt, loose, wet.

Well Graded Sand with Gravel (SW), yellowish brown (10YR 4/4), 80% coarse grained sand, 15% gravel (subrounded to subangular, 20mm), 5% cobbles (subrounded to subangular, up to 4 inches), very loose, wet.

@ 63 ft bgs: changes to 5% clay (chunks).

LOG OF BORING PT-5
(Continued)

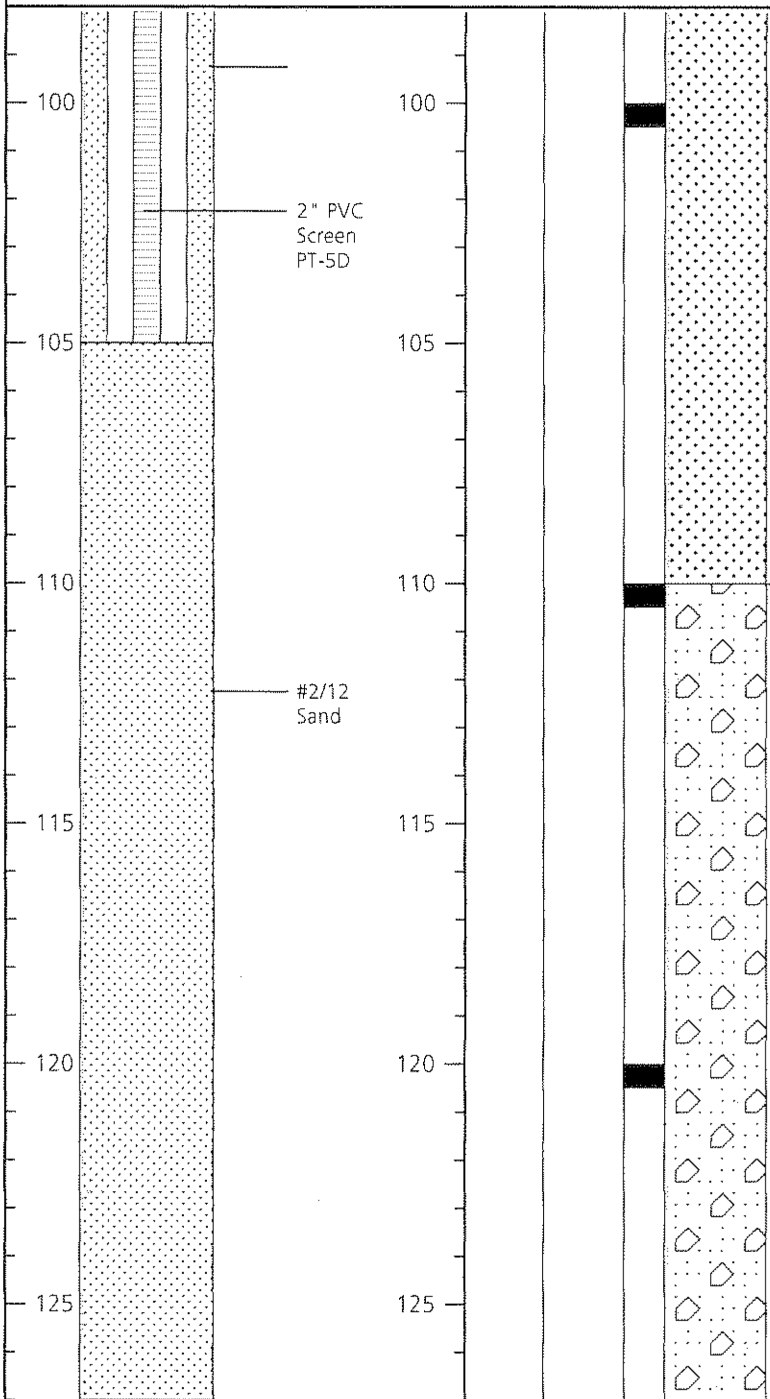
WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



Depth	Lithologic Description
65–77	Silty Sand with Gravel (ML), dark yellow brown (10YR 4/4), 50% silt, 30% fine sand, 15% gravel, 5% clay, 1% cobbles, very rounded to subangular, high plasticity, soft, wet. @ 66 ft bgs: volcanic clasts. @ 70 ft bgs: changes to Silt with Gravel, brown (10 YR 4/3), 60% silt, 30% gravel, 5% sand, 5% clay, low to medium plasticity, medium stiff, wet, trace volcanic clasts. @ 73 ft bgs: 9-inch long, 14-inch circumference volcanic rock. @ 75 ft bgs: changes to very saturated.
77–84	Poorly Graded Gravel with Sand (GW), brown (7.5 YR 4/3) to dark brown (7.5 YR 4/3), 50% gravel and cobbles (from 5mm up to over a foot), 45% sand (coarse grained, subrounded and subangular), 5% silt, loose, wet.
84–97	Well Graded Sand with Gravel (SW), dusky red (2.5 YR 3/2), 80% coarse sand, 15% gravel (2mm to 10mm, subrounded and very angular), 5% silt/clay (trace cobbles), loose to dense, wet. @ 85.5 to 86 ft bgs: very dense. @ 89 ft bgs: changes to very saturated, gravel up to 20mm, loose. @ 92 ft bgs: changes to 10% clay. @ 94 ft bgs: changes to 5% clay. @ 95.5 ft bgs: changes to Well Graded Sand, dark gray (10YR 3/1), 90% coarse sand (very angular to subrounded), 5% gravel (10mm), 5% clay, very loose, wet.

LOG OF BORING PT-5
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 102 ft bgs: changes to 10% clay.

@ 103 ft bgs: changes to dark reddish brown (5YR 3/2), coarse grained angular sand, 10% gravel (2mm-10mm), angular.

@ 107 ft bgs: changes to 5% clay, gravel very angular to subangular, up to 2 inches.

Well Graded Gravel with Sand (GW), black (7.5YR 2.5/1), 70% angular to very angular gravel (2mm-40mm), 25% coarse sand (subangular to very angular), 5% silt, loose, wet, possible top of bedrock.

@ 117 ft bgs: changes to 80% gravel, 20% coarse sand, gravel up to 2 inches.

@ 121 ft bgs: gravel (2mm-20mm).

@ 123 ft bgs: changes to some cementation.

End of Boring 127 ft bgs.

LOG OF BORING PT-6

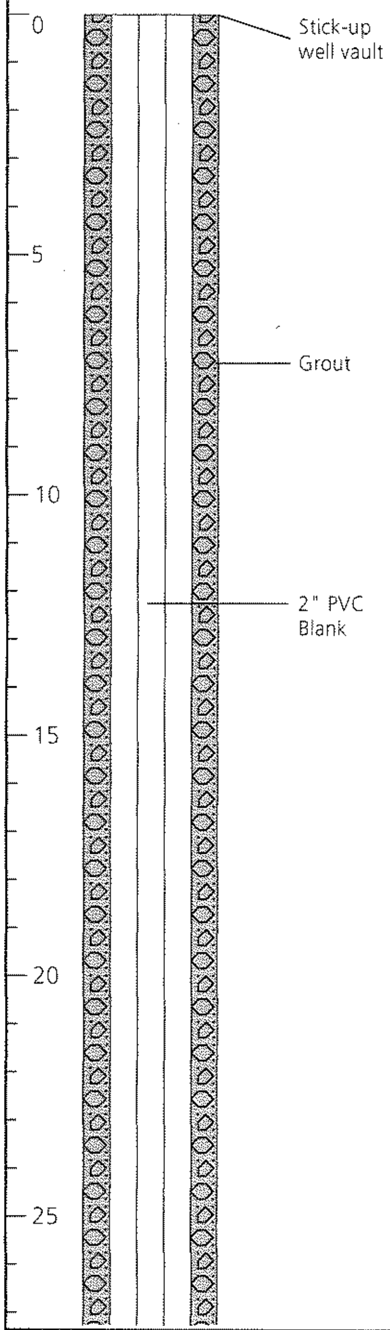
PG&E Topock
Interstate 40 and Park Moabi Road
Needles, California

Project No.:	RC000689.0001	Date Started:	28 Jan 2006
Logged by:	J. Ely	Date Completed:	28 Jan 2006
Drilling Co.:	Prosonic Corporation	Drilling Method:	Sonic
Driller:	Don Youngblood	Sample Method:	Core
Well Permit #:	2006010008	Driller's License:	C57-756217

WELL CONSTRUCTION

Boring Diameter (inches): 10 inches

Casing Diameter (inches): 2 inches

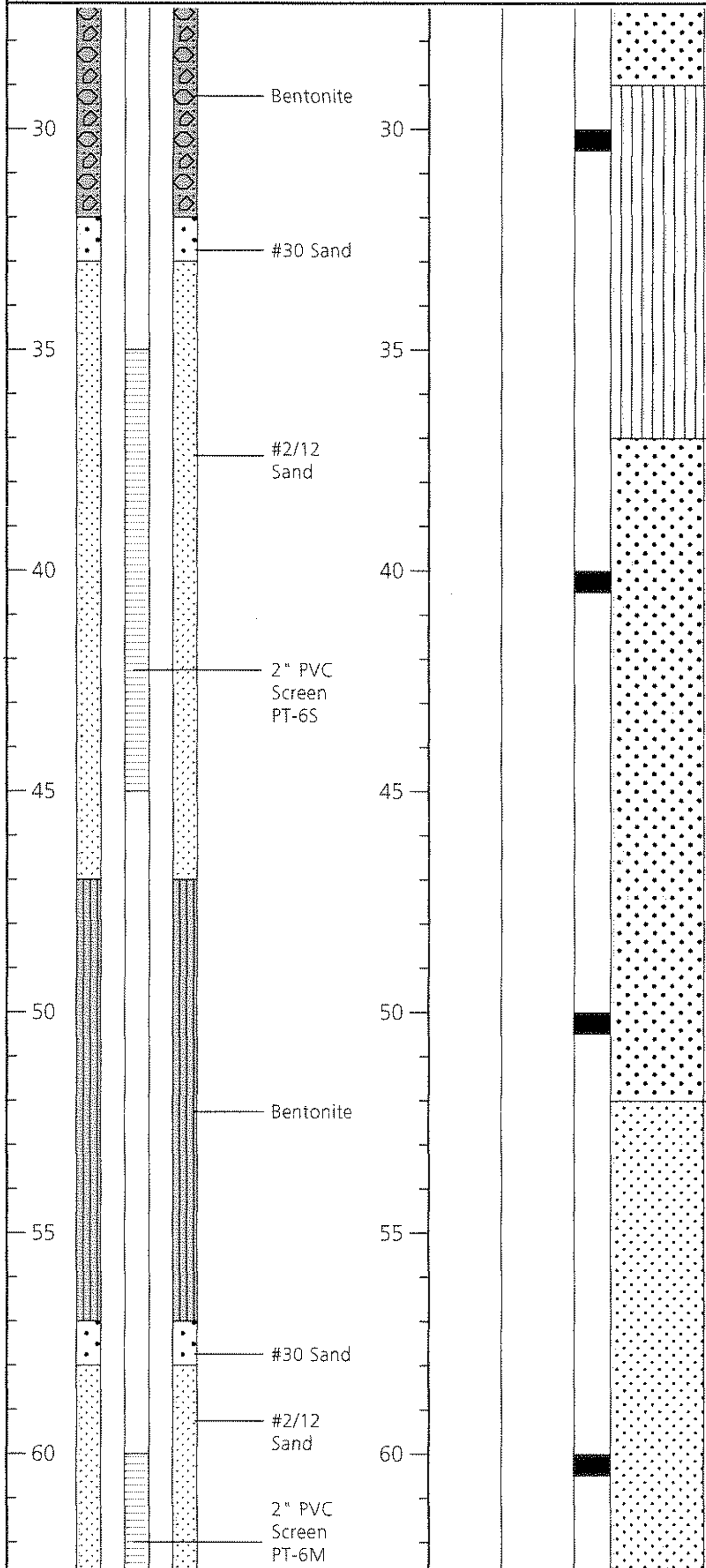


LITHOLOGIC DESCRIPTION

Depth	Headspace (ppm)	Blows/ft.	Sample	Key	Description
0					Poorly Graded Sand (SP), pale brown (10YR 6/3), 100% fine sand, angular to subangular, loose, dry.
12					@ 12 ft bgs: changes to damp.
16					@ 16 ft bgs: changes to 5-10% silt, sand is pale brown, silt is yellowish brown (10YR 5/6), damp.
19					@ 19 ft bgs: 100% fine sand, changes to dry.
21					@ 21 ft bgs: all pale brown.
27					@ 27 ft bgs: changes to 5% silt, moist.

LOG OF BORING PT-6
(Continued)

WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



@ 28 ft bgs: increasing silt.

Silt and Clay (ML/CL), very dark gray (GLEY 3/3), 60% silt, 30% clay, 10% fine sand, low to medium plasticity, wet.

@ 33 ft bgs: changes to 5% sand, medium high plasticity.

@ 34 ft bgs: changes to very dense, gradational change, increasing sand.

@ 36 ft bgs: changes to Well Graded Silty Sand (ML).

Poorly Graded Sand (SP), dark grayish brown (10YR 4/2), 90% fine sand (subrounded to subangular), 10% silt, loose, wet.

@ 42 ft bgs: changes to very dark grayish brown (10YR 3/2), increased silt 15-20%, medium dense.

@ 44 ft bgs: changes to 5% silt.

@ 45 ft bgs: changes to 100% fine grained sand, brown (10YR 4/3), loose, wet.

@ 47 ft bgs: changes to 70% fine grained sand, 30% medium grained sand.

@ 49 ft bgs: changes to trace gravel.

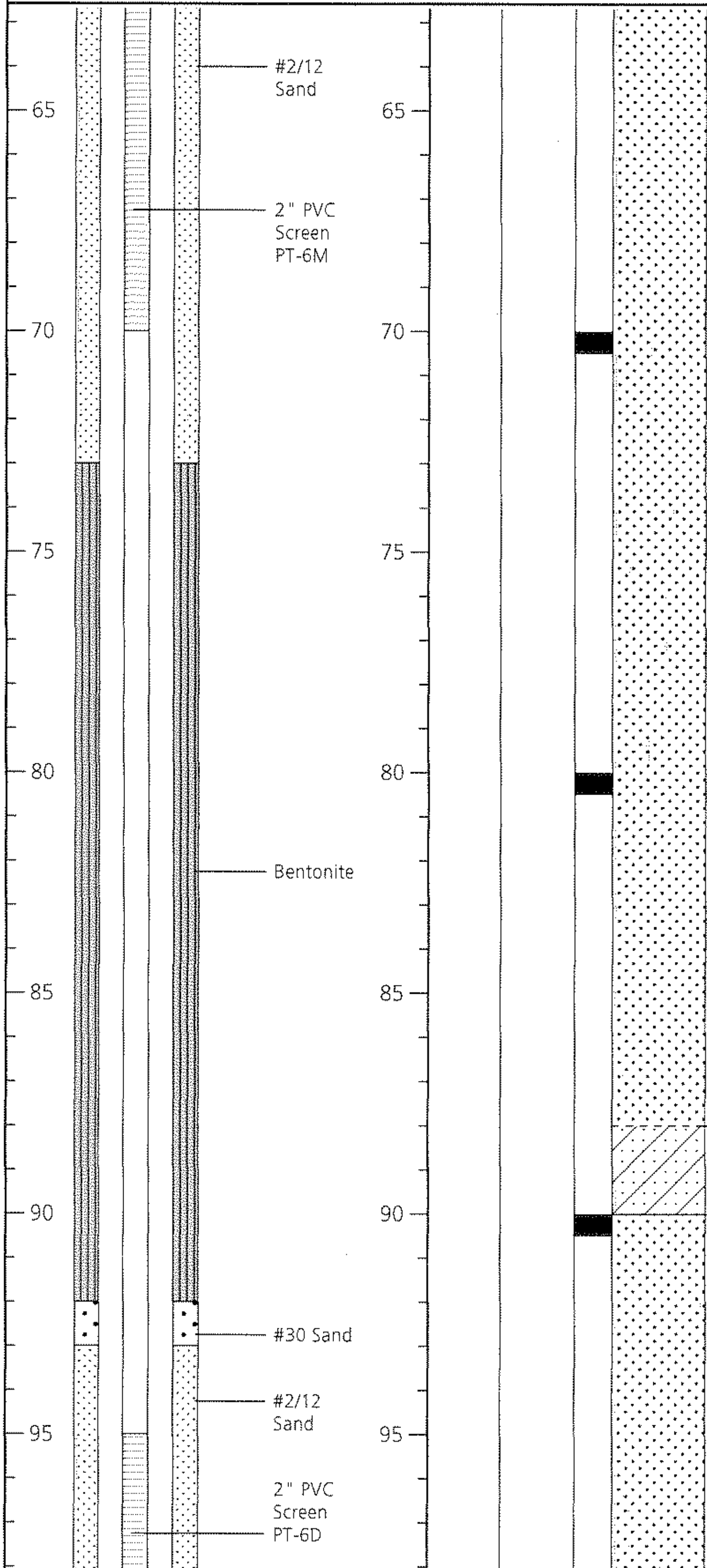
Well Graded Sand (SW), brown (10YR 4/3), 85% coarse sand, 5% fine sand, 5% gravel (angular to subrounded up to 20mm), 5% silt/clay chunks, loose, wet.

@ 58 ft bgs: changes to Well Graded Sand with Gravel (SW), dark reddish brown (5YR 3/2), 70% fine to coarse sand, 20% gravel (coarse grained), 9% silt and clay, 1% cobbles, very angular to very rounded gravel, loose to medium dense.

@ 62 ft bgs: changes to coarse sand, 5% silt and clay.

LOG OF BORING PT-6
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION



@ 65 ft bgs: changes to fine and coarse gravel, 1% cobbles, very angular.

@ 69 ft bgs: changes to 10 to 15% silt and clay.

@ 71 ft bgs: 1 large cobble ~7 inches, very angular.

@ 73 ft bgs: changes to very dark grayish brown (10YR 3/2), increased cobbles up to 6 inches, very angular to very rounded.

@ 76 ft bgs: changest to 85% coarse grained sand, 10% coarse grained gravel, 5% silt and clay, sand is angular to subangular, gravel is very angular to very rounded.

@ 80 ft bgs: changes to dark reddish brown (5YR 3/2), loose to medium dense.

@ 82 ft bgs: changes to medium dense to dense.

@ 84 ft bgs: changes to 90% coarse sand, 5% coarse gravel, 5% silt, gravel is very angular to subrounded, loose.

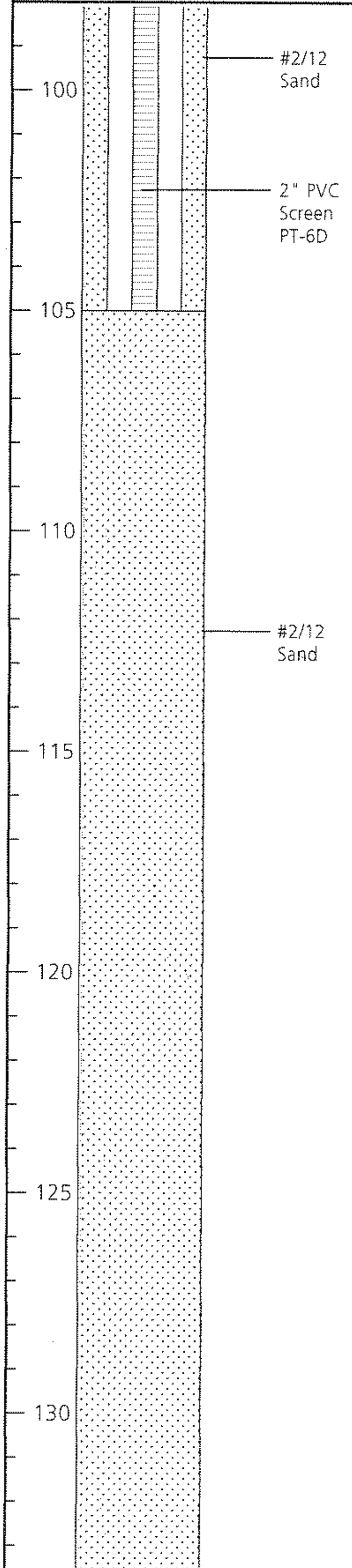
Clayey Sand (SC), 20% clay, coarse gravel, medium dense.

Well Graded Sand with Gravel and Silt (SW), medium dense, gravel very angular subrounded, up to 3 inches.

@ 96 ft bgs: changes to mostly coarse grained sand with 1 cobble ~4 inches, loose.

LOG OF BORING PT-6
(Continued)

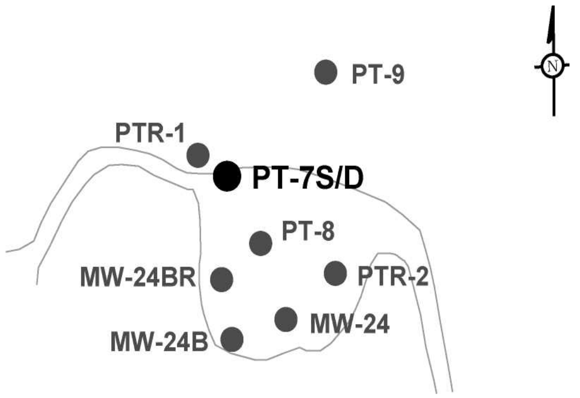
WELL CONSTRUCTION | Depth | Headspace (ppm) | Blows/ft. | Sample | Key | LITHOLOGIC DESCRIPTION



Depth	Description
99	@ 99 ft bgs: changes to less cobbles, coarse gravel, very angular, loose, very wet (soupy).
103	@ 103 ft bgs: changes to dense, wet.
107	@ 107 ft bgs: changes to 10 to 15% clay, 10% cobbles, up to 3 inches very angular.
110	@ 110 ft bgs: changes to 70% fine to coarse grained sand, 15% medium to coarse gravel (very angular to angular), 15% silt and clay, loose to medium dense, moist.
114	@ 114 ft bgs: changes to very dark grayish brown (10YR 3/2), loose.
117	@ 117 ft bgs: changes to fine to medium gravel, 1 coble (2 inches).
119.5	@ 119.5 ft bgs: changes to dense, coarse gravel, very angular.
123	@ 123 ft bgs: changes to dark reddish brown (5Y 3/2), medium dense.
124	@ 124 ft bgs: changes to very saturated.
126	@ 126 ft bgs: changes to dry to moist, slight cementation.
130	Possible bedrock, weathered rock.

LOG OF BORING PT-6
(Continued)

WELL CONSTRUCTION	Depth	Headspace (ppm)	Blows/ft.	Sample	Key	LITHOLOGIC DESCRIPTION
135	135					End of Boring at 137 ft bgs.



LOG OF BORING PT-7 S/D

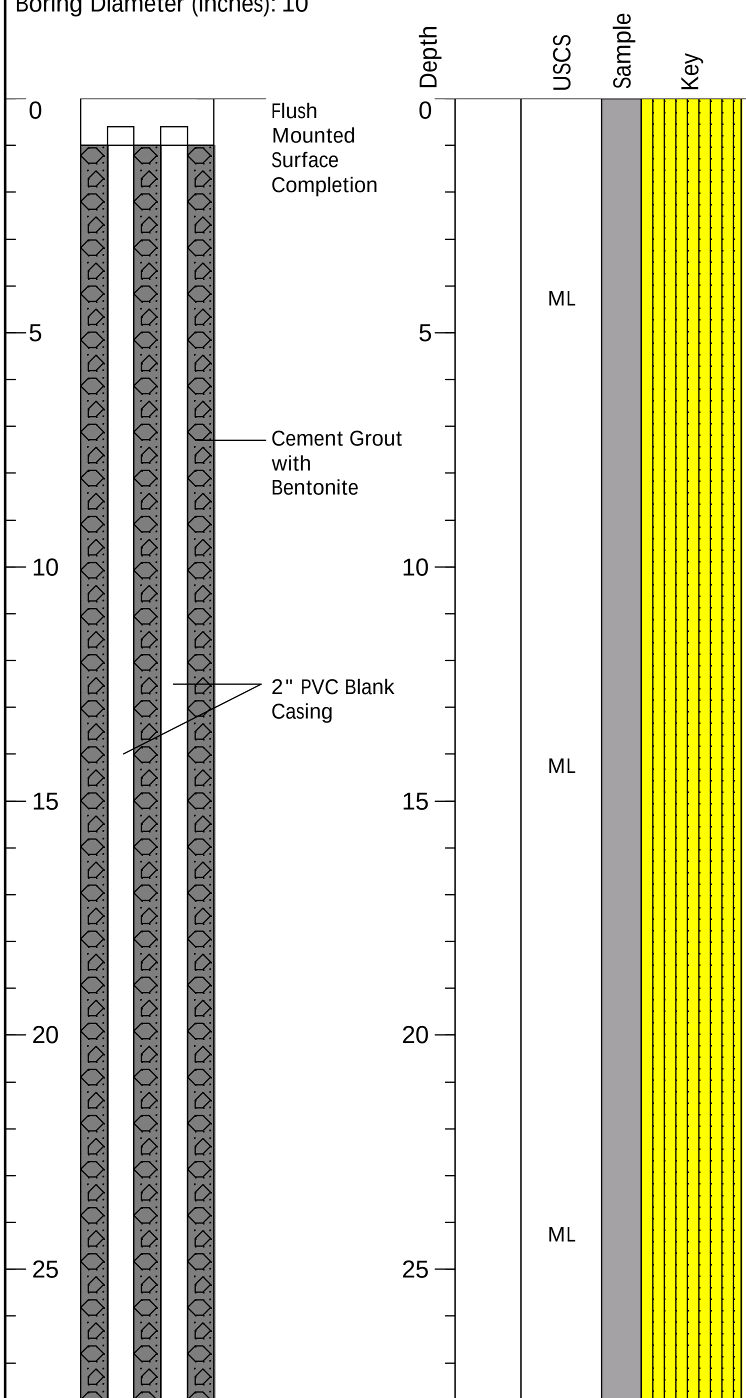
PG&E Topock Site
Needles, California

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

Boring Diameter (inches): 10



Sandy Silt with Gravel; very pale brown (10YR 8/2); 60% silt, 20% medium to coarse grained sand; 20% fine to coarse subangular gravel; trace subangular cobbles; non-plastic; dry. Cobbles average 3 to 3.5 inches from 0 to 15 feet bgs.

@ 2 feet: changes to light gray (10YR 7/2).

@ 6 feet: 4-inch cobble observed.

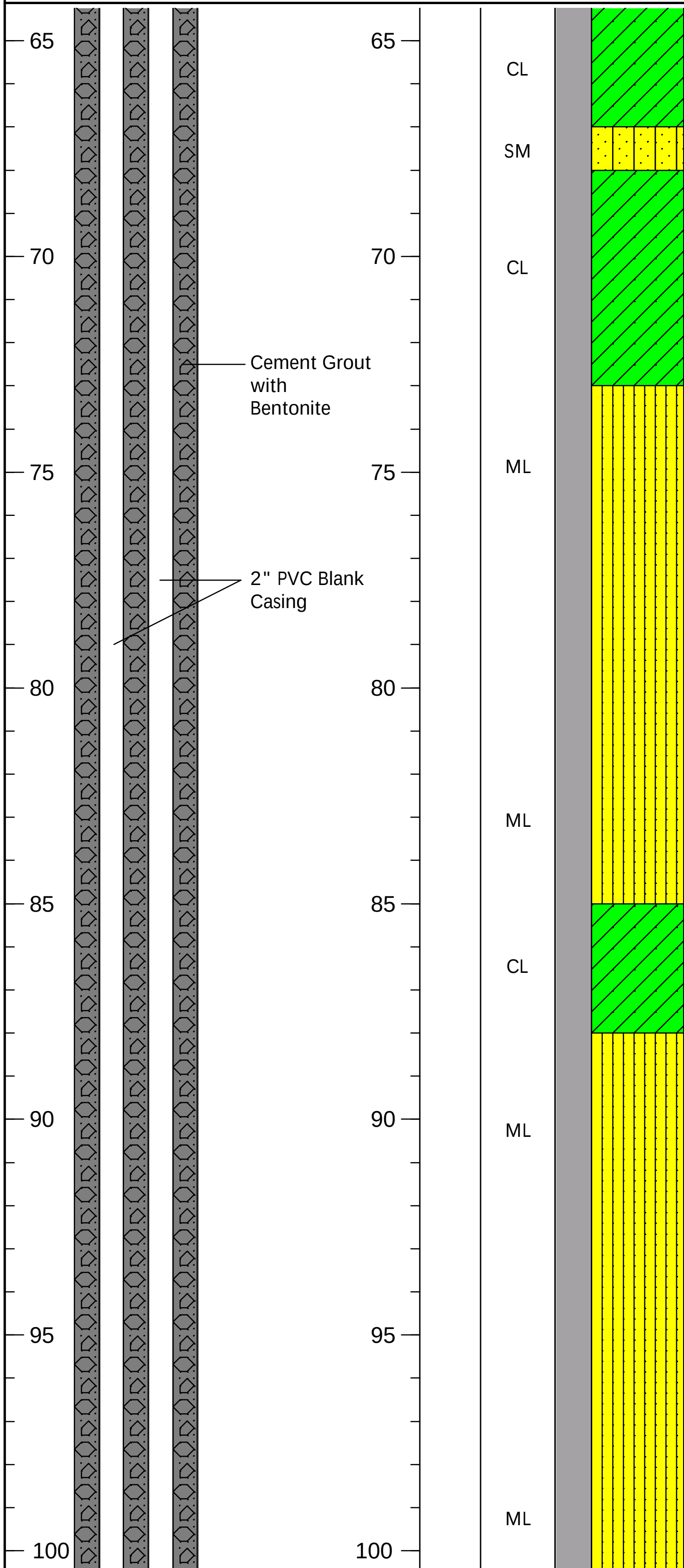
@ 15 feet: changes to Silt; light gray (2.5Y 7/2); 95% silt; 5% coarse grained sand; non-plastic; dry.

@ 18 feet: changes to Silt with Sand; 80% silt; 15%coarse grained sand; 5% fine subangular gravel. Gravel is approximately 1 inch.

@ 20 feet: changes to Sandy Silt with Gravel; 60% silt; 25% medium to coarse grained sand; 15% fine to coarse subangular gravel.

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
	30				@ 30 feet: Silt with Sand; 90% silt; 10% medium to coarse grained sand.
					@ 31 feet: Silt with Gravel; 85% silt; 15% fine to coarse subangular gravel ranging from 1 to 3 inches.
		ML			@ 32 feet: Sandy Silt; grayish brown (10YR 5/2); 60% silt; 40% medium to coarse grained sand; non-plastic; moist.
					@ 34 feet: trace subangular cobbles ranging from 3 to 4 inches.
	35				@ 35 feet: no cobbles.
Cement Grout with Bentonite					@ 37 feet: changes to light gray (2.5Y 7/2); 75% silt; 25% medium to coarse grained sand; non-plastic; dry.
	40				@ 40 feet: Sandy Silt with Gravel; light gray (2.5Y 7/2); 60% silt; 20% fine to coarse grained sand; 20% fine subangular gravel.
2" PVC Blank Casing					@ 42 feet: changes to light gray (5Y 7/1).
					@ 43 feet: changes to pinkish gray (5YR 6/2) to dark reddish brown (5YR 3/4).
	45	ML			@ 45 feet: Sandy Silt with Gravel; light gray (2.5Y 7/2); 60% silt; 30% fine to medium grained sand; 10% fine subangular gravel.
					@ 47 feet: fine to coarse grained sand.
	50				
	55				
		ML			
	60				
					@ 63 feet: trace subangular cobbles up to 3.5 inches.

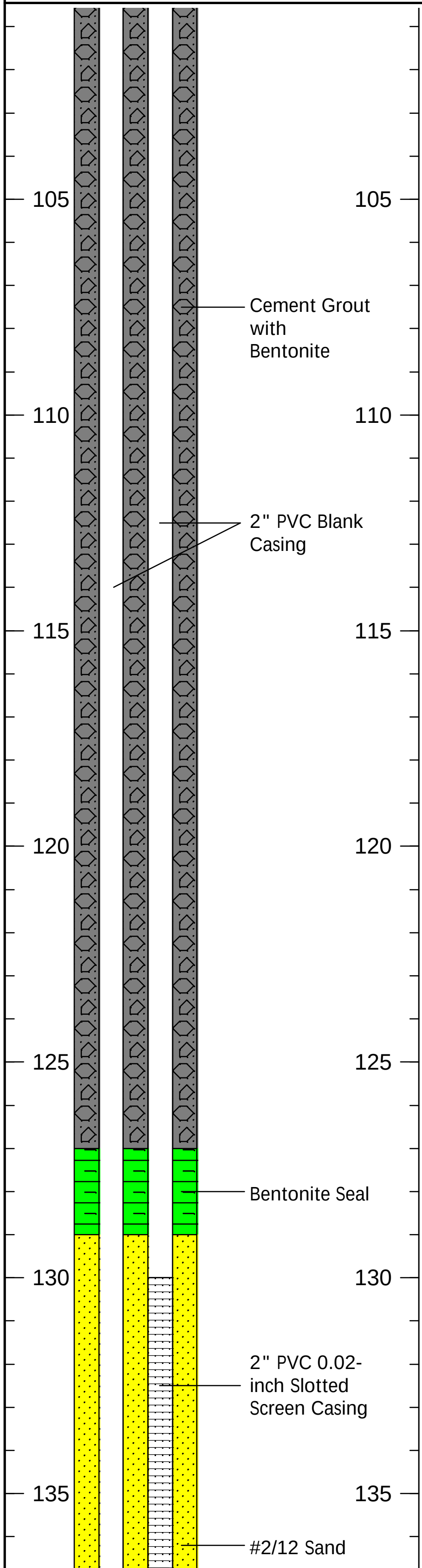
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION



USCS	Lithologic Description
CL	Sandy Clay; dark reddish brown (5YR 3/3); 60% lean clay; 40% fine to coarse grained sand; low plasticity; wet. @ 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.
SM	Silty Sand; dark grayish brown (10YR 5/2); 90% medium to coarse grained sand; 10% silt; non-plastic; wet.
CL	Lean Clay with Gravel; very dark gray (6YR 3/1); 90% clay; 10% fine subanguar 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.
ML 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.
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.
ML 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 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)

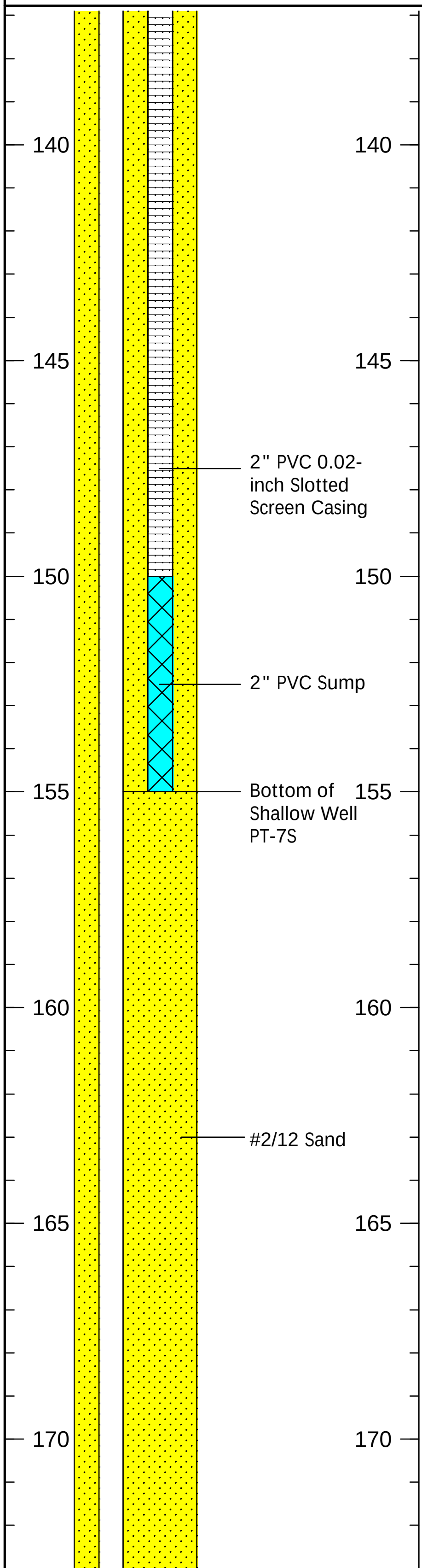
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION



USCS	LITHOLOGIC DESCRIPTION
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.
CL	Sandy Lean Clay; dark reddiish 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.
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.
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.
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.
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.
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).
	Clayey Silt; dark grayish brown (10YR 4/2); 55% silt; 45% clay; trace medium to

LOG OF BORING PT-7 S/D
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



Depth	USCS	Lithologic Description
	ML/CL	coarse grained sand and fine subangular gravel; low plasticity; hard; moist.
140	CL	Lean Clay; dark grayish brown (10YR 4/2); 95% lean clay; 5% medium to coarse grained sand; low plasticity; very stiff; wet.
145	ML	Silt; dark grayish brown (10YR 4/2); 95% silt; 5% medium to coarse grained sand; non-plastic; hard; moist. @ 144 feet: moderately cemented.
150, 155	ML	@ 152 feet: Sandy Silt with Gravel; light gray (5Y 7/1); 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel; non-plastic; very soft; moist. @ 156 feet: very dark grayish brown (10YR 3/2); with areas of light reddish brown (2.5YR 7/4) and dark red (2.5YR 3/6); 60% silt; 30% fine to coarse grained sand; 10% fine subangular gravel.
160	CL	Lean Clay with Sand; dark reddish gray (2.5YR 3/1) with areas of light reddish brown (2.5YR 7/4) and dark red (2.5YR 3/6); 90% lean clay; 10% fine to medium grained sand; low plasticity; soft; wet.
	SM	Silty Sand; dark reddish gray (2.5YR 4/1); 90% medium to coarse grained sand; 10% silt; wet.
	ML	Silt with Gravel; dark reddish gray (2.5YR 4/1) with areas of light red (2.5YR 7/8); 80% silt; 15% fine subangular gravel; 5% medium to coarse grained sand; non-plastic; wet.
	CL	Silty Clay with Sand; dark reddish brown (2.5YR 3/4); 50% clay; 40% silt; 10% coarse grained sand; low plasticity; wet.
165	ML	Sandy Silt with Gravel; dark reddish gray (2.5YR 4/1); 70% silt; 20% medium to grained sand; 10% fine subangular gravel; non-plastic; moist.
170	CL	Lean Clay; dark reddish gray (10R 3/1); 95% clay; 5% medium to coarse grained sand; low plasticity; very soft; wet.

LOG OF BORING PT-7 S/D
(Continued)

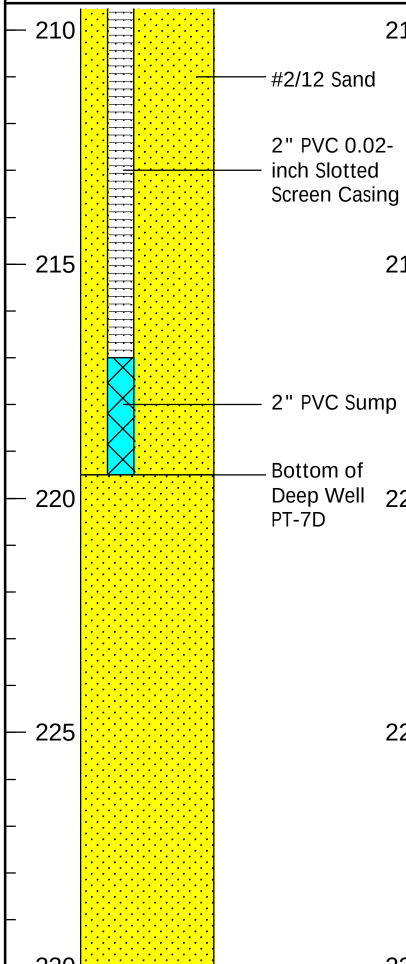
WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION

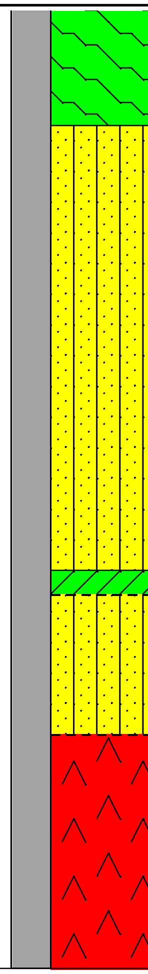
Well construction: #2/12 Sand; Neat Cement Grout with Bentonite; Bentonite Seal; 2" PVC 0.02-inch Slotted Screen Casing

Depth: 175, 180, 185, 190, 195, 200, 205

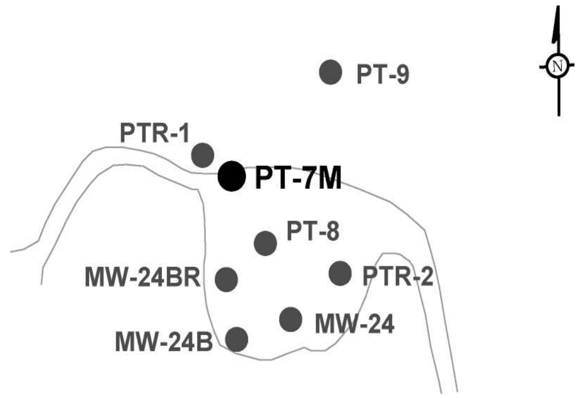
USCS	Lithologic Description
CL	
SM	Silty Sand; dark reddish gray (10R 3/1); 70% medium to coarse grained sand; 30% silt; non-plastic; wet.
CL	Lean Clay; dark reddish gray (2.5YR 3/1); 95% clay; 5% medium to coarse grained sand; trace fine subangular gravel; low plasticity; medium stiff; moist.
SM	Silty 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.
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.
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.
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.
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; wet.
CL	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.
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; wet. @ 203.5 feet: very dark grayish green (GLEY1 2.5/2).
CH	Fat Clay; dark red (2.5YR 3/6); 100% clay; plasticity; very soft; wet. @ 209 feet: trace fine subangular gravel.

WELL CONSTRUCTION





Depth	USCS	LITHOLOGIC DESCRIPTION
210	CH	@ 210 feet: Sandy Fat Clay; dark red (2.5YR 3/6); 80% clay; 20% coarse grained sand; medium stiff; wet.
215	SM	Silty Sand with Gravel; dark red (2.5YR 3/6); 60% medium to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; non-plastic; wet.
220	CL	Lean Clay with Sand; dark red (2.5YR 3/6); 90% clay; 10% coarse grained sand; medium stiff; wet.
	SM	Silty Sand with Gravel; dark red (2.5YR 3/6); 60% medium to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; non-plastic; wet. (Based on soil cuttings; driller lost sample).
225		Bedrock; conglomerate; reddish brown (5YR 4/4); 100% silt; homogeneous; dry.
230		Total Depth Explored: 230 feet bgs



LOG OF BORING PT-7 M

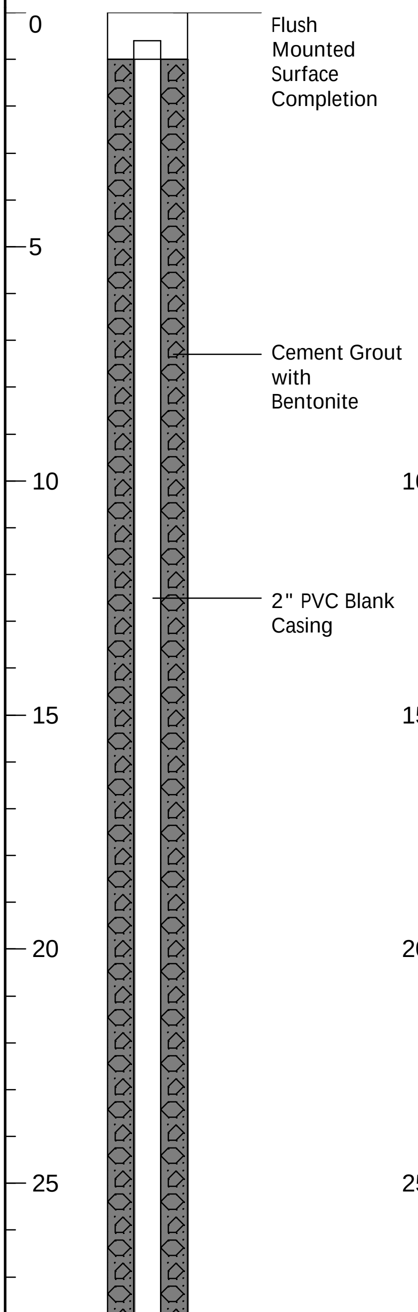
PG&E Topock Site
Needles, California

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

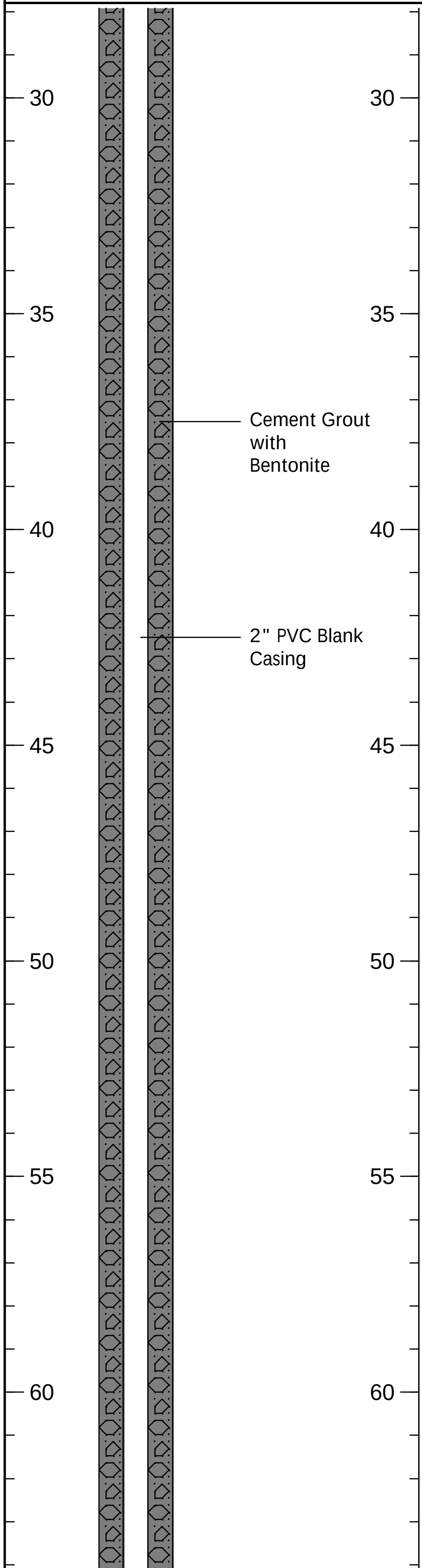
Boring Diameter (inches): 6



Depth	USCS	Sample	Key	
0				For lithologic description, see PT-7 S/D.
5				
10				
15				
20				
25				

LOG OF BORING PT-7 M
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



LOG OF BORING PT-7 M
(Continued)

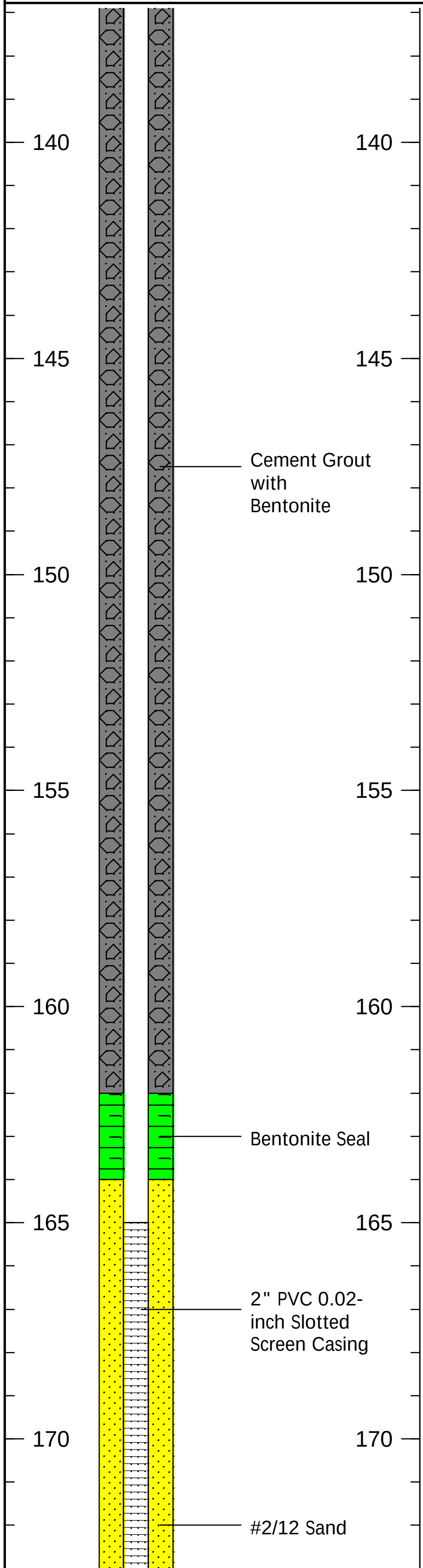
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
65	65				
70	70				
Cement Grout with Bentonite					
75	75				
2" PVC Blank Casing					
80	80				
85	85				
90	90				
95	95				
100	100				

LOG OF BORING PT-7 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
105	105				
Cement Grout with Bentonite					
110	110				
2" PVC Blank Casing					
115	115				
120	120				
125	125				
130	130				
135	135				

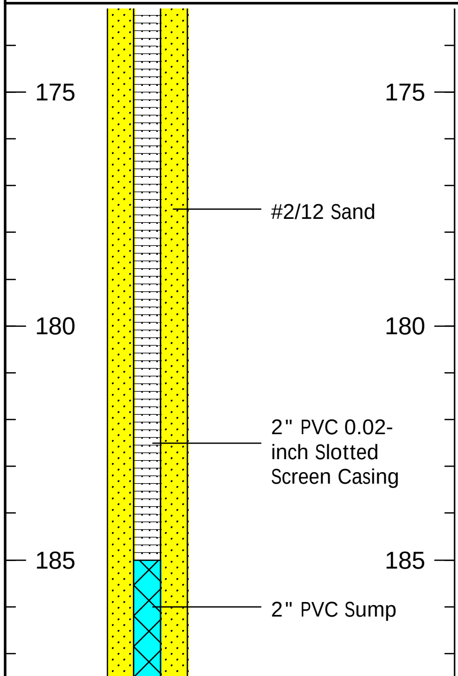
LOG OF BORING PT-7 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION

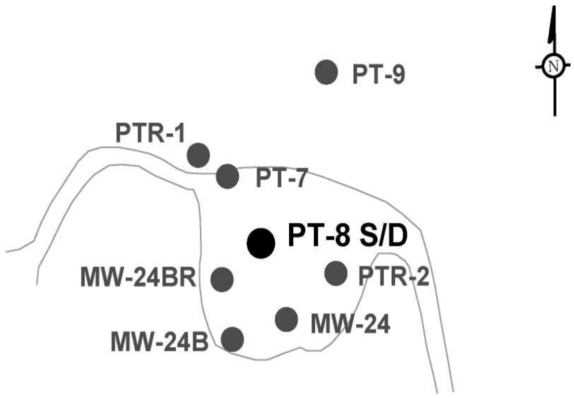


LOG OF BORING PT-7 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION



End of boring at 187.5 feet bgs



LOG OF BORING PT-8 S/D

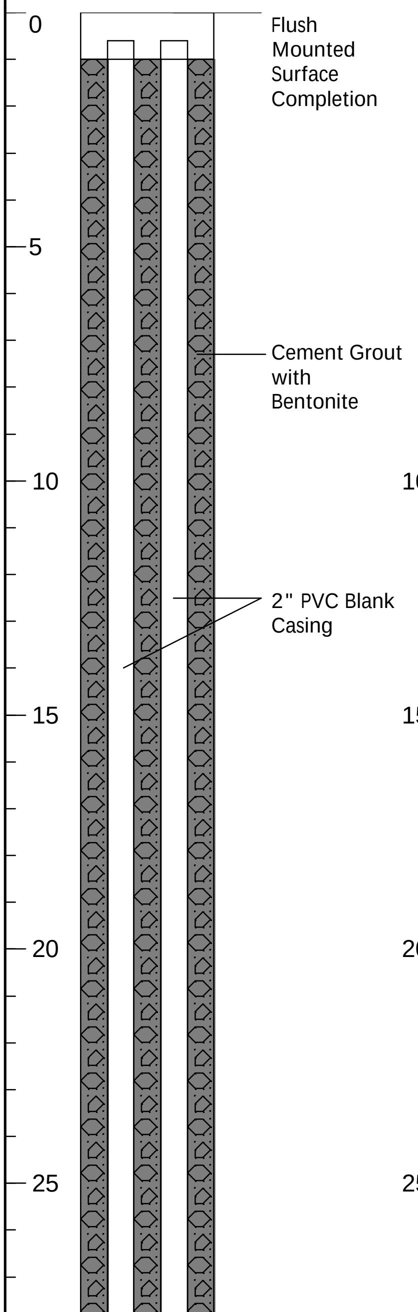
PG&E Topock Site
Needles, California

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 #2007040403, 2007040405		Driller's License:	C57-283326

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 10



Depth	USCS	Sample	Key	Description
0	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.
				@ 3 feet: trace subangular cobbles ranging from 2.9 to 3.5 inches.
5	ML			
10				
15	ML			@ 15 feet: light brownish gray (10YR 6/2).
20				
	SM			Silty Sand with Gravel; dark grayish brown (10YR 4/1); 60% fine to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; moist.
25	ML			Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt, 20% fine to coarse grained sand; 20% fine to coarse subangular gravel; trace cobbles up to 3.5 inches; non-plastic; dry.

LOG OF BORING PT-8 S/D
(Continued)

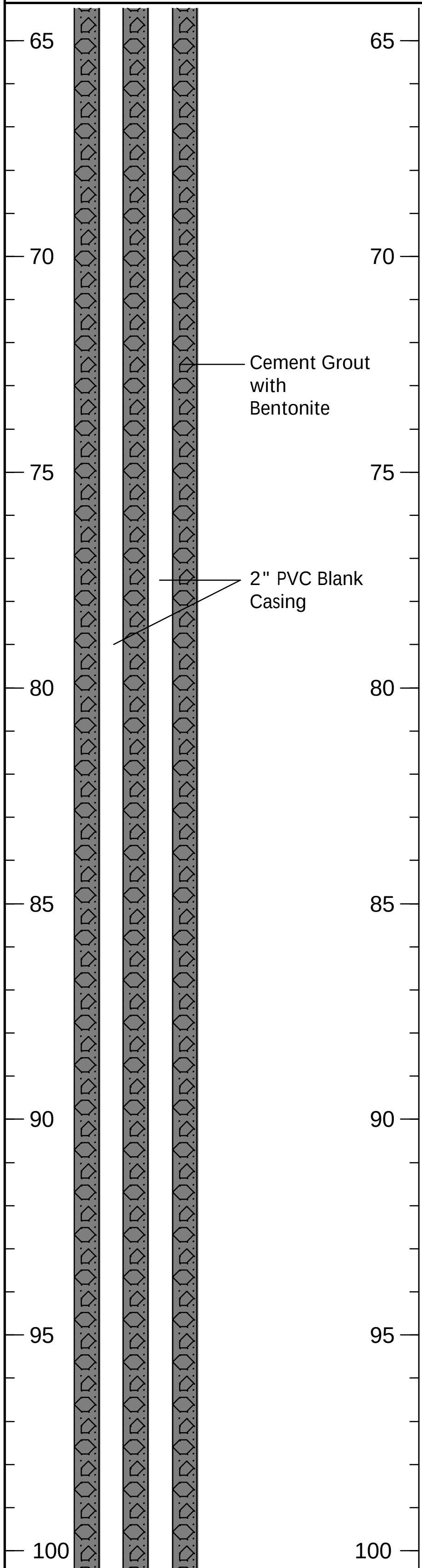
WELL CONSTRUCTION	Depth	USCS	LITHOLOGIC DESCRIPTION
	28–30.5	ML	
	30.5–31	SM	Silty Sand with Gravel; pale brown (10YR 6/3); 70% fine to coarse grained sand; 20% silt; 10% fine to coarse subangular gravel; dry.
	31–35	ML	Sandy Silt with Gravel; light gray (10YR 7/2); 60% silt, 20% fine to coarse grained sand; 20% fine to coarse subangular gravel; non-plastic; dry.
Cement Grout with Bentonite	35–39	SM	Silty Sand; dark reddish gray (10YR ?/?); 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.
2" PVC Blank Casing	39–46	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.
	46–49	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.
	49–55	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.
	55–58	SM	Silty Sand; dark reddish gray (10R 3/1); with a seam of dark greenish gray (GLEY1 4/1); 60% medium to coarse grained sand; 40% silt; trace fine subangular gravel; wet.
	58–60.5	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.
	60.5–64	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.

Depth scale: 30, 35, 40, 45, 50, 55, 60

Sample | Key

LOG OF BORING PT-8 S/D
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



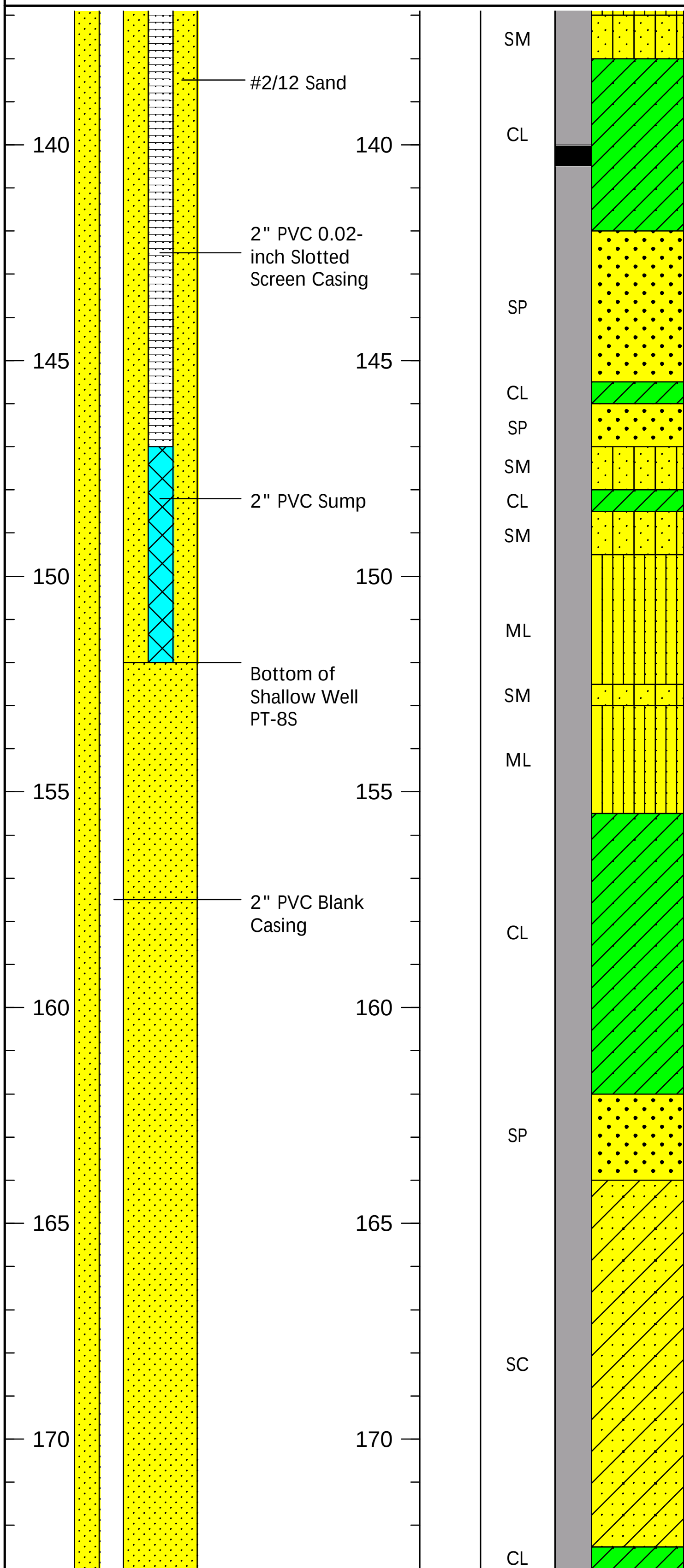
Depth	USCS	LITHOLOGIC DESCRIPTION
65–70	CL	Sandy Clay; dark reddish gray (2.5YR 3/1); 70% clay, 20% medium to coarse grained sand; trace subangular fine gravel; low plasticity; very soft; wet. @ 68 feet: dark greenish (GLEY 4/1) to light greenish gray (GLEY 7/1) seam (0.5-inch thick)
70–73	SM	Silty Sand with Gravel; dark reddish gray (2.5YR 3/1); 60% fine to medium grained sand; 25% silt; 15% fine to coarse subangular gravel; moist.
73–75	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.
75–77	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.
77–83	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.
83–85	CL	Lean Clay with Gravel; dark grayish brown (10YR 4/2); 90% lean clay; 10% fine subangular gravel; medium plasticity; medium stiff; moist.
85–88	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.
88–88.5	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.
88.5–96	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.
96–98	CL	Lean Clay with Gravel; dark brown (10YR 3/3); 90% clay; 10% fine to coarse subangular gravel; low to medium plasticity; moist.
98–100	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	LITHOLOGIC DESCRIPTION
		ML	@ 101 feet: light gray (5YR 7/1). @ 103 feet: light reddish gray (2.5YR 7/1); 80% silt; 20% fine to coarse grained sand; weak cementation; very stiff; dry.
Cement Grout with Bentonite	105	SM	Silty Sand with Gravel; light gray (5YR 7/1); 60% fine to coarse grained sand; 25% silt; 15% fine subangular gravel; dry. There are layers that are weak to moderately cemented.
2" PVC Blank Casing	110	ML	Sandy Silt; light gray (5YR 7/1); 80% silt; 20% fine to coarse grained sand; non-plastic; weakly cemented; stiff; moist. @ 113 feet: very stiff.
	115	SM	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.
		ML	Sandy Silt; light gray (5YR 7/1); 80% silt; 20% fine to coarse grained sand; non-plastic; weakly cemented; stiff; moist.
Bentonite Seal	120	SM	Silty Sand with Gravel; dark reddish gray (5YR 4/2); 60% fine to coarse grained sand; 30% silt; 10% fine subangular gravel; moist.
#2/12 Sand	125	SM	@ 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.
	130	SP	Poorly Graded Sand; dark reddish brown (5YR 3/2); 95% medium to coarse grained sand; 5% silt; wet.
2" PVC 0.02-inch Slotted Screen Casing		SM/SC	Silty Sand; dark reddish brown (5YR 3/2); 80% medium to coarse grained sand; 20% silt; trace fine to coarse subangular gravel; wet. 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.
	135	ML	Sandy Silt; reddish gray (10R 6/1); 70% silt, 30% fine to coarse grained sand; moderately cemented; non-plastic; stiff; dry.
		SM	
		ML	Silty Sand; dark reddish brown (5YR 3/2); 80% medium to coarse grained sand;

LOG OF BORING PT-8 S/D
(Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



20% silt; trace fine to coarse subangular gravel; moist.

Sandy Silt; reddish gray (10R 6/1); 70% silt, 30% fine to coarse grained sand; moderately cemented; non-plastic; stiff; dry. Underlied and overlied by 1 to 2-inch layers of moderately cemented silt with fine to coarse grained sand (hardpan).

Silty Sand; dark reddish gray (10R 4/1); 70% medium to coarse grained sand; wet.

Gravelly Clay; dark reddish gray (10YR 4/1); 70% lean clay; 20% fine to coarse subangular gravel; 10% coarse grained sand; medium plasticity; wet.

Poorly Graded Sand; dark reddish gray (10R 4/1); 95% coarse grained sand; 5% silt; wet.

Sandy Clay; dark reddish gray (10R 4/1); 60% clay, 40% medium to coarse grained sand; low plasticity; wet.

Poorly Graded Sand; dark reddish gray (10R 4/1); 95% fine to coarse grained sand; 5% silt; wet.

Silty Sand; dark reddish gray (10R 4/1); 70% fine to coarse grained sand; 30% silt; wet.

Sandy Clay; dark reddish gray (10R 4/1); 60% clay, 40% medium to coarse grained sand; low plasticity; wet.

Silty Sand; dark reddish gray (10YR 4/1); 70% fine to coarse grained sand; 30% silt; wet.

Sandy Silt with Gravel; dark reddish gray (10R 4/1); 60% silt, 30% fine to coarse grained sand; moderately cemented; non-plastic; moist.
@ 150 feet: light gray (10Y 7/1); 70% silt; 20% fine to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; moist. 1-inch moderately cemented layers present.

Silty Sand; dark reddish gray (10R 3/1); medium to coarse grained sand; wet.

Sandy Silt with Gravel; light gray (10Y 7/1); 70% silt; 20% fine to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; moist.
@ 154.5 feet: Sandy Silt; 80% silt; 20% fine to coarse grained sand; trace fine subangular gravel; moderately cemented.

Sandy Lean Clay; dark reddish gray (10R 3/1) with dark red (10R 3/6); 80% clay; 20% medium to coarse grained sand; low plasticity; moderately cemented; moist (hardpan).
@ 158 feet: 70% clay; 30% coarse grained sand; medium plasticity; very soft; wet.
@ 159 feet: weak cementation.
@ 161 feet: fine to coarse grained sand; low plasticity; very soft.

Poorly Graded Sand; dark reddish brown (2.5YR 3/4); 95% fine to coarse grained sand; 5% silt; wet.

Clayey Sand; dark reddish brown (2.5YR 3/4); 80% fine to coarse grained sand; 20% lean clay; trace fine to coarse subangular gravel up to 3.5-inches; low plasticity; very soft; wet.

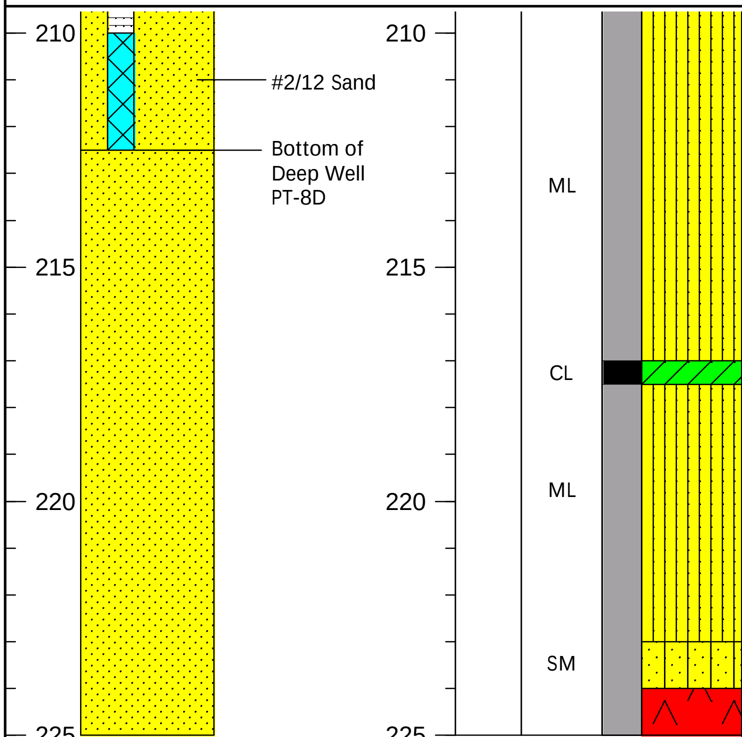
@ 165 feet: trace fine subangular gravel.

Sandy Lean Clay; dark reddish brown (2.5YR 3/4); 70% medium to coarse grained

LOG OF BORING PT-8 S/D
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
					sand; 30% ??; low plasticity; weak to moderate cementation; very stiff.
	175	ML			Sandy Silt with Gravel; light reddish gray (2.5YR 7/1) to light reddish brown (2.5YR 7/4); 60% silt; 20% fine to coarse grained sand; non-plastic; moist to wet. Layers of weak to moderate cementation.
#2/12 Sand	180	SC/SM			Clayey Sand with Gravel; dark reddish brown (2.5YR 3/4); 65% medium to coarse grained sand; 30% clay; 5% fine subangular gravel; low plasticity; very soft; wet. There are 1 to 2-inch thick layers of silty sand in between. @ 184.5 feet: Moderately cemented layer; hard (round disc).
Cement Grout with Bentonite; Bentonite Seal	185	SM			Clayey Sand with Gravel; dark reddish brown (2.5YR 3/4); 65% medium to coarse grained sand; 30% clay; 5% fine subangular gravel; low plasticity; very soft; wet. Has moderately cemented hard layers (1 to 2 inches); some layers are light reddish gray (2.5YR 7/1).
2" PVC 0.02-inch Slotted Screen Casing	190, 195	ML			Sandy Silt; light reddish gray (2.5YR 7/1); 80% silt; 20% fine to coarse grained sand; trace fine subangular gravel; non-plastic; very soft; moist. Moderately cemented, hard layers (1 to 2 inches). @ 197 feet: moderately cemented; hard. @ 199 feet: alternating non to moderately cemented with gravel layers that are very soft to stiff.
	200	SM			Silty Sand with Gravel; light reddish gray (2.5YR 7/1); 70% fine to coarse grained sand; 20% silt; 10% fine subangular gravel; moist.
		ML			Sandy Silt; light reddish gray (2.5YR 7/1); 80% silt; 20% fine to coarse grained sand; trace fine subangular gravel; non-plastic; very soft; moist.
		CH			Fat Clay; dark reddish gray; high plasticity; very soft; wet.
	205	ML			Sandy Silt with Gravel; dark reddish brown (2.5YR 3/4); 60% silt; 30% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; moderately cemented; very stiff; moist.
		CL			Sandy Lean Clay; dark reddish brown (2.5YR 3/4); 80% clay; 15% medium to coarse grained sand; 5% fine subangular gravel; medium plasticity; soft; wet.
		ML			Sandy Silt with Gravel; dark reddish brown (2.5YR 3/4); 60% silt; 30% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; moderately cemented; very stiff; moist.

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



@ 211-212 feet: very soft.

Sandy Lean Clay; dark reddish brown (2.5YR 3/4); 80% clay; 15% medium to coarse grained sand; 5% fine subangular gravel; medium plasticity; soft; wet.

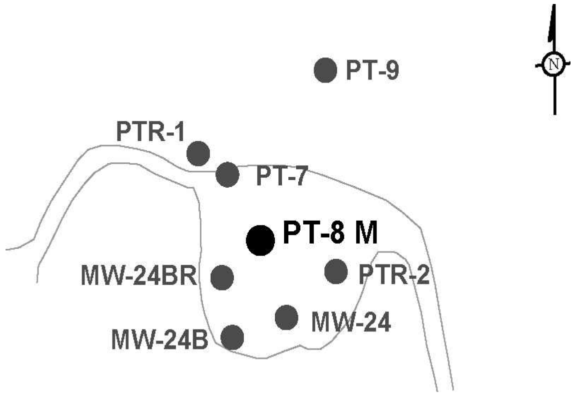
Sandy Silt with Gravel; dark reddish brown (2.5YR 3/4); 60% silt; 30% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; weakly cemented; stiff; wet.

@ 221 feet: moderately cemented; very stiff.

Silty Sand; dark reddish brown (2.5YR 3/4); 80% medium to coarse grained sand; 20% silt; non-plastic; not cemented; wet.

Bedrock

Total Depth Explored: 225 feet bgs



LOG OF BORING PT-8 M

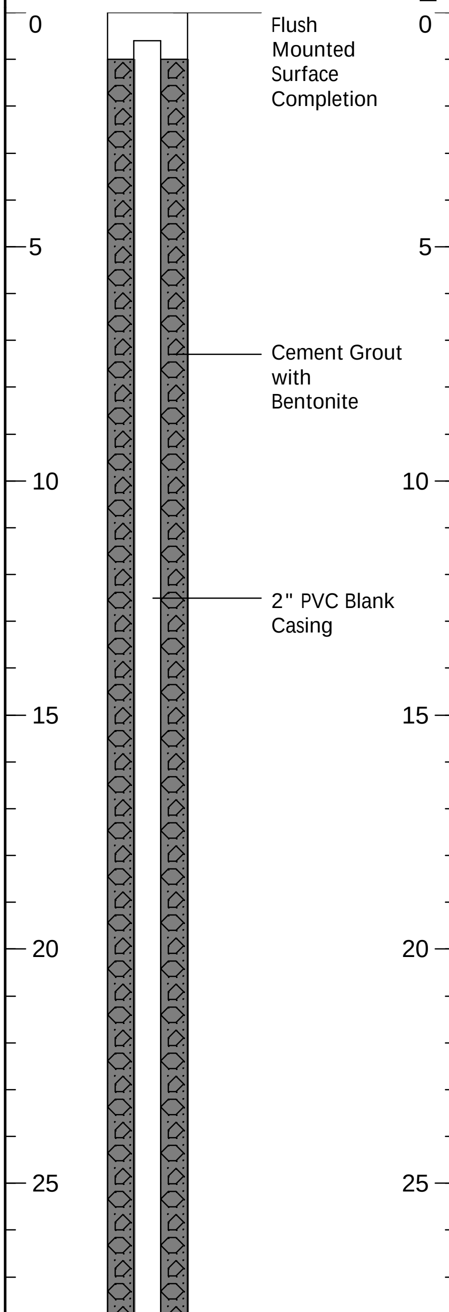
PG&E Topock Site
Needles, California

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



Depth	USCS	Sample	Key	
0				For lithology description see PT-7 S/D.
5				
10				
15				
20				
25				

LOG OF BORING PT-8 M
(Continued)

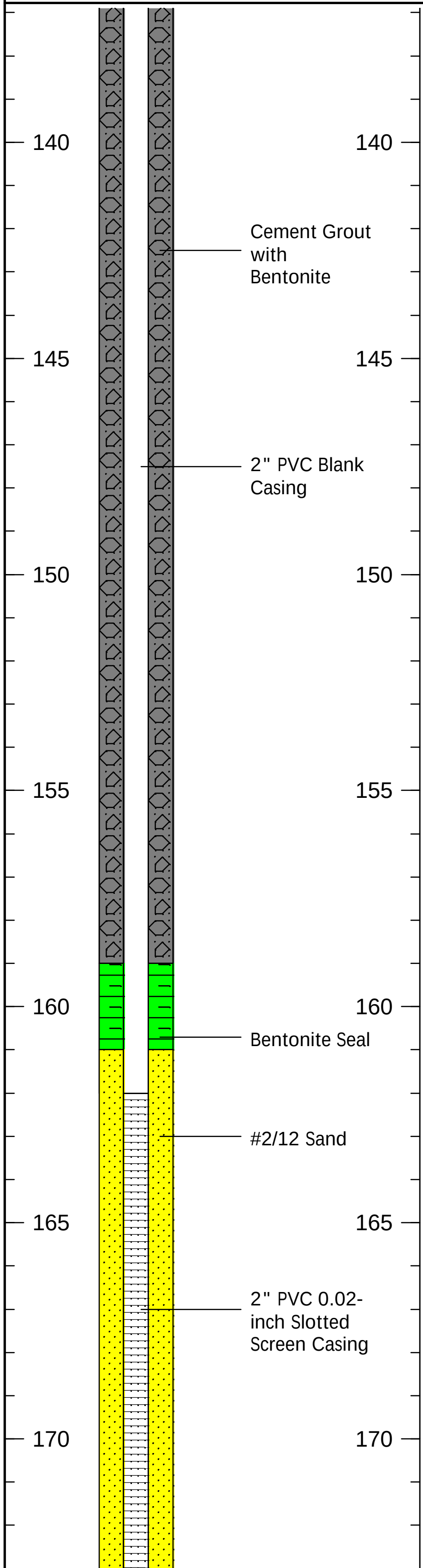
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
30	30				
35	35				
Cement Grout with Bentonite					
40	40				
2" PVC Blank Casing					
45	45				
50	50				
55	55				
60	60				

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
65	65				
70	70				
Cement Grout with Bentonite					
75	75				
2" PVC Blank Casing					
80	80				
85	85				
90	90				
95	95				
100	100				

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
105	105				
Cement Grout with Bentonite					
110	110				
2" PVC Blank Casing					
115	115				
120	120				
125	125				
130	130				
135	135				

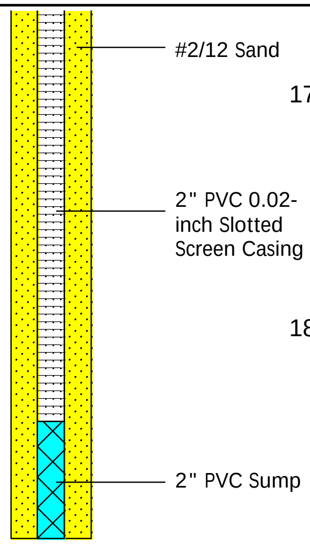
LOG OF BORING PT-8 M
(Continued)

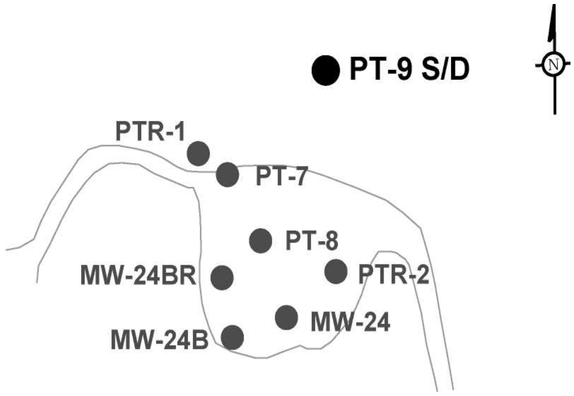
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION



LOG OF BORING PT-8 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
175	175				
180	180				
					End of boring at 184.5 feet bgs





LOG OF BORING PT-9 S/D

PG&E Topock Site
Needles, California

Project No.:	RC000689.0004	Date Started:	4 June 2007
Logged by:	Brett Bardsley	Date Completed:	6 June 2007
Drilling Co.:	WDC	Drilling Method:	Rotosonic/Mud Rotary
Drillers:	Rivera, West, Sakioka, Villegas	Sample Method:	4" x 6" Core Rod
Well Permit #	2007040408, 2007040406	Driller's License:	C57-283326

WELL CONSTRUCTION

Boring Diameter (inches): 10

Flush Mounted Surface Completion

Cement Grout with Bentonite

2" PVC Blank Casing

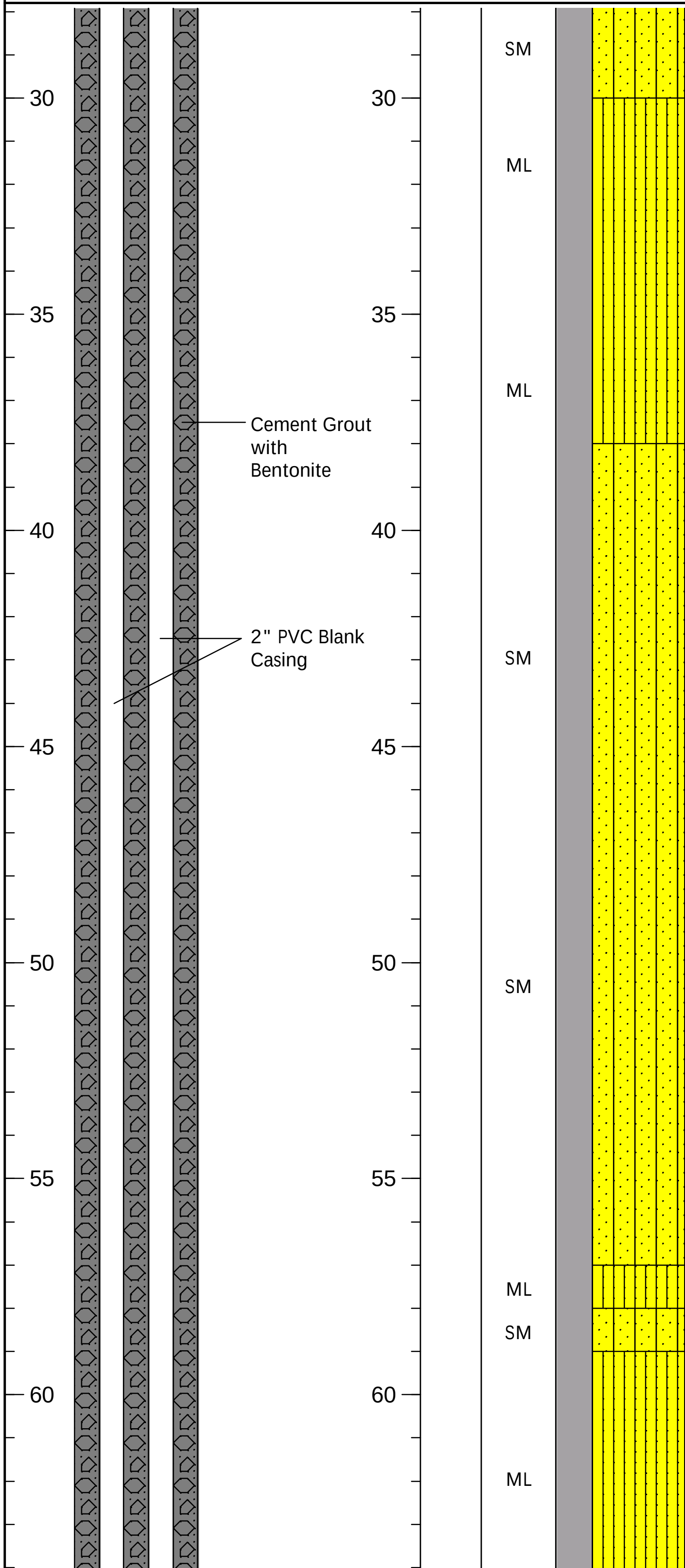
LITHOLOGIC DESCRIPTION

Depth	USCS	Description
0	ML	Sandy Silt with Gravel; very pale brown (10YR 7/3); 70% silt, 20% fine to coarse grained sand; 20% fine to coarse subangular gravel; non-plastic; very soft; dry.
2	ML	@ 2 feet: 95% silt; 5% fine subangular gravel.
5	ML	@ 5 feet: light gray (10YR 7/1); 60% silt; 20% fine to coarse grained sand; 20% fine to coarse subangular gravel.
7	ML	@ 7 feet: trace cobbles to 3.5 inches.
8	ML	@ 8 feet: 80% silt; 15% fine subangular gravel; 5% fine to coarse grained sand.
12	ML	@ 12 feet: trace cobbles up to 3.5 inches.
14	ML	@ 14 feet: Gravelly Silt; light gray (10YR 7/1); 70% silt; 20% fine to coarse subangular gravel; 10% fine to coarse grained sand; non-plastic; very soft; dry.
18	SM	Silty Sand with Gravel; light gray (10YR 7/1); 60% fine to coarse grained sand; 15% silt; 15% fine subangular gravel; dry.
20	SM	@ 20 feet: 60% fine to coarse grained sand; 30% silt; 10% fine to coarse subangular gravel; dry; occasional 1 to 2-inch weakly cemented hard layers.
22	SM	@ 22 feet: light gray (5YR 7/1) to light reddish brown (5YR 6/4); trace subangular cobbles up to 3.5 inches.

Depth scale: 0, 5, 10, 15, 20, 25

LOG OF BORING PT-9 S/D
(Continued)

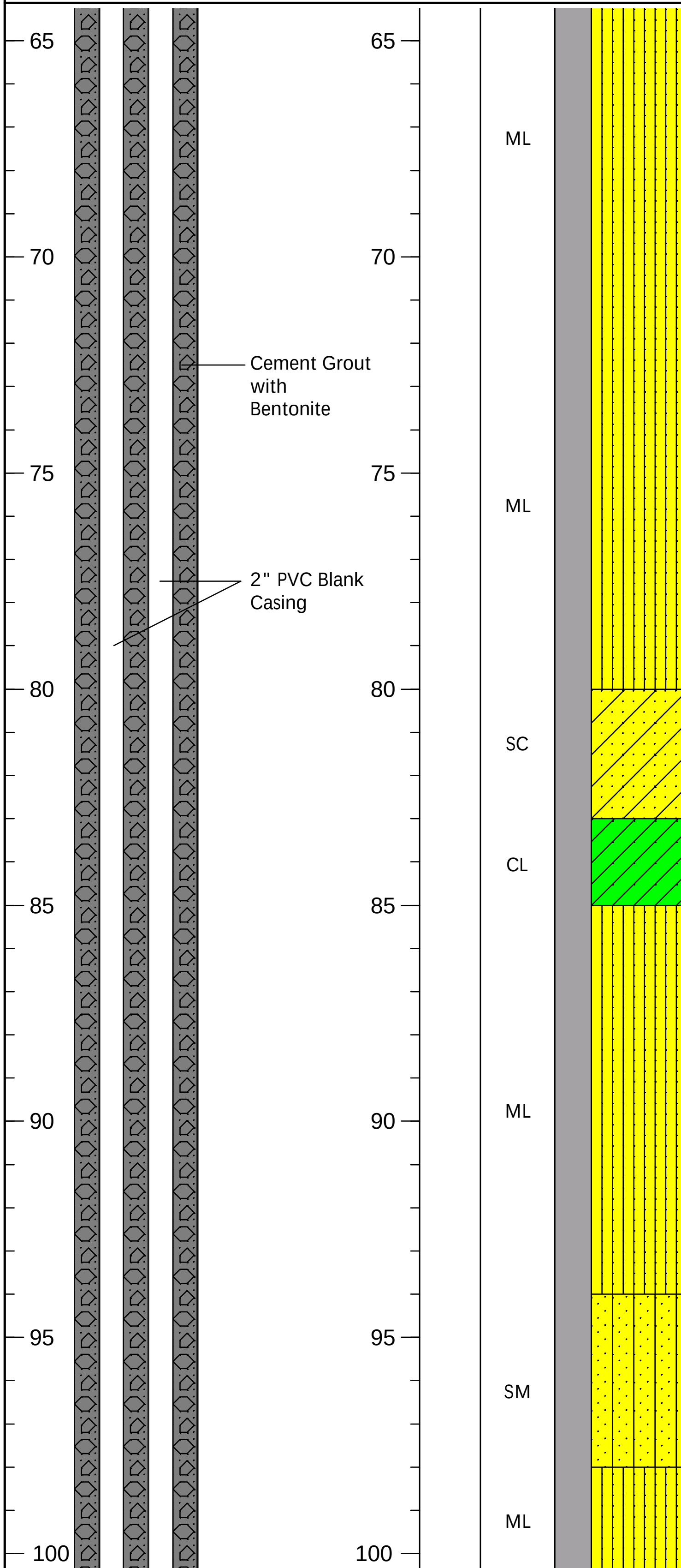
WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION



Depth	USCS	Lithologic Description
28–30	SM	
30–38	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.
	ML	@ 36 feet: moderately cemented layers; hard; dense; up to 2.5-inches thick.
38–57	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.
	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.
57–58	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.
58–59	SM	Silty Sand with Gravel.
59–64	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



@ 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.

@ 74 feet: One cemented layer was 6-inches thick.

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.

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.

Sandy Silt with Gravel; greenish gray (GLEY2 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.

@ 90 feet: trace cobbles up to 3.5 inches.

@ 92 feet: no cobbles; occasional layers of moderately cemented, very stiff material (1 to 2-inches). The majority is very soft, dry.

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.

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.

@ 100 feet: Gravelly Silt; reddish brown (2.5YR 4/3); 75% silt; 20% fine subangular

LOG OF BORING PT-9 S/D (Continued)

WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION

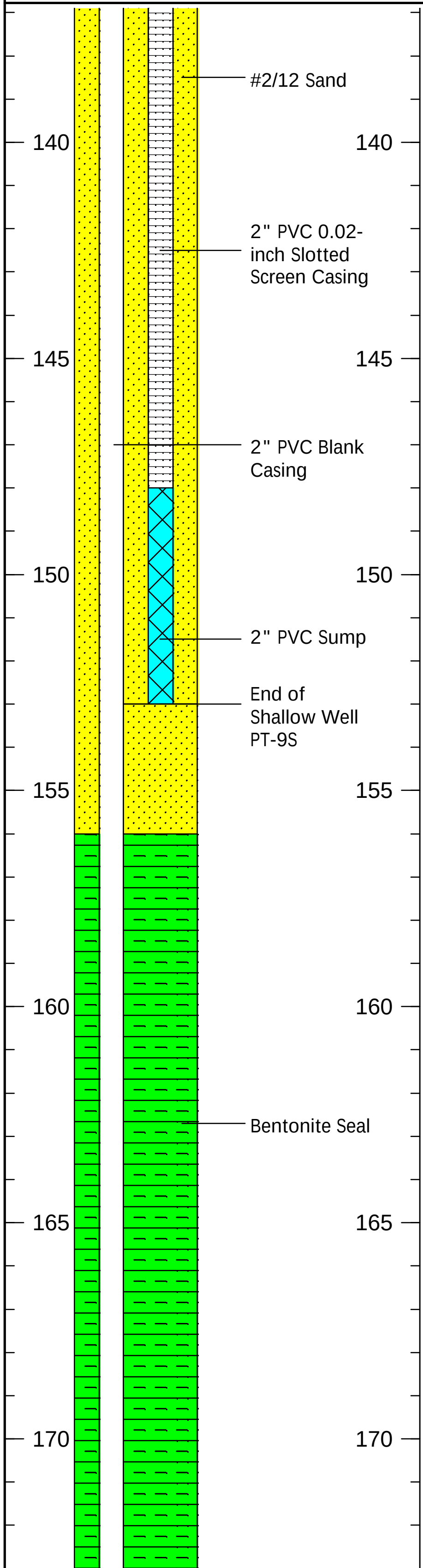
Well construction labels: Cement Grout with Bentonite; 2" PVC Blank Casing; Bentonite Seal; #2/12 Sand; 2" PVC 0.02-inch Slotted Screen Casing

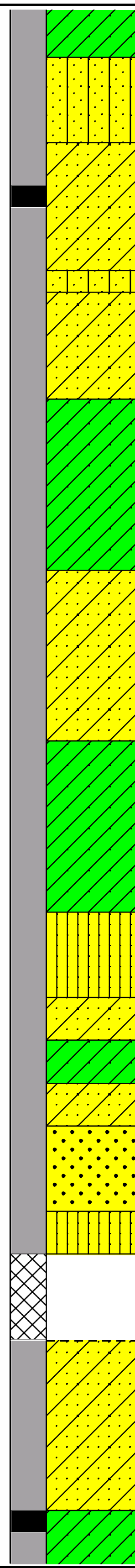
Depth: 105, 110, 115, 120, 125, 130, 135

USCS	LITHOLOGIC DESCRIPTION
ML	gravel; 5% medium to coarse grained sand; non-plastic; moderately cemented; hard; moist. @ 102 feet: Sandy Silt with Gravel; light reddish gray (2.5YR 7/1) to reddish brown (2.5YR 4/3); 70% silt; 20% fine coarse grained sand; 10% fine subangular gravel; non-plastic; weakly to moderately cemented; hard; dry to moist.
CL	Sandy Lean Clay; reddish brown (2.5YR 4/3); 80% lean clay; 20% medium to coarse grained sand; low plasticity; soft; wet.
ML	Sandy Silt; light reddish gray (2.5YR 7/1) with light reddish brown (2.5YR 7/4); 80% silt, 20% fine to coarse grained sand; trace subangular to angular gravel; non-plastic; moderately cemented; hard; dry. @ 112 feet: Silt; 90% silt; 5% coarse grained sand; 5% coarse subangular gravel; non-plastic; moderately cemented; hard; dry to moist. @ 114 feet: Sandy Silt with Gravel; 60% silt; 20% fine to coarse grained sand; 20% fine subangular gravel; non-plastic; moderately cemented; hard; dry.
ML	@ 122 feet: 60% silt; 30% medium to coarse grained sand; 10% fine subangular gravel.
SM	Silty Sand; dark reddish gray (5YR 4/2); 75% medium to coarse grained sand; 20% silt; 5% fine subangular gravel; non-plastic; loose; wet.
ML	Sandy Silt with Gravel; dark reddish gray (5YR 4/2); 65% silt; 25% fine to coarse grained sand; 10% fine subangular gravel; non-plastic; moderately cemented; very stiff; wet.
SM	Silty Sand.
ML	Sandy Silt with Gravel.
SM	Silty Sand.
ML	Sandy Silt with Gravel.
SM	Silty Sand.
ML	Sandy Silt with Gravel.
SM	Silty Sand with Gravel; dark reddish gray (5YR 4/2); 70% medium to coarse grained sand; 20% silt; 10% fine subangular gravel; dense; wet.
CL	Sandy Clay with Gravel; dark reddish gray (5YR 4/2); 70% silt; 20% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; soft; wet. @ 136 feet: moderately cemented; very stiff.

LOG OF BORING PT-9 S/D
(Continued)

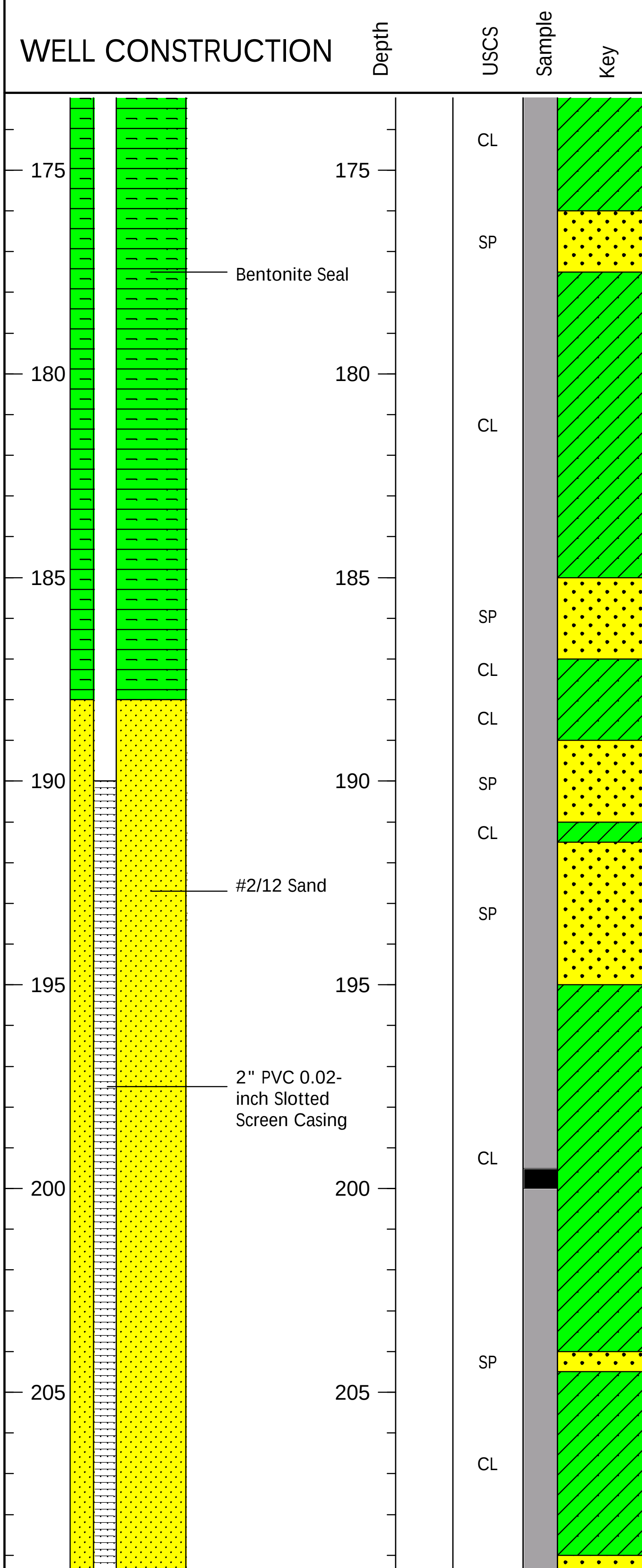
WELL CONSTRUCTION | Depth | USCS | Sample | Key | LITHOLOGIC DESCRIPTION





USCS	Lithologic Description
CL	
SM	Silty Sand with Gravel; reddish brown (5YR 4/4); 70% medium to coarse grained sand; 20% silt; 10% fine to coarse subangular gravel; loose; wet.
SC	Clayey Sand with Gravel; dark reddish brown (2.5YR 3/3); 60% medium to coarse grained sand; 30% lean clay; 10% fine to coarse subangular gravel; low to medium plasticity; wet. @ 141.5-142 feet: moderately cemented; very stiff.
SM	Silty Sand with Gravel; reddish brown (5YR 4/4); 70% medium to coarse grained sand; 20% silt; 10% fine to coarse subangular gravel; loose; wet.
SC	Clayey Sand with Gravel; dark reddish brown (2.5YR 3/3); 60% medium to coarse grained sand; 30% silt; 10% fine subangular gravel; low plasticity; dense; wet.
CL	Sandy Lean Clay; dark reddish brown (2.5YR 3/3); 70% lean clay; 30% fine to coarse grained sand; low plasticity; soft; wet. @ 147-148 feet: very stiff. @ 148 feet: 75% lean clay; 20% medium to coarse grained sand; 5% fine subangular gravel; low to medium plasticity; soft; wet.
SC	Clayey Sand with Gravel; dark reddish brown (2.5YR 3/3); 70% medium to coarse grained sand; 20% lean clay; 10% fine to coarse subangular gravel; low plasticity; loose; wet.
CL	Sandy Lean Clay with Gravel; dark reddish gray (2.5YR 3/1); 70% lean clay; 20% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; medium stiff; wet. @ 156 feet: moderately cemented; hard.
ML	Sandy Silt with Gravel; dark reddish gray (2.5YR 3/1); 70% silt, 20% fine to coarse grained sand; 10% fine to coarse subangular gravel; non-plastic; moderately cemented; hard; dry.
SC	Clayey Sand with Gravel; dark reddish gray (2.5YR 3/1); 60% medium to coarse grained sand; 30% lean clay; 20% fine subangular gravel; low plasticity; loose; wet.
CL	Sandy Clay; dark reddish gray (10R 4/1); 60% clay, 40% medium to coarse grained sand; low plasticity; wet.
SC	Clayey Sand with Gravel; dark reddish gray (2.5YR 3/1); 60% medium to coarse grained sand; 30% lean clay; 20% fine subangular gravel; low plasticity; loose; wet.
SP	Poorly Graded Sand; reddish black (2.5YR 2.5/1); 95% medium to coarse grained sand; 5% silt; very loose; wet.
ML	Sandy Silt with Gravel; dark reddish gray (2.5YR 3/1); 70% silt, 20% fine to coarse grained sand; 10% fine to coarse subangular gravel; moderately cemented; non-plastic; very stiff; wet.
SC	Clayey Sand with Gravel; dark reddish gray (2.5YR 3/1); 70% coarse grained sand; 20% lean clay; 10% fine to coarse subangular gravel; low to medium plasticity; very soft; wet. @ 170 feet: trace cobbles up to 3.5 inches.
CL	Sandy Lean Clay with Gravel; dark reddish gray (2.5YR 3/1); 70% lean clay; 20% fine to coarse grained sand; 10% fine to coarse subangular gravel; medium

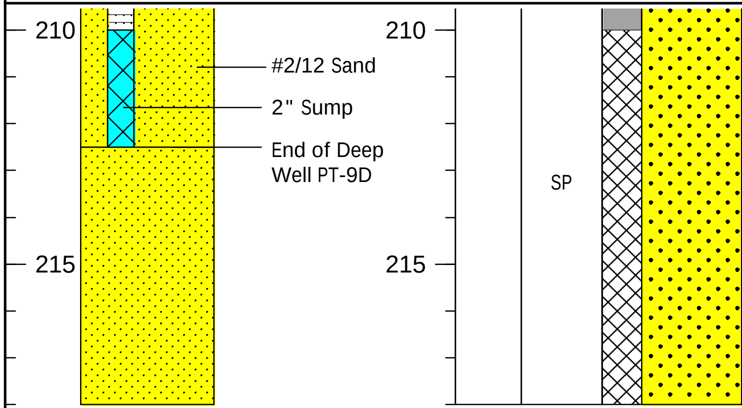
LOG OF BORING PT-9 S/D
(Continued)



USCS	LITHOLOGIC DESCRIPTION
CL	plasticity; non-cemented; soft; wet. @ 173 feet: moderately cemented; hard; moist. @ 174 feet: light red areas (2.5YR 7/8); weakly cemented; stiff.
SP	Poorly Graded Sand; dark red (2.5YR 3/6); 95% medium to coarse grained sand; 5% silt; trace fine subangular gravel; loose; wet.
CL	Sandy Lean Clay with Gravel; dark red (2.5YR 3/6); 70% lean clay; 20% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; weakly cemented; very stiff; wet. @ 180 feet: moderately cemented; hard. @ 182 feet: weakly cemented layers present (approximately 4-inches thick); medium stiff.
SP	Poorly Graded Sand; dark red (2.5YR 3/6); 95% medium to coarse grained sand; 5% silt; trace cobbles to 3.5 inches; loose; wet.
CL CL	Sandy Lean Clay with Gravel; dark red (2.5YR 3/6); 70% lean clay; 20% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; moderately cemented; hard; wet. @ 187.5 feet: White colored moderately cemented zone. @ 188 feet: medium plasticity; not cemented; soft.
SP	Poorly Graded Sand; dark red (2.5YR 3/6); 95% medium to coarse grained sand; 5% silt; loose; wet.
CL	Sandy Lean Clay with Gravel; dark red (2.5YR 3/6); 70% lean clay; 20% medium to coarse grained sand; 10% fine subangular gravel; medium plasticity; non-cemented; soft; wet.
SP	Poorly Graded Sand; dark red (2.5YR 3/6); 95% medium to coarse grained sand; 5% silt; loose; wet. Density of sand increases with depth.
CL	Sandy Lean Clay with Gravel; dark red (2.5YR 3/6); 70% lean clay; 20% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; moderately cemented; very stiff; wet. @ 196 feet: thin layers of medium plasticity. @ 198 feet: low to medium plasticity; medium stiff; weak cementation. @ 200 feet: moderate cementation; stiff. @ 202 feet: weak cementation; medium stiff; wet.
SP	Poorly Graded Sand; dark red (2.5YR 3/6); 95% medium to coarse grained sand; 5% silt; loose; wet.
CL	Sandy Lean Clay with Gravel; dark red (2.5YR 3/6); 70% lean clay; 20% medium to coarse grained sand; 10% fine subangular gravel; low plasticity; weakly cemented; stiff; wet. @ 207 feet: moderately cemented; very stiff.
	Poorly Graded Sand; dark red (2.5YR 3/6); 95% medium to coarse grained sand;

LOG OF BORING PT-9 S/D
(Continued)

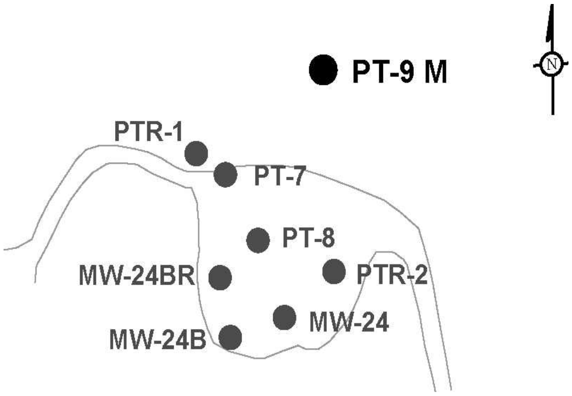
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION



5% silt; loose; wet.

Bedrock encountered at 218 feet bgs.

Total Depth Explored: 218 feet bgs



LOG OF BORING PT-9 M

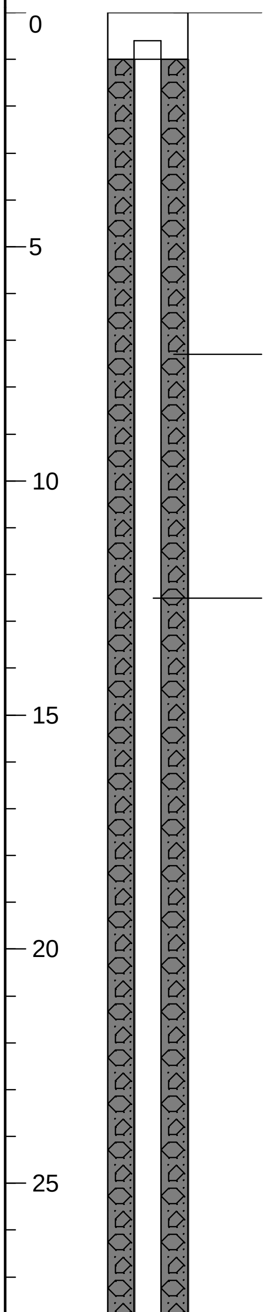
PG&E Topock Site
Needles, California

Project No.:	RC000689.0004	Date Started:	4 June 2007
Logged by:	Brett Bardsley	Date Completed:	6 June 2007
Drilling Co.:	WDC	Drilling Method:	Rotosonic/Mud Rotary
Drillers:	Rivera, West, Sakioka, Villegas	Sample Method:	4" x 6" Core Rod
Well Permit #2007040407		Driller's License:	C57-283326

WELL CONSTRUCTION

LITHOLOGIC DESCRIPTION

Boring Diameter (inches): 6



Depth		USCS	Sample	Key	
0					For lithologic description see PT-9 S/D.
5					
10					
15					
20					
25					

LOG OF BORING PT-9 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
30	30				
35	35				
Cement Grout with Bentonite					
40	40				
2" PVC Blank Casing					
45	45				
50	50				
55	55				
60	60				

LOG OF BORING PT-9 M
(Continued)

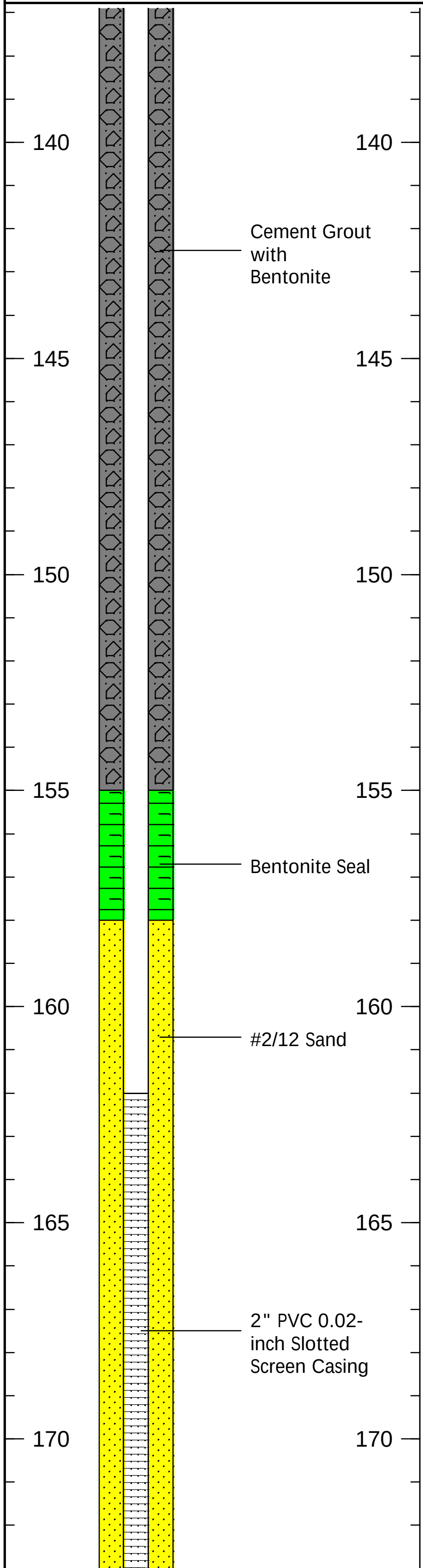
WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
65	65				
70	70				
Cement Grout with Bentonite					
75	75				
2" PVC Blank Casing					
80	80				
85	85				
90	90				
95	95				
100	100				

LOG OF BORING PT-9 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
105	105				
Cement Grout with Bentonite					
110	110				
2" PVC Blank Casing					
115	115				
120	120				
125	125				
130	130				
135	135				

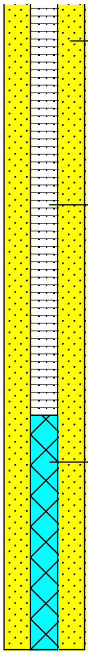
LOG OF BORING PT-9 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION



LOG OF BORING PT-9 M
(Continued)

WELL CONSTRUCTION	Depth	USCS	Sample	Key	LITHOLOGIC DESCRIPTION
175	175				
180	180				
185	185				
					End of boring at 187 feet bgs



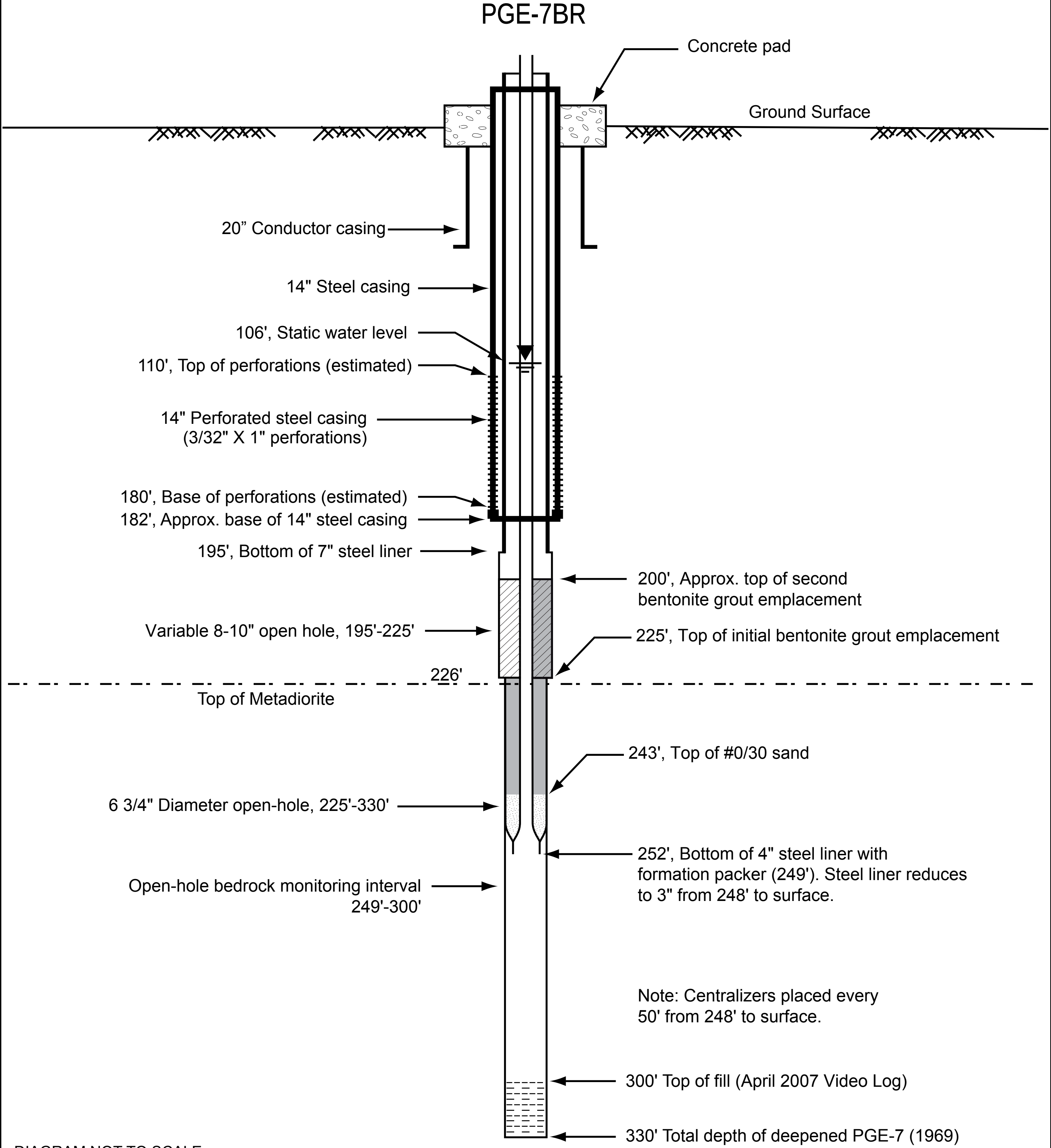


DIAGRAM NOT TO SCALE

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

ES102006003BAO_WellConstructionDiagram_PGE-7BR.ai_022808_lho

Now ID for db GIS PGE-9N

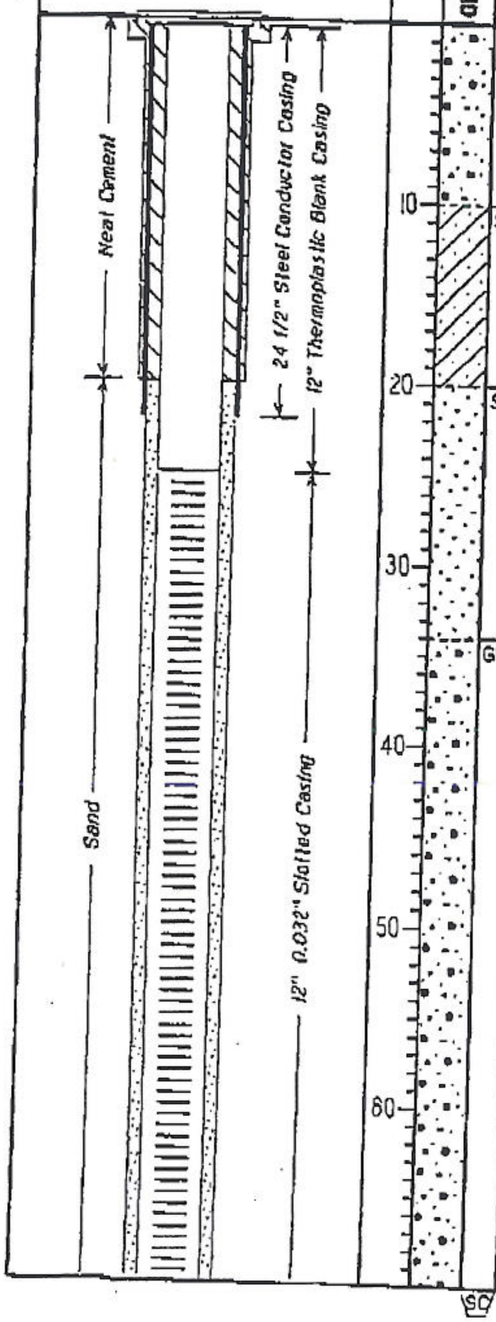
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL 15N/21W3A

Page 1 of 2

SEE SITE PLAN

ALISTO PROJECT NO: 10-186-18 DATE DRILLED: 04/22/97
CLIENT: Pacific Gas and Electric
LOCATION: Topock Compressor Station, Topock Arizona
DRILLING METHOD: Mud Rotary, 10" Trilone
DRILLING COMPANY: Howard Pumping CASING ELEVATION: 460
LOGGED BY: Dan Birch APPROVED BY: David Lipnicke



Depth	Soil Class	Geologic Description
	GW	sandy GRAVEL: brown, wet; fine to coarse gravel, fine sand.
10	SC	clayey SAND: light blue clay; fine sand.
20	SP	gravelly SAND: brown, wet; 75% fine to coarse sand, 20% fine to medium gravel, some clay 5%.
34	GW	sandy GRAVEL: brown, wet; 80% fine to medium gravel, 40% fine to coarse sand.
		Same; with wood.
	SC	

New ID for GIS = PGE-9N

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL 15N/21W3A	Page 2 of 2

SEE SITE PLAN

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WELL DIAGRAM	DEPTH (feet)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
Sand; 12" 0.032" Slotted Casing			SC	clayey gravelly SAND: brown, wet; 25% fine to coarse sand, 70% fine to coarse gravel, some brown clay 5%.
	75		SW	gravelly SAND: brown, wet; 80% fine to coarse sand, 40% fine to coarse gravel.
	80			
	90			wood chips at 89' to 90'.
	95			Fanglomerate bedrock at 94'.
				Well terminated at 95 feet.
	100			
	110			
	120			
	130			

PGE-9N

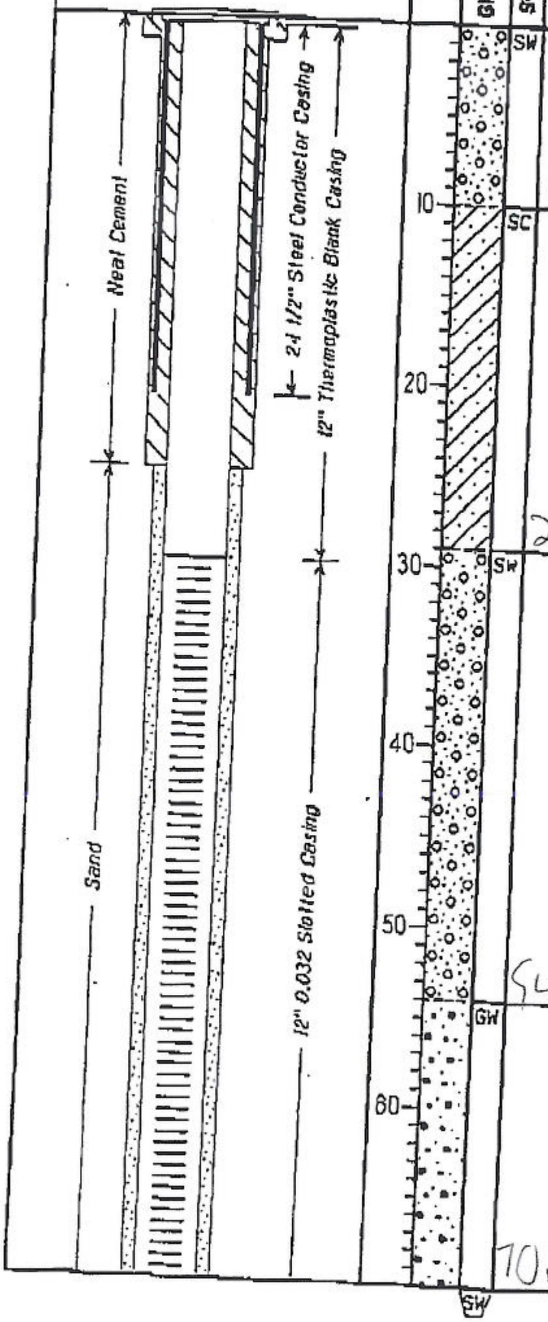
ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF WELL 15N/21W3B

SEE SITE PLAN

ALISTO PROJECT NO: 10-188-18	DATE DRILLED: 04/04/97
CLIENT: Pacific Gas and Electric	
LOCATION: Topock Compressor Station, Topock Arizona	
DRILLING METHOD: Mud Rotary, 19" Trilone	
DRILLING COMPANY: Howard Pumping	CASING ELEVATION: 460
LOGGED BY: Dan Birch	APPROVED BY: David Lipnicke

WELL DIAGRAM | DEPTH feet | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION



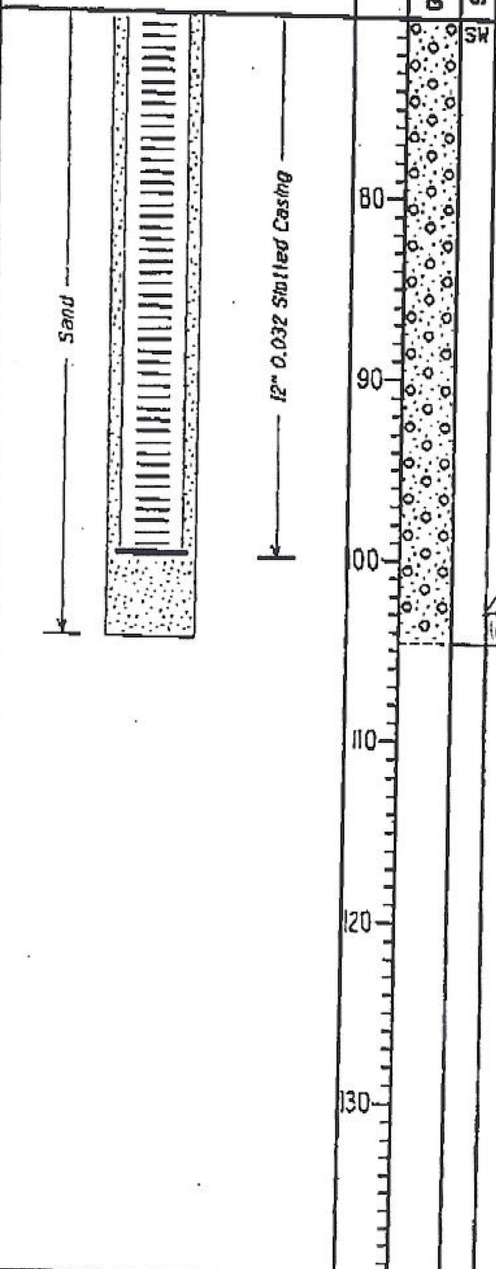
Depth	Soil Class	Geologic Description
0	SW	gravelly SAND: brown, wet; 70% fine to coarse sand, 30% fine to coarse gravel.
10	SC	clayey SAND: blue clay; 70% fine to coarse sand, some burnt wood.
29	SW	gravelly SAND: brown, wet; 70% fine to coarse sand, 30% fine to medium gravel; wood at 29' to 31'.
54	GW	sandy GRAVEL: 80% fine to coarse gravel, 30% fine to coarse sand, 10% clay.
70'	SW	Wood at 69'.

Now ID for db GIS PGE-9S

ALISTO ENGINEERING GROUP WALNUT CREEK, CALIFORNIA	LOG OF WELL 15N/21W3B	Page 2 of 2

SEE SITE PLAN	ALISTO PROJECT NO: 10-188-15	DATE DRILLED: 04/04/97
	CLIENT: Pacific Gas and Electric	
	LOCATION: Topock Compressor Station, Topock Arizona	
	DRILLING METHOD: Mud Rotary, 19" Tricone	
	DRILLING COMPANY: Howard Pumping	CASING ELEVATION: 460
	LOGGED BY: Dan Birch	APPROVED BY: David Lipnicke

WELL DIAGRAM | DEPTH feet | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION



SW

gravelly SAND: brown, wet; 70% fine to coarse sand, 30% fine to coarse gravel. color change to reddish-brown at 103'.

Color change to reddish-brown at 103'.

Fanglomerate bedrock, red, hard, chips in cuttings refusal of tricon at 104' to 104.5'.

104

Well terminated at 104.5 feet.

PGE - 9S

B(15-21) 3 ADB

*

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North Third Street
Phoenix, Arizona 85004
WELL DRILLER REPORT

RECEIVED
MAR 20 1998
RECORDS MGT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. VALLEY WELL DRILLING
P.O. BOX 637
TOPOCK, AZ 86436-0637

2. Owner Name: StANlEY + WARREN Smith
Address: 2095 FOX Hill Flaggstaff AZ 86604
City State Zip

3. Location: 15N N/S 21W E/W 3 ¼ NW ¼ SE ¼ NE
Township Range Section 10-acre 40-acre 160-acre

4. Well Registration No. 55- 565878 (Required)
5. Permit No.______ (If issued)

DESCRIPTION OF WELL

6. Total depth of hole 80 ft.
7. Type of casing PVC
8. Diameter and length of casing 5 in. from 0 to 80 in from ____ to ____
9. Method of sealing at reduction points NA
10. Perforated from 48 to 68, from ____ to ____ from ____ to ____
11. Size of cuts .35 Number of cuts per foot 20
12. If screen was installed: Length NA ft. Diam ____ in. Type ____
13. Method of construction DRilled
(drilled, dug, driven, bored, jetted, etc)
14. Date started 2/21/98
Month Day Year
15. Date completed 2/21/98
Month Day Year
16. Depth to water 50 ft. (If flowing well, so state)
17. Describe point from which depth measurements were made, and give sea-level elevation if available
GROUND lEVEl
18. If flowing well, state method of flow regulation:______
19. Remarks:______

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-565878
File No. B(15-21) 3 ADB
Received______ By______
Entered______ By______

DWR-55-55-7/95 (Rev.)

ENTERED APR 1 ? 1998

LOG OF WELL

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	8	BROWN CLAY - ROCKS
8	68	COARSE SAND + GRAVEL
68	80	Red Decomposed Rock ledge + shale
		NOTE:
		This well has a high salt content
		and may be unuseable for domestic
		use. Testing is being done to
		determine salt + mineral content.
		This hole may be abandoned after
		testing.

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: VALLEY WELL DRILLING

P.O. BOX 637
Street

TOPOCK, AZ 86436-0637
City State Zip Phone No.

Mike Epsted 2/27/98
Signature of Driller Date

BLUE STAKE #: 394170 (11-7-97) (OK BY 11-7-97)

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

MAIL TO: P.O. BOX 458 - PHOENIX, ARIZONA 85001-0458

500 North Third Street - Phoenix, Arizona 85004-3903

Phone (602) 417-2470

RECEIVED DEC 1 - 1997 GROUNDWATER MGT.

NOTICE OF INTENTION TO DRILL, DEEPEN, REPLACE OR MODIFY A WELL

PLEASE READ SPECIFIC INSTRUCTIONS, LIMITATIONS AND CONDITIONS ON REVERSE SIDE OF THIS FORM BEFORE COMPLETING.

PLEASE COMPLETE ALL ITEMS IN THE BOX BELOW DOWN TO COUNTY OR LOCAL AUTHORITY ENDORSEMENT. IF ANY WATER FROM THE PROPOSED WELL (LISTED BELOW) WILL BE USED FOR DOMESTIC PURPOSES ON A PARCEL OF LAND 20 OR FEWER ACRES, THE APPLICABLE COUNTY OR LOCAL HEALTH AUTHORITY MUST ENDORSE ALL ITEMS IN THE BOX BEFORE SUBMITTING TO THE DEPARTMENT OF WATER RESOURCES.

Land Owner's Name: STANLEY Smith & WARREN S. Smith Current Mailing Address: 2095 ~~Fox~~ Hill City: Flagstaff State: AZ Zip: 86604

Telephone No. 520 - 768 - 8716 COUNTY ASSESSOR'S PARCEL ID INFORMATION:

Well Located in Mohave County 210 - 48 - 005C 1.2 (BOOK MAP PARCEL # of Acres)

OFFICIAL SEAL OR STAMP

Well/Land Location (must be completed as requested):

NW ¼ SE ¼ NE ¼ of Section 3 Township 15 N N/S Range 21 W E/W
10AC 40AC 160AC

COUNTY OR LOCAL AUTHORITY ENDORSEMENT

Check one:
Recommend Approval ✓; Insufficient Information to Make Determination ___; Variance Required ___ (Explanation attached)

DATE 11/25/97 AUTHORIZED SIGNATURE Melvin Cassar TITLE R.S.

GENERAL INSTRUCTIONS FOR FILING NOTICE WITH ADWR

- Section §45-596(D) provides that the Director shall determine that all information required on this form has been submitted. If not, the person filing will be notified, and the drilling, deepening or modification of the well may not proceed.
- Section §45-596(d) provides that the Department has 15 days after the receipt of a complete and correct notice of intention to record the notice and mail duplicate to owner. Drill card will be mailed directly to drilling firm as stated in item #14.
- Please mail two original notices with original signatures, a site plan in DUPLICATE, and a check or money order (no cash) in the amount of $10.00 to P.O. Box 458, Phoenix, Arizona 85001-0458 or hand deliver to 500 North Third Street, Phoenix, Arizona 85004-3903. USE BLACK OR BLUE INK.
- If the well is a replacement, deepening or modification of an existing well, provide the registration number of the existing well in item 2.
- Construction standards for wells, including abandonment, shall be in accordance with Department Rules.

1. Owner of well:
STANLEY & WARREN Smith
Name
2095 FOX Hill
Current Mailing Address
Flaggstaff AZ 86604
City State Zip
Telephone No. 520 - 768 - 8716

2. Action requested: Drill New Well ✓; Deepen ___ Modify ___ Replace ___.
For a replacement well provide: Maximum capacity of the original well ___ gallons per minute; distance from the original well ___ feet.
Well Registration No.55-___

3. Construction will start about:
Month NOV Year 97

4. Description of proposed well:
Diameter 5 inches
Depth 125 feet
Type of Casing PVC

5. Design pump capacity:
35 gallons per minute

6. Lessee of land of wellsite:
Name ___
Current Mailing Address ___
City State Zip
Telephone No. ___

7. Principal Use of Water; (be specific):
Domestic

8. Other uses of Water; (be specific):
IRRIGATION

9. If use includes irrigation, state to nearest tenth, the number of acres to be irrigated; 1.2

FOR DEPARTMENT USE ONLY
File No. B(15-21)3ADB
Filed 12-1-97 By VB
Input DEC 2 2 1997 By
DUPLICATE MAILED
Date 12-22-97
Registration 55-565878
AMA/INA —
W/S 02 S/B —

10. Place of Use (Legal Description of Land):
NW ¼ SE ¼ NE ¼ Section 3
10 AC 40AC 160AC
Township 15N N/S Range 21W E/W

11. Type of Well (Check One):
Exempt ✓ Non-Exempt ___

12. Check One:
Residential ✓ Commercial ___

13. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous materials or petroleum storage areas and tanks? Yes ___ No ✓

14. Drilling Firm:
Valley Well Drilling
Name
P.O. Box 637
Mailing Address
Topock AZ 86436
City State Zip
520 - 768 - 7111
Telephone No.
341
DWR License Number
C - 53 L - 53
ROC License Category

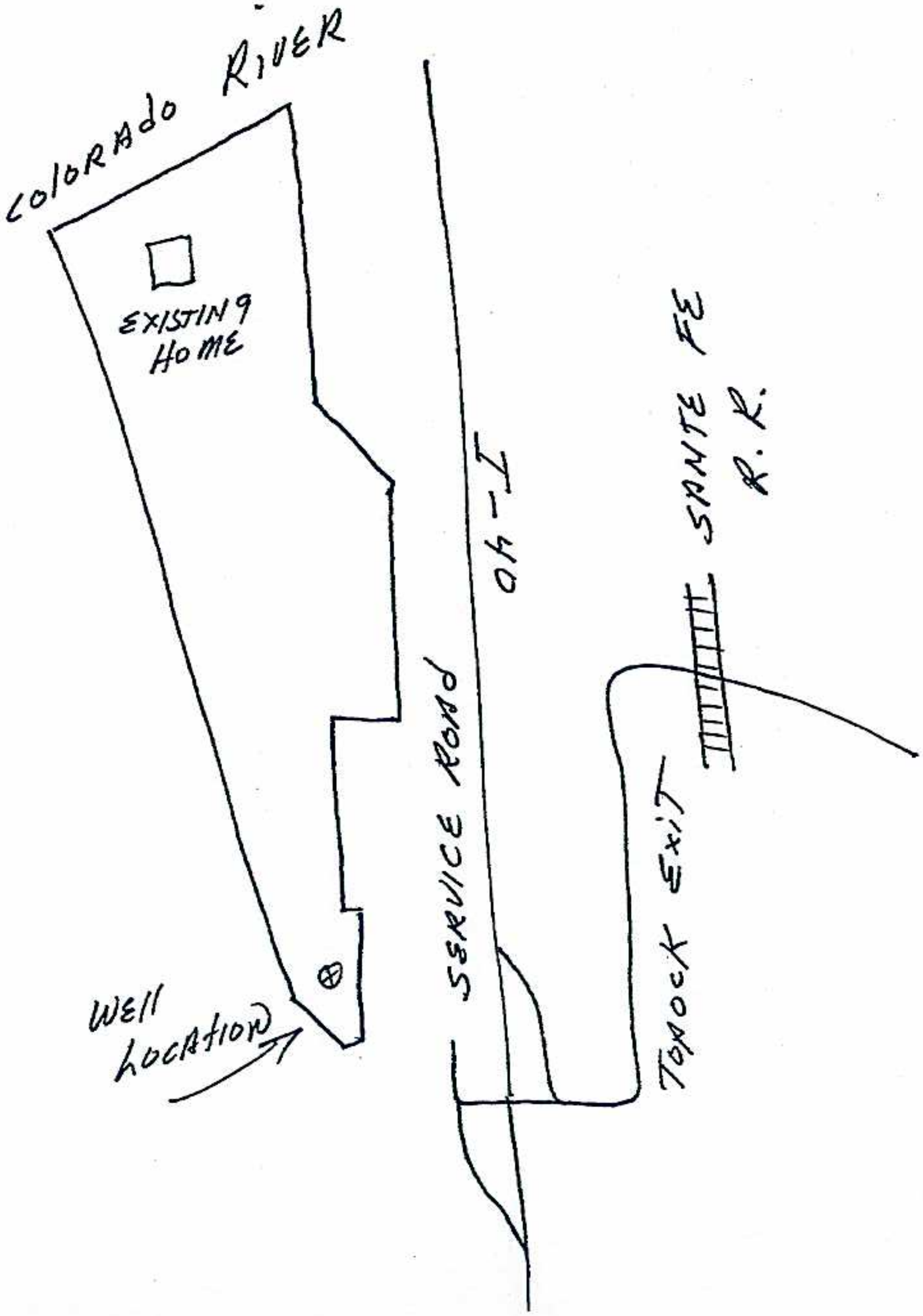
I state that this Notice is filed in compliance with A.R.S. §§45-595 and 45-596 and is complete and correct to the best of my knowledge and belief and that I understand the limitations and conditions set forth on the reverse side of this form.

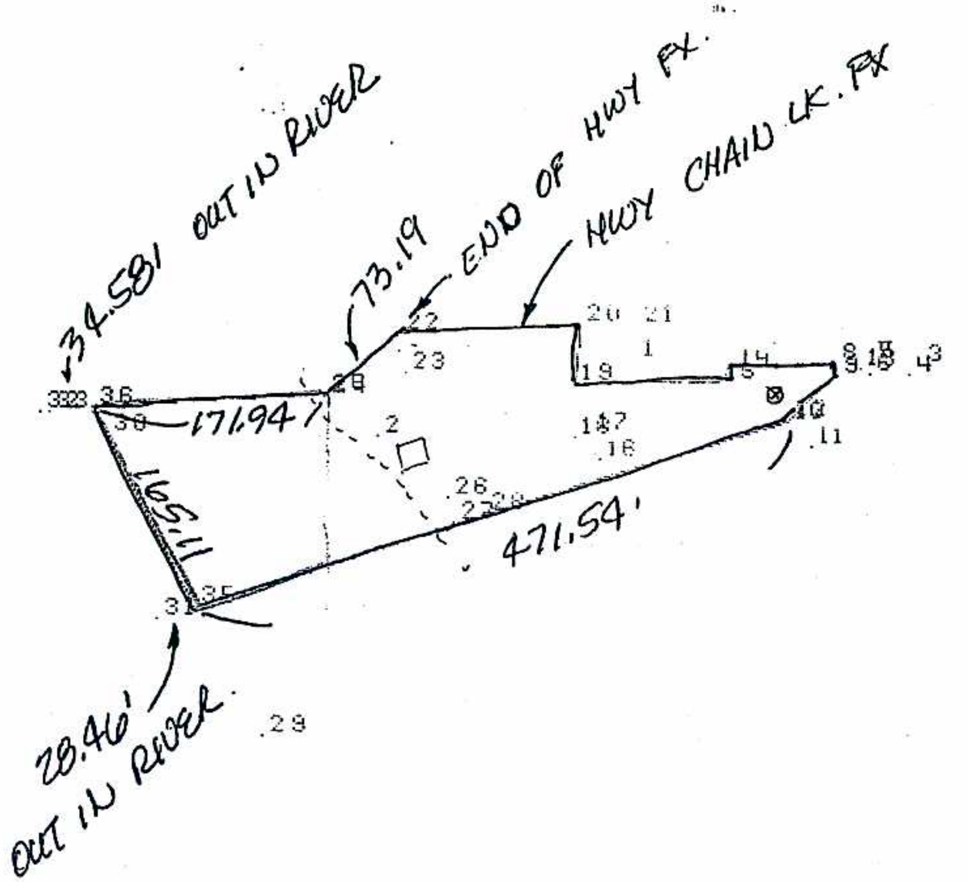
STANLEY & WARREN Smith — Stanley Smith, Warren Smith — 11-3-97

Typed or Printed Name and Title — Signature [ ] Land Owner [ ] Lessee of Wellsite, Title — Date

Stanley Smith
2095 Fox Hill
Flagstaff AZ 86004
520-768-8716
PARCEL # 210-48-005C
TN. 15N RN 21W SECT 3

RECEIVED
DEC 1 - 1997
GROUNDWATER MGT





A:TOPOC 08-22-1997 1:24 PM

WELL DRILLING LEGAL (10 ACRE)
SE1/4 NE1/4 NE1/4 SEC. 3 T15N. R.21W.

DEPARTMENT OF WATER RESOURCES OCT 1980

Topock #2 16N-21W-35S
Drilled to 140', Sep. 1980

LOG OF WELL

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

FROM (FEET)	TO (FEET)	DESCRIPTION OF FORMATION MATERIAL
0'	50'	BOULDERS
50'	60'	SANDSTONE ← may be Tmc
60'	97'	" + CLAY
97	107	GRAVEL ← Tmc
107	130	Broken granite (sm. amount of clay)
130	140	Broken granite
		1st H_2O 97'
		Bearing H_2O strata 97-140'
		12" steel casing
		Factory Perforated
		100-140'

either pTbr knob or metaigneous megabraccia blocks in Tmc

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein contained are true to the best of my knowledge and belief.

Driller Wellette + Askew
Name

POB 2263 Bhc. Az. 86430
Address

Date 10-2-80

Phoenix, Arizona 85004

Topock #2

Registration No. 55-85599
Owner of
Well Site Southwest Gas of Arizona

File No. B(16-21)35 cdd

COMPLETION REPORT

1. Completion Report to be filed with the Department within 30 days after installation of pump equipment.

2. The tested pumping capacity of the well in gallons per minute for a non-flowing well should be determined by measuring the discharge of the pump after continuous operation for at least 4 hours and for a flowing well by measuring the natural flow at the land surface.

3. Drawdown of the water level for a non-flowing well should be measured in feet after not less than 4 hours of continuous operation and while still in operation and for a flowing well the shut-in pressure should be measured in feet above the land or in pounds per square inch at the land surface.

4. The static groundwater level should be measured in feet from the land surface immediately prior to the well capacity test.

LOCATION OF THE WELL

T16N, R21W, Sec. 35, SE¼ SE¼ SW¼.

Date Well Completed 9-29-80 Depth of Well 140'

1. Well Test:
Test Pumping Capacity 400 (Gal. per min.) Date Well Tested 10/15/80

Method of Discharge Measurement Current Meter (weir, orifice, current meter, etc.)

Static Groundwater Level 50' 8" ft. Drawdown 25' ft.

Total Pumping Lift 425' ft. Drawdown (Flowing Well) lbs.

2. Equipment Installed:

Kind of Pump Submersible turbine (turbine, centrifugal, etc.)

Kind of Power Elec (Elec., Nat. Gas, Etc.) H.P. Rating of Motor 60

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

[signature]
Signature

P.O. Box 1178
Address

12/19/80, 19
Date

Bullhead City Az 86430
City State Zip

Topock #3

Phone (702) 878-7757

DRILLING & PUMPS INC.

3521 SPRING MOUNTAIN ROAD
LAS VEGAS, NEV. 89102

June 5 1974

Southwest Gas Corporation
P O Box 46
Bullhead City Ariz

$\boxed{\text{Topock - 3}}$ 16N-21W-35S
Drilled May 17, 1974 to 250'

Well #3 at Topack Ariz

Drillers log of formations

	0-11	sand & boulders
	11-23	gravel.sand & boulders
	23-30	gravel w/ few boulders
	30-33	boulder
	33-43	clay
	43-46	silty sand
	46-52	boulders & gravel
~90'	52-91	clay w/ interbedded rock = may be Tmc Miocene Conglm ?
Miocene Bedrock	91-146	boulders & gravel
	146-180	decomposed granite
	180-250	decomposed granite w/ rhyolite boulders

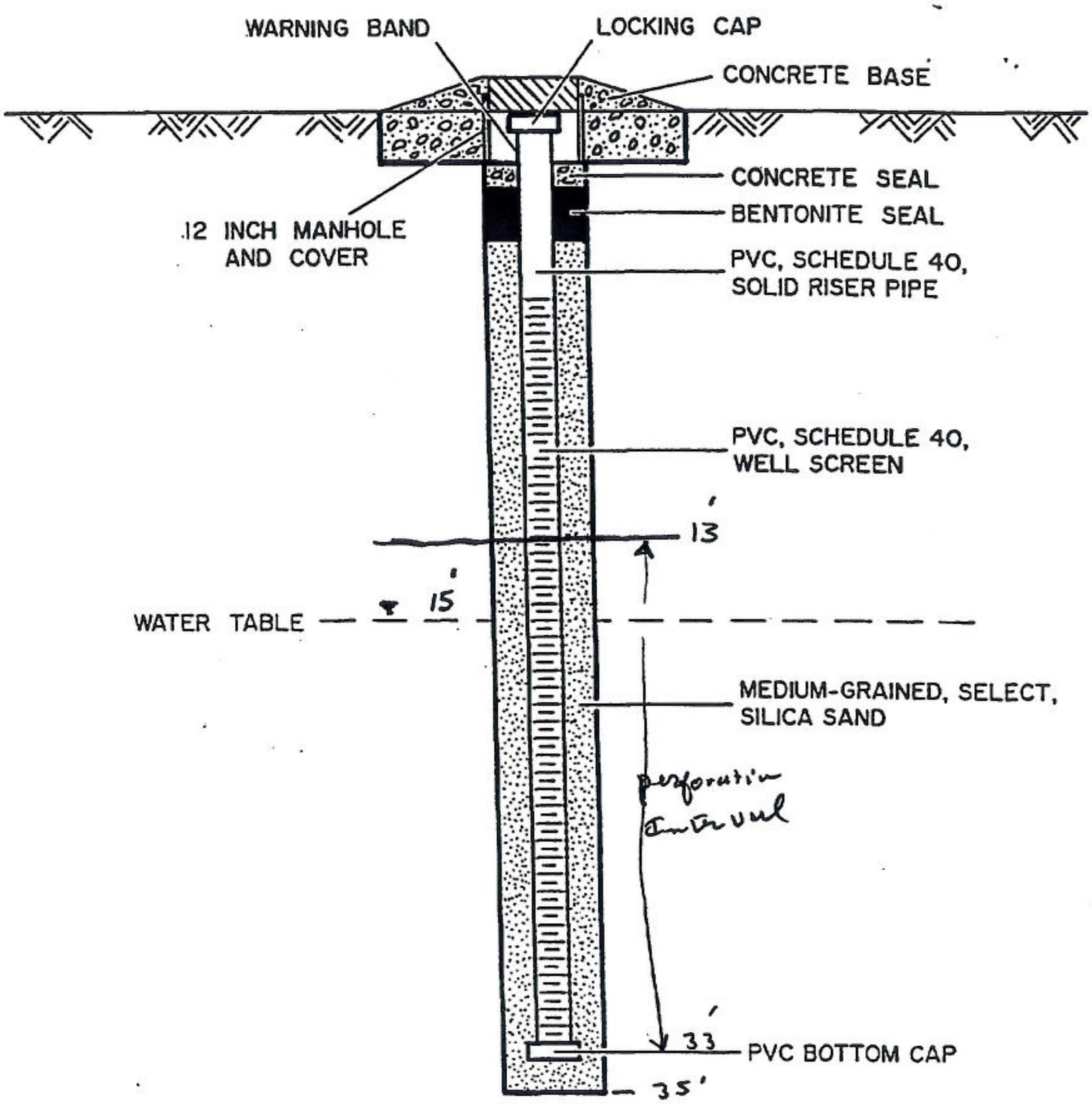
either pTbr knob or meta ign. mega breccia in Tmc

Well Installed May 1974
12" steel cased Perforated 85-130
150-190
210-250

Due to high TDS, poor WQ, Southwest Gas recompleted
plug-back to 150' NEW screen interval 85-130' ONLY
WQ improved

Reportedly produces ~ 350 gpm, ACTIVE well for
City of Needles
& PG&E Station

PGS434625



WELL LOG

Well Size = 4" Diameter
Total Depth = 35 Ft
Screen Slot = = 0.02 inches
Screened Interval = 13 TO 33 Ft

Depth To Groundwater = 15 Ft
Sand (Depth) = 12 TO 35 Ft
Bentonite (Depth) = 10 TO 12 Ft
Concrete (Depth) = 0 TO 10 Ft

WESTERN TECHNOLOGIES INC.

Golden Shores Marina
HC12 Box 502
Topock, ARIZONA 86436

BY: Jack Trenst	**DATE:** 12-13-90	**PROJECT NO.:** 7470K149	**PLATE:**

2181J016 185

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
15 South 15th Avenue
Phoenix, Arizona 85007

RECEIVED
OCT 15 1991
OPERATIONS DIV

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner NORMA PHILLIPS
Name
HC 12, BOX 502, TOPOCK, ARIZONA 86436
Mailing Address

2. Driller ENVIRO DRILL, INC. LICENSE NO. 533
Name
3737 EAST BROADWAY ROAD PHOENIX, ARIZONA 85040
Mailing Address

3. Location of well: T15N, R21W, SEC. 3, NE, NE, NE

Topock Marina

4. Permit No. (MW-6)
(If issued)

TMW-6

DESCRIPTION OF WELL

5. Total depth of hole 35 ft.

6. Type of casing PVC SCH 40

7. Diameter and length of casing 4 in. from 0 to 32, 0 in from 32 to 35.

8. Method of sealing at reduction points BENTONITE

9. Perforated from 12 to 32, from __ to __, from __ to __.

10. Size of cuts 0.020 Number of cuts per foot 48

11. If screen was installed: Length 20 ft. Diam 4 in. Type SCH 40 PVC

12. Method of construction ROTARY DRILL
drilled, dug, driven, bored, jetted, etc

13. Date started JANUARY 15 1991
Month Day Year

14. Date completed JANUARY 15 1991
Month Day Year

15. Depth to water 19 ft. (If flowing well, so state)

16. Describe point from which depth measurements were made, and give sea-level elevation if available FROM TOP OF MANHOLE @ 468.465 FT ABOVE MEAN SEA LEVEL

17. If flowing well, state method of flow regulation:

18. Remarks:

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

REG. No. 55-530349

File No. B(15-21)3aaa

Entered ENTERED OCT 16 1991

DWR-55-55-2/89

LOG OF WELL MW-6

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	17	FILL: DARK GRAY, WELL GRADED SANDY SILT, CHANGING TO TAN
		CLEAN, FINE TO MEDIUM GRAINED SUBROUNDED TO SUBANGULAR
		COARSE GRAINED SAND WITH ANGULAR COBBLES & GRAVELS.
17	35	ALLUVIUM: GRAY BROWN SILTY, CLAYEY, FINE TO MEDIUM GRAINED
		SAND WITH GRAVEL.

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Gabriel R. Escamilla Jr.
Name

ENVIRO-DRILL, INC.
P O BOX 24189
PHOENIX, AZ 85074

Address

City State Zip

Date 2/11/91

2181J016 2c

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
15 South 15th Avenue
Phoenix, Arizona 85007

RECEIVED
OCT 15 1991
OPERATIONS DIV.

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner NORMA PHILLIPS
Name
HC 12, BOX 502, TOPOCK, ARIZONA 86436
Mailing Address

2. Driller ENVIRO DRILL, INC. LICENSE NO. 533
Name
3737 EAST BROADWAY ROAD PHOENIX, ARIZONA 85040
Mailing Address

3. Location of well: T15N, R21W, SEC.3, NE, NE, NE

Topock Marina
TMW-8

4. Permit No. (MW-8)
(If issued)

DESCRIPTION OF WELL

5. Total depth of hole 31 ft.
6. Type of casing SCH 40 PVC
7. Diameter and length of casing 4 in. from 0 to 25, 0 in from 25 to 31.
8. Method of sealing at reduction points BENTONITE
9. Perforated from 5 to 25, from – to –, from – to –.
10. Size of cuts 0.020 Number of cuts per foot 48
11. If screen was installed: Length 20 ft. Diam 4 in. Type SCH 40 PVC
12. Method of construction ROTARY DRILLED
drilled, dug, driven, bored, jetted, etc
13. Date started JANUARY 16 1991
Month Day Year
14. Date completed JANUARY 16 1991
Month Day Year
15. Depth to water 11 ft. (If flowing well, so state)
16. Describe point from which depth measurements were made, and give sea-level elevation if available TOP OF MANHOLE COVER AT 461.232 FT ABOVE MEAN SEA LEVEL
17. If flowing well, state method of flow regulation:
18. Remarks:

ENVIRO DRILL, INC.
PHOENIX, AZ 85040

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

REG. No. 55-530350

File No. B(15-21)3aaa

Entered ENTERED OCT 16 1991

DWR-55-55-2/89

LOG OF WELL MW-8

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	10	ALLUVUIM - BROWN AND RED BROWN, SILTY, FINE TO MEDIUM GRAINED SAND WITH GRAVEL
10	31	BROWN SAND, AS ABOVE, WITH COBBLES

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Gabriel R. Escomilla Jr.
Name

Address ENVIRO-DRILL, INC.
P O BOX 24189
PHOENIX, AZ 85074

City State Zip

Date 9/11/91

2181J016 385

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
15 South 15th Avenue
Phoenix, Arizona 85007

RECEIVED
OCT 15 1991
OPERATIONS DIV.

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner NORMA PHILLIPS
Name
HC 12, BOX 502, TOPOCK, ARIZONA 86436
Mailing Address

2. Driller ENVIRO DRILL, INC. LICENSE NO. 533
Name
3737 EAST BROADWAY ROAD PHOENIX, ARIZONA 85040
Mailing Address

3. Location of well: T15N, R21W, SEC.3, NE, NE, NE

Topock Marina
TMW-9

4. Permit No. (MW-9)
(If issued)

DESCRIPTION OF WELL

5. Total depth of hole 31 ft.
6. Type of casing SCH 40 PVC
7. Diameter and length of casing 4 in. from 0 to 31, ____ in from ____ to ____.
8. Method of sealing at reduction points BENTONITE
9. Perforated from 6 to 31, from ____ to ____, from ____ to ____.
10. Size of cuts 0.020 Number of cuts per foot 48
11. If screen was installed: Length 25 ft. Diam 4 in. Type SCH 40 PVC
12. Method of construction ROTARY DRILLED
drilled, dug, driven, bored, jetted, etc
13. Date started JANUARY 16 1991
Month Day Year
14. Date completed JANUARY 16 1991
Month Day Year
15. Depth to water 11 ft. (If flowing well, so state)
16. Describe point from which depth measurements were made, and give sea-level elevation if available TOP OF MANHOLE COVER @ 460.270 FT ABOVE MEAN SEA LEVEL
17. If flowing well, state method of flow regulation:
18. Remarks:

DO NOT WRITE IN THIS SPACE
OFFICE RECORD
REG. No. 55-530351
File No. B(15-21)3aaa
Entered ENTERED OCT 16 1991 By

DWR-55-55-2/89

LOG OF WELL MW-9

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	10	FILL: BROWN, FINE TO COURSE GRAINED SAND WITH GRAVEL
10	14	BROWN TO DARK GRAY, SILTY FINE TO MEDIUM GRAINED SAND
14	18	ALLUVIUM: DARK GRAY, SILTY SAND AND SANDY SILT
18	31	RED BROWN, AND DARK GRAY SILTY SAND WITH GRAVEL

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Gabriel R. Escamilla
Name

Address ENVIRO-DRILL, INC.
P O BOX 24189
PHOENIX, AZ 85074

City State Zip

Date 2/11/91

2181J016 485

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
15 South 15th Avenue
Phoenix, Arizona 85007

RECEIVED
OCT 1 5 1991
OPERATIONS DIV.

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner NORMA PHILLIPS
Name
HC 12, BOX 502, TOPOCK, ARIZONA 86436
Mailing Address

2. Driller ENVIRO DRILL, INC. LICENSE NO. 533
Name
3737 EAST BROADWAY ROAD PHOENIX, ARIZONA 85040
Mailing Address

3. Location of well: T15N, R21W, SEC.3, NE, NE, NE

Topock Marina
TMW-10

4. Permit No. (MW-10)
(If issued)

DESCRIPTION OF WELL

5. Total depth of hole 35 ft.
6. Type of casing PVC SCH 40
7. Diameter and length of casing 4 in. from 0 to 30, 0 in from 30 to 35.
8. Method of sealing at reduction points BENTONITE
9. Perforated from 10 to 30, from ___ to ___, from ___ to ___.
10. Size of cuts 0.020 Number of cuts per foot 48
11. If screen was installed: Length 20 ft. Diam 4 in. Type PVC SCH 40
12. Method of construction ROTARY DRILLED
drilled, dug, driven, bored, jetted, etc
13. Date started JANUARY 17 1991
Month Day Year
14. Date completed JANUARY 17 1991
Month Day Year
15. Depth to water 21 ft. (If flowing well, so state)
16. Describe point from which depth measurements were made, and give sea-level elevation if available TOP OF MANHOLE COVER AT 470.00 FT ABOVE MEAN SEA LEVEL
17. If flowing well, state method of flow regulation:
18. Remarks:

DO NOT WRITE IN THIS SPACE OFFICE RECORD	
REG. No.	55-530352
File No.	B915-21) 3aaa
Entered	ENTERED OCT 16 1991 By

LOG OF WELL MW-10

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	5	FILL: BROWN, DAMP, LOOSE TO MEDIUM DENSE, SANDY GRAVEL AND COBBLES
5	18	BROWN TO TAN, MOIST, LOOSE TO MEDIUM DENSE, FINE TO MEDIUM GRAINED SAND WITH GRAVEL AND COBBLES
18	24	ALLUVIUM: GRAY-BROWN, SILTY CLAYEY, FINE TO MEDIUM GRAINED SAND
24	30	SAND ABOVE, BECOMING COURSE GRAINED
30	35	BROWN TO GRAY BROWN, MEDIUM AND COURSE GRAINED SILTY SAND

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Gabriel A. Escamilla Jr.
Name

ENVIRO-DRILL, INC.
Address P O BOX ~~24189~~
PHOENIX, AZ 85074

City State Zip

Date 2/11/91

2181J016 585

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
15 South 15th Avenue
Phoenix, Arizona 85007

RECEIVED
OCT 15 1991
OPERATIONS DIV.

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner NORMA PHILLIPS
Name
HC 12, BOX 502, TOPOCK, ARIZONA 86436
Mailing Address

2. Driller ENVIRO DRILL, INC. LICENSE NO. 533
Name
3737 EAST BROADWAY ROAD PHOENIX, ARIZONA 85040
Mailing Address

3. Location of well: T15N, R21W, SEC.3, NE, NE, NE

Topock Marina

4. Permit No. (MW-11)
(If issued)

TMW-11

DESCRIPTION OF WELL

5. Total depth of hole 35 ft.

6. Type of casing SCH 40 PVC

7. Diameter and length of casing 4 in. from 0 to 30 , 0 in from 30 to 35 .

8. Method of sealing at reduction points BENTONITE

9. Perforated from 10 to 30 , from - to - , from - to - .

10. Size of cuts 0.020 Number of cuts per foot 48

11. If screen was installed: Length 20 ft. Diam 4 in. Type SCH 40 PVC

12. Method of construction ROTARY DRILLED
drilled, dug, driven, bored, jetted, etc

13. Date started JANUARY 18 1991
Month Day Year

14. Date completed JANUARY 18 1991
Month Day Year

15. Depth to water 19 ft. (If flowing well, so state)

16. Describe point from which depth measurements were made, and give sea-level elevation if available TOP OF MANHOLE COVER AT 468.137 FT ABOVE MEAN SEA LEVEL

17. If flowing well, state method of flow regulation:

18. Remarks:

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

REG. No. 55-530353

File No. B(15-21)3aaa

Entered ENTERED OCT 16 1991 By

DWR-55-55-2/89

LOG OF WELL MW-11

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	5	FILL: BROWN, DAMP, LOOSE TO MEDIUM DENSE, SANDY GRAVEL AND COBBLES
5	18	BROWN MOIST, LOOSE TO MEDIUM DENSE, FINE TO MEDIUM GRAINED SAND WITH COBBLES AND GRAVEL
18	35	ALLUVIUM: GRAY TO BROWN, SILTY CLAYEY, FINE TO MEDIUM GRAINED SAND

I hereby certify that this well was drilled by me (or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Gabriel R. Escamilla Name

Address ENVIRO-DRILL, INC. P O BOX 24189 PHOENIX, AZ 85074

City State Zip

Date 9/11/91

B3 Drilling Logs for Exploratory and Test Borings in Study Area

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF BORING XMW-9

SEE SITE PLAN

ALISTO PROJECT NO: *10-320-06* DATE DRILLED: *06/25/97*

CLIENT: *Pacific Gas and Electric Company*

LOCATION: *Topock Compressor Station, Needles, CA*

DRILLING METHOD: *Resonant Sonic, Continuous Core*

DRILLING COMPANY: *Boart Longyear* CASING ELEVATION:

LOGGED BY: *Dan Salaices/ Dan Birch* *APPROVED BY:* *Dan Salaices*

BORING DIAGRAM	DEPTH feet	SOIL CLASS	GEOLOGIC DESCRIPTION
GROUT		GP	GRAVEL: pinkish gray, yellowish gray, light medium gray; 4-70 mm, subangular.
			At 2 feet, sandy GRAVEL: light medium gray; 60% gravel, 4-6 mm; 40% sand, fine to coarse grained.
			At 3 feet, GRAVEL: pinkish yellow, light medium gray; 60% gravel, 4-70 mm; 40% cobbles, fractured.
		SP	ALLUVIUM/OLDER ALLUVIUM CONTACT AT 4 FEET. gravelly SAND: dark yellowish brown; 70% sand, fine to medium grained; 30% gravel, subangular to angular, various grays and browns.
	10	GP/GC	sandy clayey GRAVEL: mottled olive gray to dark yellowish brown; 60-70% gravel, 4-40 mm, subangular to angular; 15-20% sand, fine to coarse grained; 10-25% fines; slightly moist.
	20	SP	gravelly SAND: dark yellowish brown; 70% sand, fine grained, minor coarse grained; 30% gravel, light medium gray, subangular, 4-20 mm; occasional fractured cobbles.
	30	GP/GC	sandy clayey GRAVEL: mottled light olive gray to dark yellowish brown; 80% gravel, 4-20 mm, subangular, 0-15% cobble fragments; 20-30% sand, fine to coarse grained; 5-15% fines; slightly moist; slight to low plasticity.
	40		At 42 feet, 70-85% gravel.
	50	GP	sandy GRAVEL: light olive brown; 80% gravel, 4-30 mm, subangular, fractured cobbles; 20% sand, fine grained with minor coarse grained; slightly moist.
		GP/GM	sandy silty GRAVEL: mottled dark yellowish brown to olive gray; 80% gravel, 4-30 mm, subangular and fractured; 10% sand, fine grained; 10% fines, moist.
	60	CL	sandy CLAY: moderate brown; 40% sand, very fine; occasional fine gravel; low plasticity; moist.
			Fractured cobbles.
		GP/GM	sandy silty GRAVEL: light olive gray to moderate brown; 80% gravel, 4-50 mm, subangular to fractured; 10% sand, fine grained; 10% fines; moist.
		GP	RED FANGLOMERATE
			GRAVEL: moderate reddish brown; 90% gravel, 4-50 mm, appears crushed by drill bits, very angular; less than 10% sand/fines; dry.
			At 69 feet, color change to pale red.

LOG OF BORING XMW-9

BORING DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
GROUT			GP	At 73 feet, color change to dark yellowish brown; material is very crushed and powdered; rock fragments are up to 100 mm and olive gray with dark reddish brown mineral coating on fractures.
				CHEMEHUEVI FORMATION: olive gray; very hard; old fracture surfaces with dark reddish brown mineral coating.
	80			Total depth of boring is 77.5 feet.
	90			
	100			
	110			
	120			
	130			
	140			
	150			

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

LOG OF BORING B-25

SEE SITE PLAN

ALISTO PROJECT NO: 10-320-08 DATE DRILLED: 04/15-16/98

CLIENT: Pacific Gas and Electric Company

LOCATION: Topock Compressor Station, Needles, CA

DRILLING METHOD: Ingersol Rand STRATEX/Air rotary

DRILLING COMPANY: THF Drilling CASING ELEVATION:

LOGGED BY: Dan Salaices APPROVED BY: Dan Salaices

BORING DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
Cement/Bent Grout	10		GM	silty GRAVEL: light gray to light yellowish-brown; ~80-70% gravel, subangular to angular, to 4-15 mm with fresh fractures, ~30-40% fines, non-plastic; dry.
	20		GP/GM	sandy silty GRAVEL: light gray to light yellowish-brown; ~80% gravel, subangular to angular, 4-15 mm with fresh fractures; ~30% sand, fine- to medium-grained; ~10% fines, non-plastic; dry.
	30		SP	gravelly SAND: light yellowish-brown; ~80-80% sand, fine- to medium-grained; gravel, subangular, 4-15 mm; dry.
	40			SAND: light yellowish-brown; ~95% fine- to very fine-grained; ~5% gravel, 4-8 mm; dry.
	50			gravelly SAND: light yellowish-brown; ~80-80% sand, fine- to medium-grained; gravel, subangular, 4-15 mm; dry.
	60		GP	sandy GRAVEL: light gray to medium gray; ~80-80% gravel, subangular to angular, 4-25 mm; ~20-40% sand, fine- to coarse-grained; dry.

LOG OF BORING B-25

BORING DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
Cement/Bent Grout	80		GP	sandy GRAVEL contiuned.
	90		SP	SAND: light yellowish-brown; fine- to medium-grained; ~5-10% gravel, 4-8 mm; dry.
	100, 110		GP	sandy GRAVEL: light gray to medium gray; ~60-80% gravel, subangular to angular, 4-25 mm; ~20-40% sand, fine- to coarse-grained; dry.
	120, 130		SM	silty SAND: pale brown; ~70-80% sand, fine- to medium-grained; ~15-25% fines; non-plastic, ~5% gravel, 4-7 mm; moist.
	140, 150		SP/SM	gravelly silty SAND: pale brown; ~60-70% sand, fine- to medium-grained; ~20-30% gravel, subangular to angular, 4-8 mm; ~10% fines; moist.

LOG OF BORING B-25

BORING DIAGRAM	DEPTH feet	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
Cement/Bent Grout			SP/SM	gravelly silty SAND continued.
	170			
	180			
	190			
	200			BEDROCK: dark greenish-gray; 100% rock (crushed), subangular to angular, fresh fractures; dry.
	210			Total depth of boring is 210 feet.
	220			
	230			
	240			

TABLE B-9

PGE-1

WATER WELL DRILL & TEST LOG
WATER WELL NO. 1

FOOTAGE	ACCUMULATIVE FOOTAGE		REMARKS
20	0 - 20	GP (Fill)	Fill & Lava Rock
15	20 - 35	GW	Sand, Gravel & Rock
15	35 - 50	GP	Gravel, sandy Limestone
13	50 - 63		Gravel, sandy Limestone
5	63 - 68		Gravel, sandy Limestone
~~–~~	~~–~~		Shut down awaiting 20" Conductor Pipe to prevent fill from caving.
~~–~~	~~–~~		
4	68 - 72	GW	Set 20" Conductor Pipe - Sand, Gravel & Rock
8	72 - 80		Sand, Gravel & Rock
~~–~~	~~80~~		Dressing Tool
~~–~~	~~80~~		Dressing Tool
10	80 - 90	GW	Sand, Gravel & Rock
15	90 - 105		Sand, Gravel & Rock
~~–~~	~~105~~		Dressing Tool
5	105 - 110	GW	Bentonite fell 25' in 12 Hrs. Water Indication
10	110 - 120		Bentonite fell 25', Sand, Gravel & Rock
19	120 - 139		Bentonite fell 25', Sand, Gravel & Rock
9	139 - 148	PLS	Hard Limestone
3	148 - 151	GW	Sand, Gravel & Rock, Hard Limestone
~~–~~	~~–~~		Drilling Rig Shutdown, Engine Trouble
7	151 - 158	LS	Hard Limestone
8	158 - 166		Hard Limestone
~~–~~	~~166~~		Hard Limestone
~~–~~	~~166~~		Hard Limestone
7	166 - 173	BR + LS	Hard Limestone & Granite
2	173 - 175		Hard Limestone & Granite

3 (Con't) PGE-1

TE	REMARKS
4	Building Bit
5	Reaming
6	Reaming
7	Reaming
8	Run Casing to 176' - 3"
9	Bailed
10	Set up Test Pump
11	Started Pumping, Pumped 17 Hours
12	Started 48 Hr. Test at 8:15 A.M.
13	Continued 48 Hr. Test
14	Complete 48 Hr. Test

Results of Test

Static Water Level - 100' - 10"

Pull Down - 17' - 0"

Pumping Level - 117' - 10"

Gal. / Min. - In excess of 400 GPM without breaking suction

Recovery Time - 45" per min.

terials in Well

There is 18' - 0" of 20" Conductor Pipe

There is 177' - 0" of 14" Casing including perforated Casing

There is 78' - 0" of Perforated Casing

Perforations 5/32" X 1" with 68 Perforations per foot.

At all time while pumping, the well was pumped at a rate between 400 and 500 GPM and it is the driller's opinion that well will improve. The static Water level in Water Well No. 2 did not lower at any time while pumping Water Well No. 1.

TABLE B-9

PGE-1

2
(Con't)

REMARKS

Awaiting Casing

Awaiting Casing

Run Casing to 90 Ft.

Casing wouldn't go, Awaiting welder to pull casing

Pulled Casing, Built up bit

Built up Bit

Started Reaming

Continued Reaming Engine Breakdown

Awaiting Engine Repair Parts

Repaired Engine

Built up Bit & Reaming

Reaming

Reaming

Reaming

Reaming

Running Casing

Casing wouldn't go

Pulled Casing

Built up Bit

Built up Bit

Reaming

Reaming

Reaming

No Work

No Work

BECHTEL CORPORATION ENGINEERS
Two Twenty Bush Street ~ San Francisco 4, Calif.

COPY
#12
(Handwritten) 113785

Needles, California
June 21, 1951

Mr. J. A. Love
Pacific Gas and Electric Company
245 Market Street
San Francisco, California

Subject: Elevations with reference to Water Well #2

Dear Sir:

With reference to our telephone conversation this date, the following are the elevations requested with reference to the Water Well.

Top of Casing, Water Well No. 2	5/452.76
Top of Water in Casing	4/456.00
Static Water Level	4/454.00
River Level (8:00 A.M. 6-20-51)	4/453.83
Bottom of River Channel	4/439.00

The bottom of the River Channel from the bridge to Station 20 (approximately across from Workman's "El Rancho Colorado") is 1400 feet and varies between 4/439.00 and 4/439.50. The river bottom consists of sand, quicksand and river silt with no indication of reefs.

Yours truly

W. E. Lake

cc: A. J. Orselli
A. G. Harding
M. Hixson
File

TABLE B-9

4 (Con't)

	PGE-1 Water Well No. 1	PGE-2 Water Well No. 2
Elevation, Top of Casing	5 ⁄ 55.29	5 ⁄ 52.76
Water Level in Casing from top	100.83	98.16
Elevation, Water in Casing	~~4 ⁄ 55.46~~ 454.46	4 ⁄ 54.60

COPY
Bechtel Corporation

DRILL AND TEST LOG

Water Well No. 2

Date	Ft/Day	Cumulative Footage	Remarks
6-1	20	20	Starting Elevation-552.00, Sand, Rock & Gravel Formation
6-2	12	32	Sand, Rock & Gravel Formation
6-3	15	47	
6-4	18	65	
6-5	16	81	
6-6	14	95	Bentonite fell 25' Overnight, Indication of Water
6-7	15	110	Bentonite fell 25'
6-8	9	119	Niggerheads encountered
6-9	13-	132	Bentonite fell 25'
6-10	14	146	Bentonite fell 25'
6-11	4	150	Iron Oxide Rock found at 150' level, Starting Reaming and Bailing Hole
6-12			Set ~~148'-10 3/4"~~ 148' 10.75" Casing, 54' of which was perforated. Bottom Elevation-403.86
6-13			Continued bailing well, Water Level-98 ft. from top of casing.

6-20	Test Crew arrived
6-21	Set up test pump, Column Length-128'-0"
6-22	Set up test pump, started pumping at 4:30 P.M., Pumped 4½ hours.
6-23	Continued pumping, Water cleared up at 3:00 P.M., Draw down approximately 14 ft., Pumped 12 hours
6-24	Shut down
6-25	Continued pumping, Pumped 12 hours.
6-26	Continued pumping, Pumped 24 hours.
6-27	Continued pumping, Pumped 3½ hours. Maximum 200 GPM with this length of column.
6-28	Shut down to lower column.
6-29	Shut down to lower column.
6-30	Started installation of 12 ft. additional column.
7-1	Continued installation of 12 ft. additional column.
7-2	Continued installation of 12 ft. additional column.
7-3	Pumped and surged well.
7-4	Started 48 hour test run at 1:00P.M.
7-5	Continued 48 hour test run.
7-6	Continued 48 hour test run. Completed at 1:00 P.M.

PG20004841

COPY
Bechtel Corporation

Results of Test

Top of Casing elevation - 552.76

Static Water Level - 98'-2" from Top of casing

Pull Down - 39'-4"

Pumping Level - 137'-6" from Top of casing

Gal/Min. - 330 GPM without breaking suction

Recovery Time - 30 inch per minute

There is 54'-0" of perforated casing

Size of Perforation - 5/32" x 1" with 68 perforations per foot

It is the driller's opinion that the performance of the well will improve and that the drilling of No. 1 Water Well will not affect the performance of No. 2 Water Well.

TOP A3 0049757

POOR QUALITY ORIGINAL

WATER WELL DRILL & TEST LOG
WATER WELL NO. 1

DATE	FOOTAGE	ACCUMULATIVE FOOTAGE	REMARKS
7-13	20	20	Fill & Lava Rock
7-14	15	35	Sand, Gravel & Rock
7-15	15	50	Gravel, sandy Limestone
7-16	13	63	Gravel, sandy Limestone
7-17	5	68	Gravel, sandy Limestone
7-18	-	-	Shut down awaiting 20" Conductor Pipe to prevent fill from caving.
7-19	-	-	
7-20	4	72	Set 20" Conductor Pipe - Sand, Gravel & Rock
7-21	8	80	Sand, Gravel & Rock
7-22	-	80	Dressing Tool
7-23	-	80	Dressing Tool
7-24	10	90	Sand, Gravel & Rock
7-25	15	105	Sand, Gravel & Rock
7-26	-	105	Dressing Tool
7-27	5	110	Bentonite fell 25' in 12 Hrs. Water Indication
7-28	10	120	Bentonite fell 25', Sand, Gravel & Rock
7-29	19	139	Bentonite fell 25', Sand, Gravel & Rock
7-30	9	148	Hard Limestone
7-31	3	151	Sand, Gravel & Rock, Hard Limestone
8-1	-	-	Drilling Rig Shutdown, Engine Trouble
8-2	7	158	Hard Limestone
8-3	8	166	Hard Limestone
8-4	-	166	Hard Limestone
8-5	-	166	Hard Limestone
8-6	7	173	Hard Limestone & Granite
8-7	2	175	Hard Limestone & Granite

DATE	REMARKS
8-8	Awaiting Casing
8-9	Awaiting Casing
8-10	Run Casing to 90 Ft.
8-11	Casing wouldn't go, Awaiting welder to pull casing
8-12	Pulled Casing, Built up bit
8-13	Built up Bit
8-14	Started Reaming
8-15	-------
8-16	Continued Reaming Engine Breakdown
8-17	Awaiting Engine Repair Parts
8-19	Repaired Engine
8-20	Built up Bit & Reaming
8-21	Reaming
8-22	Reaming
8-23	Reaming
8-24	Reaming
8-25	Running Casing
8-26	Casing wouldn't go
8-27	Pulled Casing
8-28	Built up Bit
8-29	Built up Bit
8-30	Reaming
8-31	Reaming
9-1	Reaming
9-2	No Work
9-3	No Work

DATE	REMARKS
9-4	Building Bit
9-5	Reaming
9-6	Reaming
9-7	Reaming
9-8	Ran Casing to 176' - 3"
9-9	Bailed
9-10	Set up Test Pump
9-11	Started Pumping, Pumped 17 Hours
9-12	Started 48 Hr. Test at 8:15 A.M.
9-13	Continued 48 Hr. Test
9-14	Complete 48 Hr. Test

Results of Test

Static Water Level	- 100' - 10"
Pull Down	- 17' - 0"
Pumping Level	- 117' - 10"
Gal. / Min.	- In excess of 400 GPM without breaking suction
Recovery Time	- 45" per min.

Materials in Well

There is 18' - 0" of 20" Conductor Pipe

There is 177' - 0" of 14" Casing including perforated Casing

There is 78' - 0" of Perforated Casing

Perforations 5/32" X 1" with 68 Perforations per foot.

At all time while pumping, the well was pumped at a rate between 400 and 500 GPM and it is the driller's opinion that well will improve. The static Water level in Water Well No. 2 did not lower at any time while pumping Water Well No. 1.

4
(Con't)

	Water Well No. 1	Water Well No. 2
Elevation, Top of Casing	5 ¢ 55.29	5 ¢ 52.76
Water Level in Casing from top	100.83	98.16
Elevation, Water in Casing	4 ¢ 55.46	4 ¢ 54.60

High line [illegible]

#1 WELL PUMP

Depth drilled 176'
Depth of pump 141'10"

The perforations are slots 3/16" X 1"
Never able to break suction and estimated gpm is 500. The red rock formation was not reached. The water level in this well varies between 60' and 86'. Pull down is around 30'.
Well casing 14".

PUMP.

Peerless type 12RO Moturbo
130' - 5" ID - 2" X 1 3/16"
25 H.P. 3 ph. 440 V. 60 cyc. 1760 R.P.M.
[illegible] LA Bowl Unit 5" ID Butt pipe
Peerless Pump Div.
1760 R.P.M.
8 - LA 16 Stage
Bowl T - 83320
Impeller T - 83411
Dia: 5 11/32

#2 WELL

Depth drilled 152'
Depth of [redacted] Casing 149' — 142 ft.

The perforations are slots 3/16" wide and 1" long.
Test pumped for 5 hrs. and gave 300 gpm. Suction could be broken momentarily. Well has been pumped and surged for about 100 hours. The red rock formation was reached between 148' and 150'. There are 52' of perforations. Static water level is 52'. The draw down is 20' at 200 gpm. Lowered bowls to 149'. Delivery then became 325 gpm with 40' draw down.

PUMP.

Same as #1.

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.DO	IW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Investigation PG&E Topock Injection Area		HOLE DEPTH (ft): 411.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 548.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,026.39	EASTING (CCS NAD 27 Z 5): 7,613,368.09	DATE STARTED: 11/12/2004	DATE COMPLETED: 11/19/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: D. Thomas	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0					**NO FORMAL LOG** -see boring log for well OW-1 completed ~60 ft east of IW-1	Conductor casing set to 10 ft bgs, wash casing to 270 ft bgs without collection of core or chips.
						easier drilling, some cobbles to 270'
						Mud Properties: viscosity=43 sec, density =95 lbs/gal, sand=4.5% cake c/ml, ph=7, filter press=7.8 ml
270						
270–275		core 1	0		-1" angular metadiorite pieces in shoe	continuous 94 mm core started at 270 ft bgs, drilling rate=20ft/hr
275						
275–280		core 2	0		-3 rocks in first few inches of core barrel	chattering, slow drilling, drill rate = 15ft./hr
280						

CH2MHILL

SHEET 2 of 6	**PROJECT NUMBER:** 326128.01.07.DO	**BORING NUMBER:** IW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Investigation PG&E Topock Injection Area		**HOLE DEPTH (ft):** 411.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA
SURFACE ELEVATION: 548.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,026.39	**EASTING (CCS NAD 27 Z 5):** 7,613,368.09	**DATE STARTED:** 11/12/2004 **DATE COMPLETED:** 11/19/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** D. Thomas

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
					NO FORMAL LOG	
		core 3	0		-several 1" cobbles in core barrel of metadiorite rock	
285		core 4	0		-1.5" diameter rock in core barrel, metadiorite rock	note: using finger bit to core
		core 5	0.5	SW/GP	**GRAVELY WELL GRADED SAND** -lt olive brn 2.5YR5/3, 8% gravel, ang-subang.	
290		core 6	0.08		- angular metadiorite cobbles up to 1"	
					-more gravely	drilling rate=30ft/hr
		core 7	0.25	SW/SP	**GRAVELLY WELL GRADED SAND**	
295		core 8	0.25		-sand w/gravel, fines, red in color, up to 1.5", subang	dropped core barrel in hole
		core 9	0.33		-metadiorite cobbles cored, .5" w/loose cobbles, ang	
300		core 10	0.5	SW/SM	**WELL GRADED SAND WITH SILT AND GRAVEL** -med olive brn 5Y4/4, 15% gravel, up to .5", ang-subang, 8% fines.	drilling rate=15ft/hr
305		core 11	0.67		**POORLY GRADED FINE SAND WITH GRAVEL** -dk reddish-brn 10R3/4, up to .25" gravel ang-subang, <10%fines.	drilling rate=10ft/hr
310		core 12	0.33		-metadiorite cobbles	drilling rate=10ft/hr
315						

CH2MHILL

SHEET 3 of 6	PROJECT NUMBER: 326128.01.07.DO	BORING NUMBER: IW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Investigation PG&E Topock Injection Area		HOLE DEPTH (ft): 411.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 548.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,026.39	EASTING (CCS NAD 27 Z 5): 7,613,368.09	DATE STARTED: 11/12/2004	DATE COMPLETED: 11/19/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: D. Thomas	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
320		core 13	0.25		**POORLY GRADED FINE SAND WITH GRAVEL** -dk reddish-brn 10R3/4, up to .25" gravel ang-subang, <10%fines. -8-10% gravel, fine sand	drilling rate=12ft/hr chattering
325		core 14	0.25			chattering drilling rate=8ft/hr
330		tricone cuttings	0		-dk reddish brn 10R2/4	drilling rate=15ft/hr
335		tricone cuttings	0	SP		drilling rate=20ft/hr
340		tricone cuttings	0		-Hard consolidated material, metadiorite quartzite and metamorphic bedrock, very uniform size, angular, "salt & pepper" appearance	drilling rate =15ft/hr softer drilling
345		tricone cuttings	0			drilling rate =20ft/hr
350		tricone cuttings	0			drilling rate=15ft/hr very hard

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.DO	IW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Investigation PG&E Topock Injection Area		**HOLE DEPTH (ft):** 411.0	**DRILLING CONTRACTOR:** WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 548.0 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,103,026.39	**EASTING (CCS NAD 27 Z 5):** 7,613,368.09	**DATE STARTED:** 11/12/2004	**DATE COMPLETED:** 11/19/2004
DRILLING METHOD: Mud Rotary		**WATER LEVEL (ft):** ---	**DRILLING EQUIPMENT:** WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			**LOGGED BY:** D. Thomas	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
		tricone cuttings	0		**POORLY GRADED FINE SAND WITH GRAVEL** -dk reddish-brn 10R3/4, up to .25" gravel ang-subang, <10%fines.	drilling rate=12ft/hr
355		tricone cuttings	0			harder
		core 15	0.17			drilling rate=12ft/hr
360		core 16	0.04			
		tricone cuttings	0		**CONGLOMERATE (BR)** - mixture of metamorphic rocks, consolidated reddish brown conglomerate, and silty sandstone, v hard metamorphic / felsic rock fragments, may be some megabreccia deposits. -Hard consolidated material, "salt & pepper" appearance	drilling rate=6ft/hr
365		tricone cuttings	0			drilling rate=30ft/hr
370		tricone cuttings	0			drilling rate=19ft/hr. cuttings coarser 375-377 cuttings coarser
375		tricone cuttings	0			drilling rate=19ft/hr
380		tricone	0			drilling rate=19ft/hr
385						

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.DO	IW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Investigation PG&E Topock Injection Area		HOLE DEPTH (ft): 411.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 548.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,026.39	EASTING (CCS NAD 27 Z 5): 7,613,368.09	DATE STARTED: 11/12/2004	DATE COMPLETED: 11/19/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: D. Thomas	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		cuttings		BR	**CONGLOMERATE (BR)** - mixture of metamorphic rocks, consolidated reddish brown conglomerate, and silty sandstone, v hard metamorphic / felsic rock fragments, may be some megabreccia deposits.	drilling rate=19ft/hr
390		tricone cuttings	0			
395		core button bit 1	0.08			
400		core button bit 2	0			drilling rate=14ft/hr, chatter
405		core button bit 3	0			
410		core button bit 4	0			drilling rate=14ft/hr

Boring Terminated at 411 ft

ABBREVIATIONS

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

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
326128.01.07.DO	IW-1

SOIL BORING LOG

PROJECT NAME: IM-3 Investigation PG&E Topock Injection Area		HOLE DEPTH (ft): 411.0	DRILLING CONTRACTOR: WDC Exploration & Wells, Montclair, CA	
SURFACE ELEVATION: 548.0 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,103,026.39	EASTING (CCS NAD 27 Z 5): 7,613,368.09	DATE STARTED: 11/12/2004	DATE COMPLETED: 11/19/2004
DRILLING METHOD: Mud Rotary		WATER LEVEL (ft): ---	DRILLING EQUIPMENT: WDC 30K	
LOCATION: East Mesa, Parcel No. 650-151-06			LOGGED BY: D. Thomas	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
					ang = angular subang = subangular subrnd = subrounded rnd = rounded br = bedrock formation ss = sandstone conglom = conglomerate comptd = compacted qtz = quartz	

CH2MHILL

PROJECT NUMBER: 327061

BORING NUMBER: PE-01A

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 90.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 461.2 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,326.16	**EASTING (CCS NAD 27 Z 5):** 7,616,405.15	**DATE STARTED:** 02/27/2005 — **DATE COMPLETED:** 02/28/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9.5 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: Floodplain approx 600 ft SE of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
0–7		CC1	7	SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, 100% f qtz rich round to subrnd sand, minor FeOx staining, organics	Sonic boring continuously cored for logging. Selected core samples were preserved for future testing. Selected core samples also collected for USGS testing.
8						PE1A-USGS-8, PE1A-PW-8
9					- wet at ~9', increase in organic content	water level approx. 9.5 ft.
10		CC2	10	ML	**CLAYEY SILT (ML)** - very dk grey 2.5YR3/1, 10% v f sand, organic rich, non sticky	
12				SP	**POORLY GRADED SAND (SP)** - 100% f sand (as above)	
15						
19		CC3	10		- fine-grained organics to ~19'	
20				SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, 100% qtz rich round to subrnd f sand	PE1A-USGS-20, PE1A-PW-20
25						PE1A-24.5' (Isoflow groundwater grab sample)
30		CC4	10		- yellowish brn 10YR5/4,	PE1A-USGS-30, PE1A-PW-30
33						PE1A-GS-33
35						

CH2MHILL

SHEET 2 of 3	PROJECT NUMBER: 327061	BORING NUMBER: PE-01A

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 90.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 461.2 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,326.16	**EASTING (CCS NAD 27 Z 5):** 7,616,405.15	**DATE STARTED:** 02/27/2005 **DATE COMPLETED:** 02/28/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9.5 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: Floodplain approx 600 ft SE of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND (SP)** - lt yellowish brn 10YR6/4, 100% qtz rich round to subrnd f sand	
40					- as above	PE1A-USGS-40, PE1A-PW-40
		CC5	10			
45					- some organics present	PE1A-44.5 (Isoflow groundwater grab sample)
50						PE1A-USGS-50, PE1A-PW-50
		CC6	10		- 10% rnd to subrnd gravel to 2"	
55						
				SW	**WELL GRADED SAND WITH GRAVEL (SW)** - brn 7.5YR5/4, 70% f sand, 15% gravel, 10% m sand, 5% c sand, trace of reddish brn clay lenses	
60						PE1A-USGS-60, PE1A-PW-60
		CC7	10			PE1A-PW-63
65				SP	**POORLY GRADED SAND (SP)** - lt yellow brn 10YR6/4, 100% qtz rich sand (80% fine and 20% medium)	PE1A-64.5' (Isoflow groundwater grab sample)
70						

CH2MHILL

PROJECT NUMBER: 327061	BORING NUMBER: PE-01A

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		HOLE DEPTH (ft): 90.0	DRILLING CONTRACTOR: Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 461.2 ft. MSL	NORTHING (CCS NAD 27 Z 5): 2,102,326.16	EASTING (CCS NAD 27 Z 5): 7,616,405.15	DATE STARTED: 02/27/2005	DATE COMPLETED: 02/28/2005
DRILLING METHOD: Rotosonic		WATER LEVEL (ft): approx. 9.5 ft. bgs	DRILLING EQUIPMENT: Track Mounted Sonic	
LOCATION: Floodplain approx 600 ft SE of well TW-2D, MW-20 bench			LOGGED BY: B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC8	10		**POORLY GRADED SAND (SP)** - lt yellow brn 10YR6/4, 100% qtz rich sand (80% fine and 20% medium) - 25% m sand, 5% c sand, trace gravel	PE1A-USGS-70, PE1A-PW-70
75				CL	**CLAY (CL)** - brn 7.5YR4/4, trace fine sand, plastic, slightly sticky, rolls easily	PE1A-74.5 (Isoflow groundwater grab sample)
80		CC9	10	SW	**GRAVELLY SAND (SW)** - 40% f sand, 20% m sand, 15% gravel, 10% c sand, 5% clay (rnd to subrnd)	PE1A-USGS-80, PE1A-PW-80
85				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - 60% f-c rnd to subrnd gravel, (metamorphic, quartzite, granitic clasts), <2% fines, >38% f-c sand - trace clay at 85'	PE1A-84.5 (Isoflow groundwater grab sample)
90		CC10	3	BR	**CONGLOMERATE (BR)** - dk reddish brn 2.5YR3/4, 80% fines, 10% f sand, 10% subang gravel, very hard, shattered, weakly cemented, dry	Top Miocene Conglomerate at 87 ft Exploratory boring PE-1A grout-sealed after drilling; no well installed at this location

Boring Terminated at 90 ft

ABBREVIATIONS

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

PROJECT NUMBER:	BORING NUMBER:
327061	PE-01B

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock	**HOLE DEPTH (ft):** 87.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ	
SURFACE ELEVATION: 458.6 ft. MSL / **NORTHING (CCS NAD 27 Z 5):** 2,102,210.36	**EASTING (CCS NAD 27 Z 5):** 7,616,424.89	**DATE STARTED:** 02/26/2005	**DATE COMPLETED:** 02/27/2005
DRILLING METHOD: Rotosonic	**WATER LEVEL (ft):** approx. 9 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic	
LOCATION: Floodplain approx 650 ft SE of well TW-2D, MW-20 bench		**LOGGED BY:** B. Trebble, T. Lae	

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/ NUMBER	SAMPLE RECOVERY (ft)	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.
0					**POORLY GRADED SAND (SP)** - yellowish brn 10YR5/4, 100% f qtz rich sand, subrnd to rnd, loose, damp, organic rich top 4 feet	Sonic boring continuously cored for logging. Selected core samples were preserved for future testing. Selected core samples also collected for USGS testing.
4		CC1	7			
5						
8					- very dk gray at/near water table	PE1B-USGS-8, PE1B-PW-8 water table at approx. 9 ft. bgs
10						
12		CC2	10			
15						
17				SP	- fine-grained organics to ~17'	
20						PE1B-USGS-20, PE1B-PW-20
22		CC3	10			
24						PE1B-24 Isoflow groundwater grab sample
25						
27					- color changes to grayish brn 10YR4/2 from 27-34', organics	
30						PE1B-USGS-30, PE1B-PW-30
32		CC4	10			
34					- color change to brn 10YR5/3, 100% f qtz rich sand	PE1B-GS-34
35						

CH2MHILL

PROJECT NUMBER: 327061	BORING NUMBER: PE-01B

SOIL BORING LOG

PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 87.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 458.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,210.36	**EASTING (CCS NAD 27 Z 5):** 7,616,424.89	**DATE STARTED:** 02/26/2005 — **DATE COMPLETED:** 02/27/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: Floodplain approx 650 ft SE of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
				SP	**POORLY GRADED SAND (SP)** - yellowish brn 10YR5/4, 100% f qtz rich sand, subrnd to rnd, loose, damp, organic rich top 4 feet	
					- from 37-39', slightly darker grey brn 10YR4/2, trace fines (1-2%)	
40		CC5	10			PE1B-USGS-40, PE1B-PW-40
					- brn 10YR5/3, 100% f qtz rich sand, subrnd to rnd	
45						PE1B-44 Isoflow groundwater grab sample
50		CC6	10			PE1B-USGS-50, PE1B-PW-50
55					- 3" thick f gravel zone, c sand, half an inch thick clay layer	
		CC7	10	SW	**GRAVELLY SAND (SW)** - lt olive brn 2.5YR5/3, 60% f sand, 20% c sand, 10% f rnd gravel, 10% c gravel, metamorphic, qtz, gneiss	PE1B-GS-58
60						PE1B-USGS-60, PE1B-PW-60, PE1B-GS-61
				CL	**FAT CLAY (CL)** - brn 7.5YR5/3, 100% clay ~ 6" thick, soft, sticky rolls easily	
				SW	**GRAVELLY SAND (SW)** - 30% f gravel, 30% c sand, 30% m sand, 10% f sand	
65						
					POORLY GRADED SAND (SP) - color as above, 90% f rnd to subrnd sand, 10% gravel	
70						

CH2MHILL

SHEET 3 of 3	PROJECT NUMBER: 327061	BORING NUMBER: PE-01B

SOIL BORING LOG

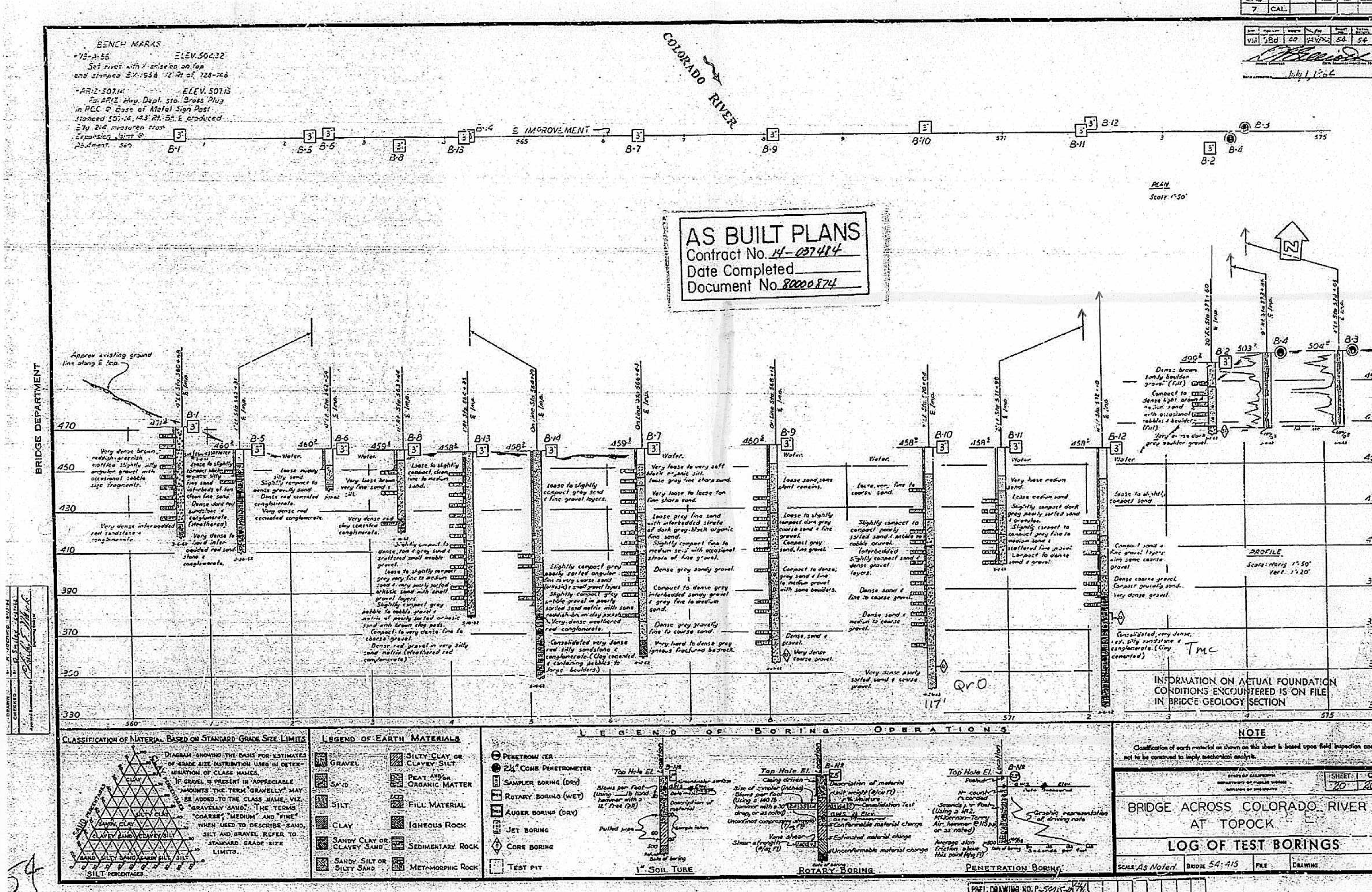
PROJECT NAME: Extraction Well, Interim Measures - PG&E Topock		**HOLE DEPTH (ft):** 87.0	**DRILLING CONTRACTOR:** Prosonic Corp. Phoenix, AZ
SURFACE ELEVATION: 458.6 ft. MSL	**NORTHING (CCS NAD 27 Z 5):** 2,102,210.36	**EASTING (CCS NAD 27 Z 5):** 7,616,424.89	**DATE STARTED:** 02/26/2005 **DATE COMPLETED:** 02/27/2005
DRILLING METHOD: Rotosonic		**WATER LEVEL (ft):** approx. 9 ft. bgs	**DRILLING EQUIPMENT:** Track Mounted Sonic
LOCATION: Floodplain approx 650 ft SE of well TW-2D, MW-20 bench			**LOGGED BY:** B. Trebble, T. Lae

DEPTH BGS (feet)	SAMPLE INTERVAL	SAMPLE TYPE/NUMBER	SAMPLE RECOVERY (ft)	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.
		CC8	10	SP	**POORLY GRADED SAND (SP)** - color as above, 90% f rnd to subrnd sand, 10% gravel - 99% f sand, 1% f gravel	PE1B-USGS-70, PE1B-PW-70 PE1B-74 Isoflow groundwater grab sample
75				GW	**WELL GRADED GRAVEL WITH SAND (GW)** - olive brn 2.5YR4/3, 68% f sand, 30% f c gravel, trace clay (1-2%), qzite, gneiss, volcanics	
				CL	**CLAY (CL)** - brn 10YR4/3, 5% gravel, trace sand, sticky plastic	
80		CC9	10	SC	**CLAYEY SAND WITH GRAVEL(SC)** - 60% f sand, 20% clay, 10% f gravel, 10% c gravel, rnd, chert, volcanics, igneous	PE1B-USGS-80, PE1B-PW-80 PE1B-82 Isoflow groundwater grab sample
85				BR	**CONGLOMERATE (BR)** - dk reddish brn 2.5YR3/4, 75% fines, 10% f sand, 15% subang gravel, very hard, shattered, weakly cemented, dry	Top Miocene Conglomerate 83.5 ft Exploratory boring PE-1B grout-sealed after drilling; no well installed at this location

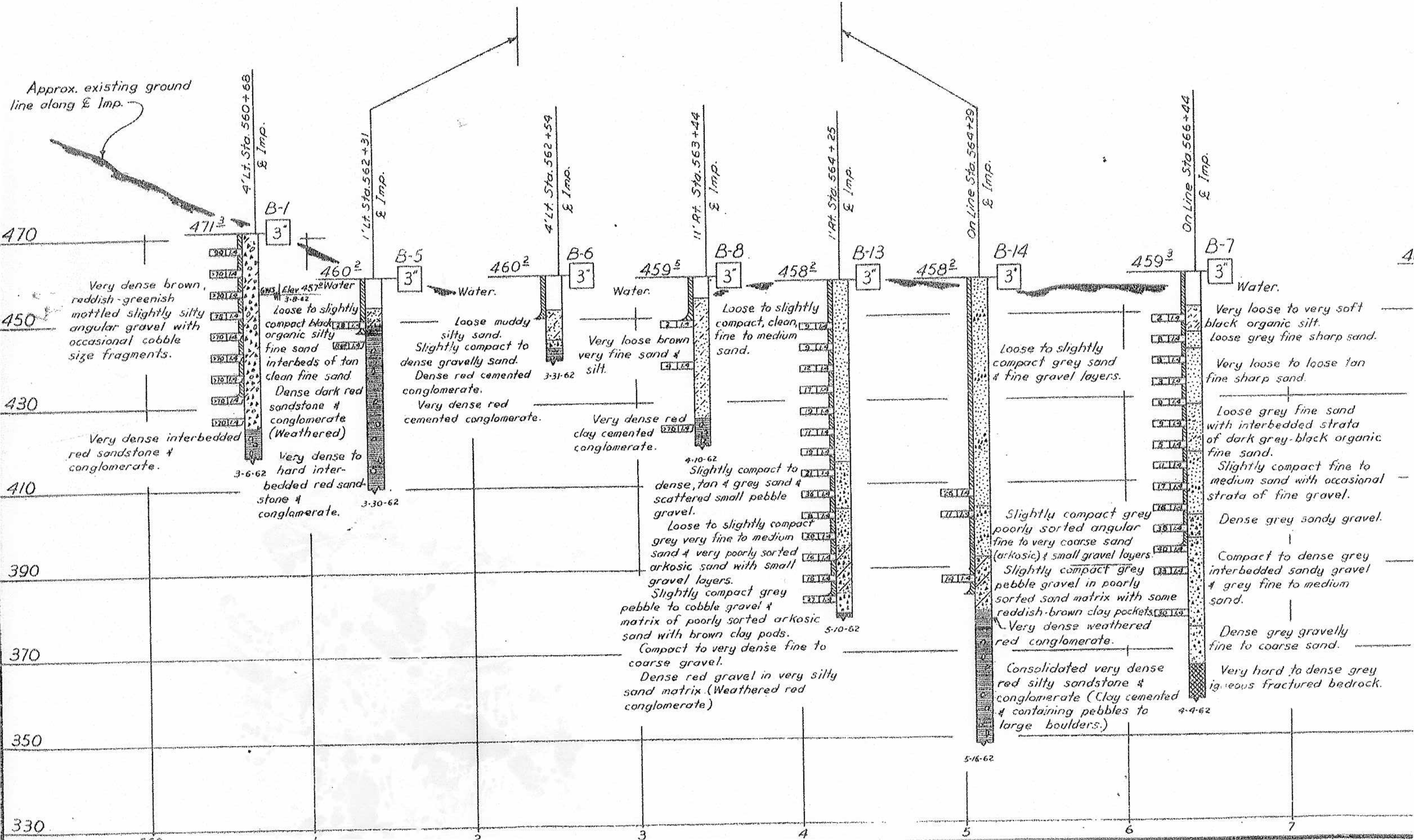
Boring Terminated at 87 ft

ABBREVIATIONS

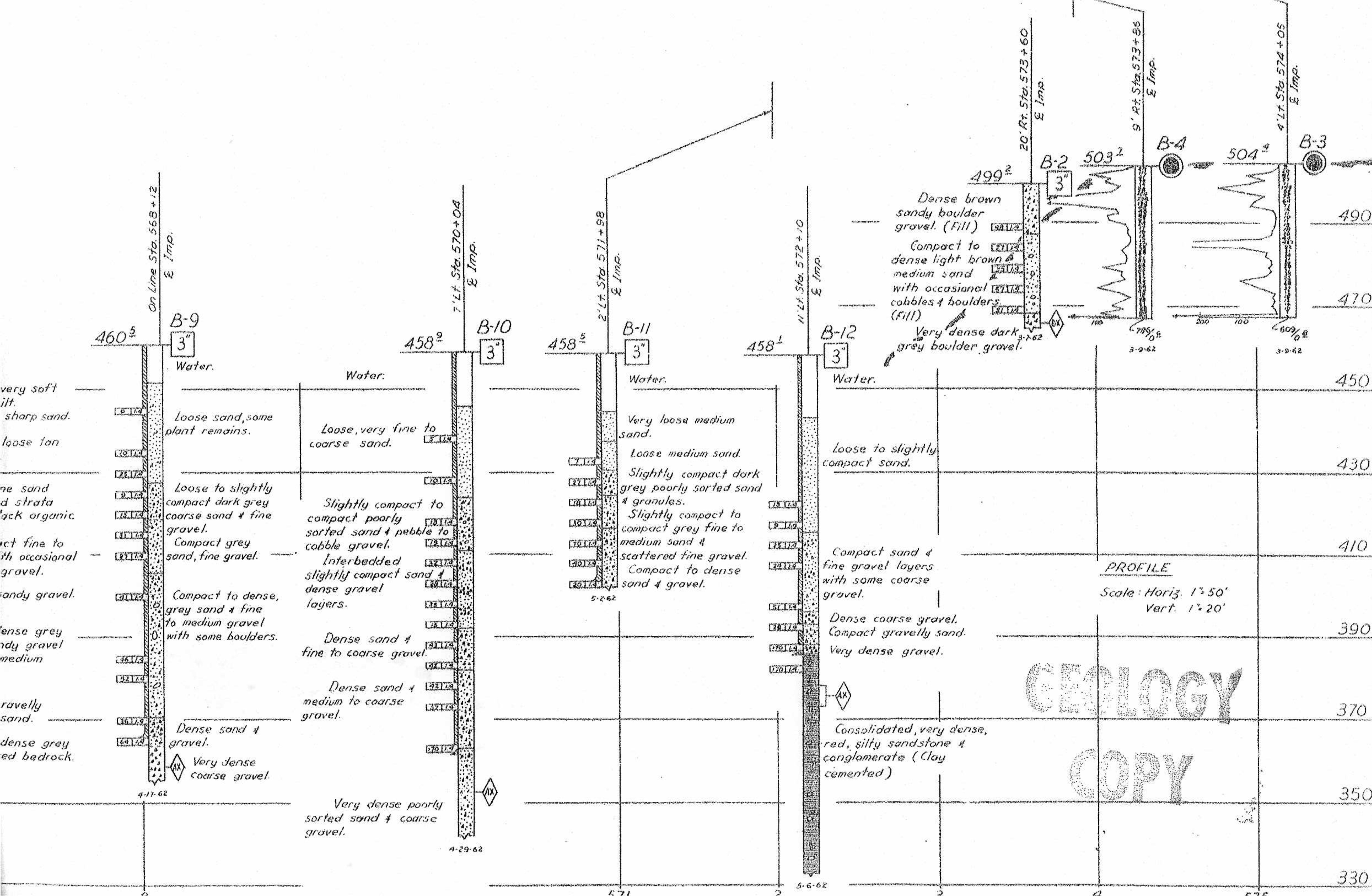
cc = continuous core run
brn = brown
lt = light
dk = dark
vf = very fine-grained
f = fine-grained
m = medium-grained
c = coarse-grained
vc = very coarse-grained
ang = angular
subang = subangular
subrnd = subrounded
rnd = rounded
br = bedrock formation
ss = sandstone
conglom = conglomerate
comptd = compacted
qtz = quartz



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN

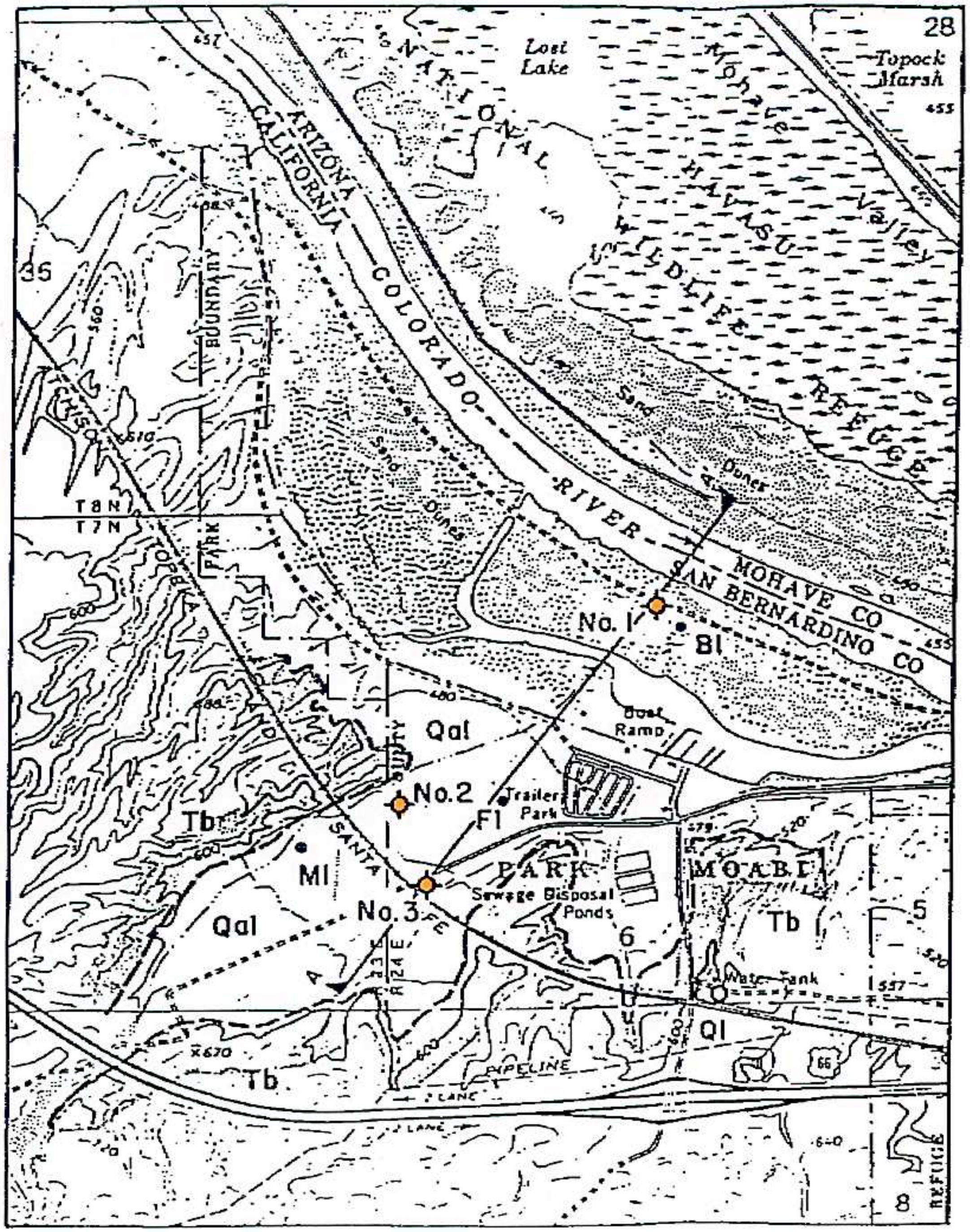


Approx. existing ground line along ℄ Imp.
470
450
430
410
390
370
350
330
4'Lt. Sta. 560+68 ℄ Imp.
B-1
3"
471 3
Very dense brown, reddish-greenish mottled slightly silty angular gravel with occasional cobble size fragments.
Very dense interbedded red sandstone & conglomerate.
3-6-62
GWS Elev 457± Water 3-8-62
1'Lt. Sta. 562+31 ℄ Imp.
B-5
3"
460 2
Loose to slightly compact black organic silty fine sand interbeds of tan clean fine sand.
Dense dark red sandstone & conglomerate (Weathered)
Very dense to hard inter-bedded red sand-stone & conglomerate.
3-30-62
Water.
Loose muddy silty sand.
Slightly compact to dense gravelly sand.
Dense red cemented conglomerate.
Very dense red cemented conglomerate.
4'Lt. Sta. 562+54 ℄ Imp.
B-6
3"
460 2
3-31-62
Water.
Very loose brown very fine sand & silt.
Very dense red clay cemented conglomerate.
11' Rt. Sta. 563+44 ℄ Imp.
B-8
3"
459 5
4-10-62
Loose to slightly compact, clean, fine to medium sand.
1'Rt. Sta. 564+25 ℄ Imp.
B-13
3"
458 2
Slightly compact to dense, tan & grey sand & scattered small pebble gravel.
Loose to slightly compact grey very fine to medium sand & very poorly sorted arkosic sand with small gravel layers.
Slightly compact grey pebble to cobble gravel & matrix of poorly sorted arkosic sand with brown clay pods.
Compact to very dense fine to coarse gravel.
Dense red gravel in very silty sand matrix (Weathered red conglomerate)
5-10-62
On Line Sta. 564+29 ℄ Imp.
B-14
3"
458 2
Loose to slightly compact grey sand & fine gravel layers.
Slightly compact grey poorly sorted angular fine to very coarse sand (arkosic) & small gravel layers.
Slightly compact grey pebble gravel in poorly sorted sand matrix with some reddish-brown clay pockets.
Very dense weathered red conglomerate.
Consolidated very dense red silty sandstone & conglomerate (Clay cemented & containing pebbles to large boulders.)
5-16-62
On Line Sta. 566+44 ℄ Imp.
B-7
3"
459 3
Water.
Very loose to very soft black organic silt.
Loose grey fine sharp sand.
Very loose to loose tan fine sharp sand.
Loose grey fine sand with interbedded strata of dark grey-black organic fine sand.
Slightly compact fine to medium sand with occasional strata of fine gravel.
Dense grey sandy gravel.
Compact to dense grey interbedded sandy gravel & grey fine to medium sand.
Dense grey gravelly fine to coarse sand.
Very hard to dense grey igneous fractured bedrock.
4-4-62
1
2
3
4
5
6
7



On Line Sta. 568+12 ℄ Imp.
B-9
460⁵
3"
Water.
very soft
ilt.
sharp sand.
loose tan
ne sand
d strata
lack organic
ct fine to
th occasional
gravel.
sandy gravel.
dense grey
ndy gravel
medium
ravelly
sand.
dense grey
ed bedrock.
Loose sand, some plant remains.
Loose to slightly compact dark grey coarse sand & fine gravel.
Compact grey sand, fine gravel.
Compact to dense, grey sand & fine to medium gravel with some boulders.
Dense sand & gravel.
Very dense coarse gravel.
4-17-62
7' Lt. Sta. 570+04 ℄ Imp.
B-10
458⁹
3"
Water.
Loose, very fine to coarse sand.
Slightly compact to compact poorly sorted sand & pebble to cobble gravel.
Interbedded slightly compact sand & dense gravel layers.
Dense sand & fine to coarse gravel.
Dense sand & medium to coarse gravel.
Very dense poorly sorted sand & coarse gravel.
4-29-62
2' Lt. Sta. 571+98 ℄ Imp.
B-11
458⁵
3"
Water.
Very loose medium sand.
Loose medium sand.
Slightly compact dark grey poorly sorted sand & granules.
Slightly compact to compact grey fine to medium sand & scattered fine gravel.
Compact to dense sand & gravel.
5-2-62
11' Lt. Sta. 572+10 ℄ Imp.
B-12
458¹
3"
Water.
Loose to slightly compact sand.
Compact sand & fine gravel layers with some coarse gravel.
Dense coarse gravel.
Compact gravelly sand.
Very dense gravel.
Consolidated, very dense, red, silty sandstone & conglomerate (Clay cemented)
5-6-62
20' Rt. Sta. 573+60 ℄ Imp.
B-2
499²
3"
Dense brown sandy boulder gravel. (Fill)
Compact to dense light brown medium sand with occasional cobbles & boulders. (Fill)
Very dense dark grey boulder gravel.
3-7-62
9' Rt. Sta. 573+85 ℄ Imp.
B-4
503⁷
3-9-62
4' Lt. Sta. 574+05 ℄ Imp.
B-3
504⁴
3-9-62
490
470
450
430
410
390
370
350
330
PROFILE
Scale: Horiz. 1"=50'
Vert. 1"=20'
GEOLOGY COPY
571
575

Figu



EXPLANATION

Qal — ALLUVIUM
Recent sand, gravel and silt

Tb — BOUSE FORMATION
Pliocene sand, silt, clay, limestone and tufa.

GEOLOGIC CONTACT
Approximately located

F1 ● WATER WELL

Q1 ○ EXPLORATORY BORING

No.2 EXPLORATORY BORING BY LC&A

A — A' GEOLOGIC SECTION

Reference: Base map from U.S.G.S. 7½' Whale Mtn. Quadrangle, 1971.

N

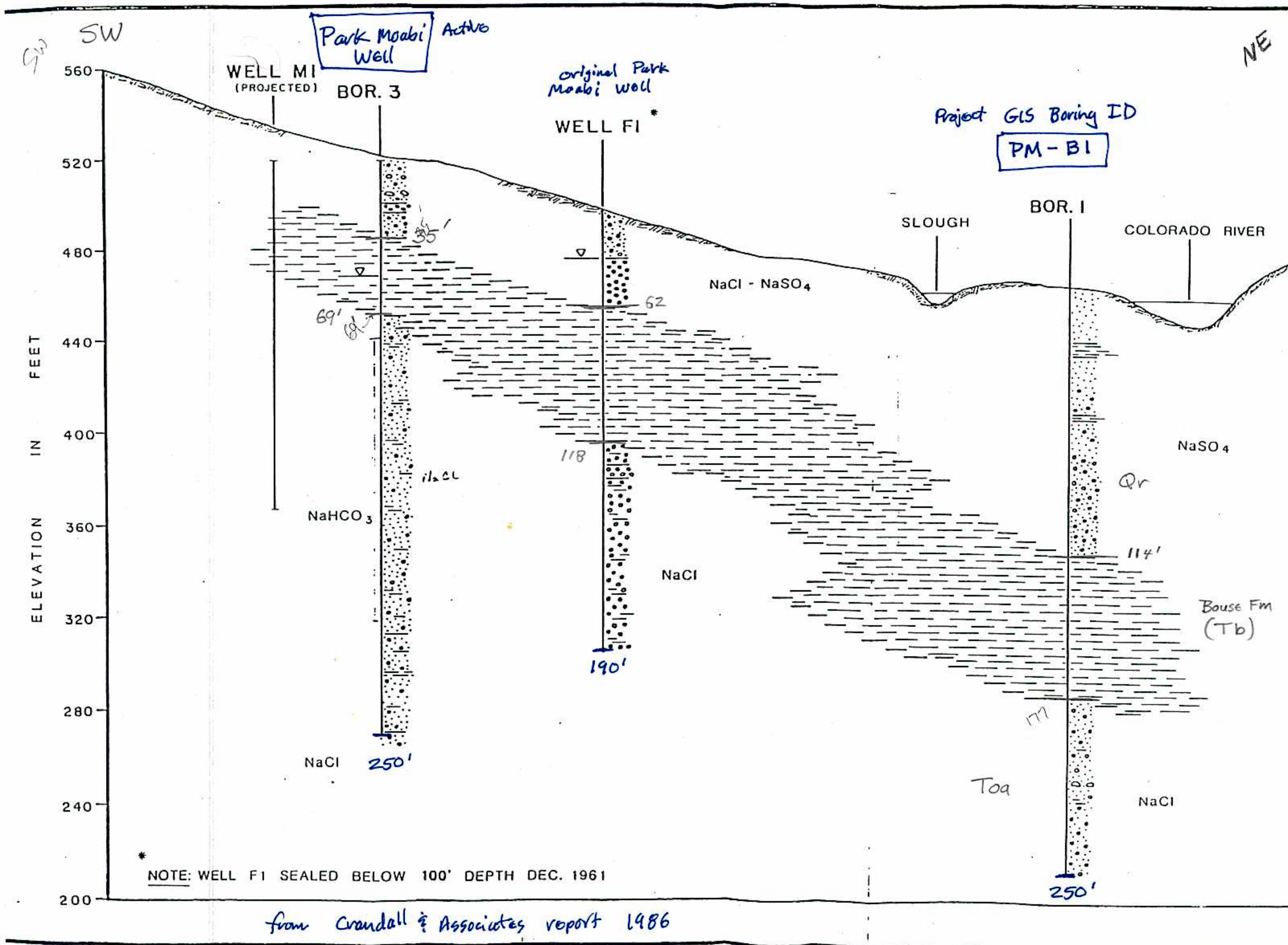
SCALE IN FEET

0 1000 2000 3000 4000

LOCATION OF WELLS

PARK MOABI

SAN BERNARDINO COUNTY, CALIF.



SW
NE
Park Moabi Well
Active
original Park Moabi well
Project GIS Boring ID
PM-B1
WELL MI
(PROJECTED)
BOR. 3
WELL F1 *
SLOUGH
BOR. 1
COLORADO RIVER
560
520
480
440
400
360
320
280
240
200
ELEVATION IN FEET
35'
69'
62
118
NaCl - NaSO4
NaHCO3
NaCl
NaSO4
Qr
114'
Bouse Fm
(Tb)
190'
177
250'
Toa
NaCl
250'
* NOTE: WELL F1 SEALED BELOW 100' DEPTH DEC. 1961
from Crandall & Associates report 1986

E-85417-B

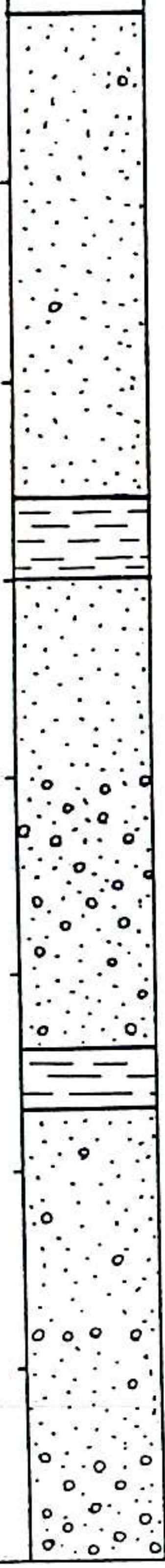
LITHLOGIC LOG

1986

PM-B1

Park Moabi Water Supply Investigation
Crandall & Assoc

Boring ~~Well~~ only No. 1

Depth	Graphic Log	EC (umhos)		Description of Materials
				Road base material
			SAND	Brown silty sand, very fine to medium grained sand, soft, damp to moist, few rounded gravels
10				
20				
			CLAY	Black silty clay, soft
30		790	SAND	Brown silty sand Decaying organic odor
40		950		Gravels increase, rounded, pebble size to 3/4", 3 gpm, collect water sample
50		600		Clayier
			CLAY	Black sandy silty clay, soft
60		500	SAND	Brown clayey silty sand, very fine to medium grained sand, soft, some fine gravels
70		980		Gravels increase, angular to rounded, caving
		1,000		5 gpm, collect water sample

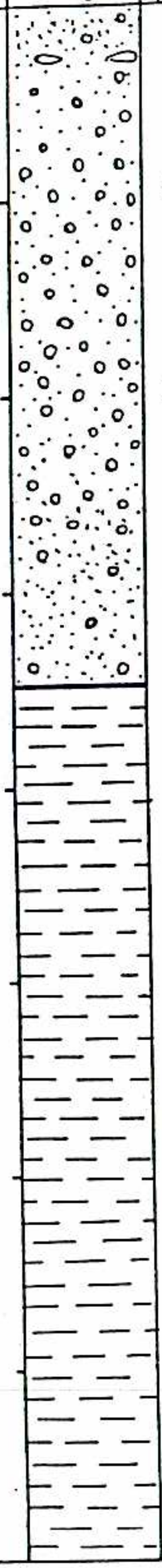
E-85417-B

LITHLOGIC LOG

1986
PM-B1

Park Moabi Crandall & Associates
Water Supply Investigation

Well No. 1



Depth	Graphic Log	EC (umhos)		Description of Materials
				Caving gravels
90		1,200		
100		1,900		
				Gravels decrease, sands increase
110		3,500		
			CLAY	Grey silty clay, moderately firm, plyable
120		1,800		
130		3,500		
140		7,000		Some fine sand
150		4,100		
		5,200		

LITHLOGIC LOG

Well No. 1

Depth	Graphic Log	EC (umhos)	Description of Materials	
170		4,350		
180		2,400	SAND & GRAVEL	Green to brown silty gravelly sand, very fine to coarse grained sand, fine angular gravels predominately meta-igneous composition
190		2,200		
200		2,400		38 gpm, collect water sample
210		2,300		
220		2,400		50 gpm
230		3,600		
				236' to 238' sand bed
		3,200		

LITHLOGIC LOG

Well No. 1

Depth	Graphic Log	EC (umhos)	Description of Materials
250		4,750	Total Depth: 250 ft., 60 gpm, water sample collected
260			

B4 Drilling Data and Grain-size Analyses for Hydrostratigraphic Units

TABLE B-4
Summary of Drilling Log Data and Site Hydrostratigraphic Units Encountered
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station

		Boring Log: Depth & Elevation				Miocene Bedrock		Saturated Fluvial HSUs		Toa0 HSU
Well Name or Cluster ID	Location ID	Elevation Grnd Surface ft MSL	Boring Depth ft bgs	Elevation Boring Depth ft MSL	HSU at Boring Total Depth	Depth Top Bedrock ft bgs	Elevation Top Bedrock ft MSL	Depth Top Fluvial ft bgs	Depth Base Fluvial ft bgs	Depth Top Basal Alluvium ft bgs
MW-1	MW-01	660	212	448	Toa	NDE	< 448	not present		NDE
MW-3	MW-03	649	207	442	Toa	NDE		not present		NDE
MW-4	MW-04	624	180	444	Toa	NDE		not present		NDE
MW-5	MW-05	635	188	447	Toa	NDE		not present		NDE
MW-6	MW-06	642	194	448	Toa	NDE		not present		NDE
MW-7	MW-07	630	188	442	Toa	NDE	< 442	not present		NDE
MW-8	MW-08	627	179	447	Toa	NDE		not present		NDE
MW-9	MW-09	534	89	445	Toa	NDE		not present		NDE
MW-10	MW-10	529	99	430	Toa	NDE		not present		NDE
MW-11	MW-11	521	86	435	Toa	NDE		not present		NDE
MW-12	MW-12	483	50	433	Toa	50	433	not present		NDE
MW-13	MW-13	487	50	437	Toa	NDE		not present		NDE
MW-14	MW-14	570	135	435	Toa	NDE		not present		NDE
MW-15	MW-15	640	204	436	Toa	NDE	< 436	not present		NDE
MW-16	MW-16	655	218	437	Toa	NDE		not present		NDE
MW-17	MW-17	588	150	438	Toa	NDE		not present		NDE
MW-18	MW-18	544	110	434	Toa	NDE		not present		NDE
MW-19	MW-19	499	66	433	Toa	NDE		not present		NDE
MW-20	MW-20-130	499	132	367	Toa0	(est 132)	(est 367)	not present		132
MW-21	MW-21	506	62	444	Toa0	(est 66)	(est 440)	not present		52
MW-22	MW-22	458	11	447	Tmc	12	446	5	12	not present
MW-23	MW-23	505	80	425	Tmc	1	504	not present		not present
MW-24	MW-24BR	563	442	121	pTbr	225	338	not present		200
MW-25	MW-25	541	107	434	Toa	NDE		not present		NDE
MW-26	MW-26	503	74	429	Toa	NDE		not present		
MW-27	MW-27-085	458	107	351	Tmc	87	371	6	87	not present
MW-28	MW-28-090	465	148	317	Toa0	NDE		12	93	141
MW-29	MW-29	483	40	444	Qr2	NDE		29	63	NDE
MW-30	MW-30-050	466	67	399	Qr2	NDE		13	NDE	NDE
MW-31	MW-31-135	495	168	327	Toa0	NDE		not present		134
MW-32	MW-32-035	459	37	422	Tmc	35	424	5	35	not present
MW-33	MW-33-210	485	237	248	Tmc	222	263	32	52	153
MW-34	MW-34-100	459	116	343	Tmc	98	361	5	98	not present
MW-35	MW-35-135	481	168	313	Toa	(est 391)	(est 90)	not present		NDE
MW-36	MW-36-100	467	108	359	Tmc	98	369	13	98	not present
MW-37	MW-37D	484	228	256	Tmc	228	256	not present		200
MW-38	MW-38D	523	195	328	Tmc	185	338	not present		152
MW-39	MW-39-100	465	118	347	Tmc	108	357	12	51	86
MW-40	MW-40D	567	268	299	Tmc	265	302	not present		245
MW-41	MW-41D	477	320	157	Tmc	301	176	not present		250
MW-42	MW-42-065	461	81	380	Tmc	70	391	10	70	not present
MW-43	MW-43-090	460	97	363	Tmc	89	371	12	89	not present
MW-44	MW-44-125	471	134	337	Tmc	125	346	15	97	123
MW-45	MW-45-095	467	97	370	Tmc	95	372	12	95	not present
MW-46	MW-46-205	481	217	264	Tmc	211	270	26	96	156
MW-47	MW-47-115	483	117	366	Toa	NDE		25	115	NDE
MW-48	MW-48	484	155	329	Tmc	50	434	not present		45
MW-49	MW-49-365	483	384	99	Tmc	370	113	28	63	226
MW-50	MW-50-200	495	248	247	Tmc	227	268	not present		179
MW-51	MW-51	502	114	388	Tmc	113	389	not present		87

TABLE B-4
Summary of Drilling Log Data and Site Hydrostratigraphic Units Encountered
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PG&E Topock Compressor Station

Well Name or Cluster ID	Location ID	Boring Log: Depth & Elevation				Miocene Bedrock		Saturated Fluvial HSUs		Toa0 HSU
		Elevation Grnd Surface ft MSL	Boring Depth ft bgs	Elevation Boring Depth ft MSL	HSU at Boring Total Depth	Depth Top Bedrock ft bgs	Elevation Top Bedrock ft MSL	Depth Top Fluvial ft bgs	Depth Base Fluvial ft bgs	Depth Top Basal Alluvium ft bgs
MW-52	MW-52D	460	102	358	Tmc	87	373	6	87	not present
MW-53	MW-53D	460	133	327	Tmc	130	330	6	130	not present
MWP-1	MWP-01	675	127	548	pTbr	96	579	not present		
MWP-2	MWP-02	674	270	404	pTbr	219	455	not present		
MWP-2RD	MWP-02RD	674	279	395	pTbr	250	424	not present		
MWP-3	MWP-03	661	222	439	pTbr	188	473	not present		
MWP-7	MWP-07	675	110	565	pTbr	96	579	not present		
MWP-8	MWP-08	677	211	466	est Tmc			not present		
MWP-9	MWP-09	680	220	460	pTbr	215	465	not present		
MWP-10	MWP-10	675	235	440	pTbr	230	445	not present		
MWP-12	MWP-12	662	217	445	pTbr	130	532	not present		
MWP-14	MWP-14	674	221	453	est Tmc			not present		
MWP-15	MWP-15	676	290	386	pTbr	247	429	not present		
MWP-16	MWP-16	690	261	429	pTbr	255	435	not present		
CW-1	CW-01D	564	360	204	Tmc	358	206	not present		320
CW-2	CW-02D	547	385	162	Tmc	380	167	not present		330
CW-3	CW-03D	532	360	172	Toa0	NDE		not present		315
CW-4	CW-04D	516	337	179	pTbr	334	182	not present		292
IW-1	IW-01	545	411	134	Tmc	340	205	not present		300
IW-2	IW-02	547	412	135	pTbr	350	197	not present		305
IW-3	IW-03	551	411	140	pTbr	348	203	not present		318
OW-1	OW-01D	548	291	257	Toa	NDE		not present		292
OW-2	OW-02D	547	347	200	Tmc	347	200	not present		302
OW-3	OW-03D	556	275	281	Toa	NDE		not present		332
OW-5	OW-05D	550	350	200	Tmc	346	204	not present		300
P-1	P-01	694	217	477	est Tmc	NDE		not present		
P-2	P-02	536	249	287	Toa	NDE		not present		
PE-1	PE-01	467	99	368	Tmc	89	378	12	89	not present
PE-1A	PE-01A	461	90	371	Tmc	87	374	10	87	not present
PE-1B	PE-01B	459	87	372	Tmc	83	376	10	83	not present
PGE-1	PGE-01	554	176	378	Toa	NDE		not present		
PGE-2	PGE-02	552	152	400	Toa	NDE		not present		
PGE-6	PGE-06	562	180	382	Toa	NDE		not present		
PGE-7	PGE-07	563	330	233	pTbr	225	338	not present		
PGE-8	PGE-08	595	562	33	pTbr	140	455	not present		
PGE-9N	PGE-09N	460	95	365	Tmc	100	360	6	100	not present
PGE-9S	PGE-09S	459	100	359	Tmc	104	355	5	104	not present
PT-1 (Ponds)	PGE-PT-1	625	280	345	Toa	(est 299)	(est 326)	not present		
Park Moabi-1	PM-01	510	190	320	Toa	NDE		not present		NDE
Park Moabi-3	PM-03	517	250	267	Toa	NDE		not present		NDE
Park Moabi-4	PM-04	485	145	340	Toa	NDE		not present		NDE
PM-B1	PM-B1	475	250	225	Toa	NDE		not present		
PM-B2	PM-B2	495	80	415	Toa	NDE		not present		
PT-1 (ISPT)	PT-1D	472	125	347	Tmc	123	349	15	73	not determined
PT-2	PT-2D	471	127	344	Tmc	120	351	15	est 43	not determined
PT-3	PT-3D	472	129	343	Tmc	121	351	15	69	not determined
PT-4	PT-4D	472	127	345	est Tmc	not determined		15	74	103
PT-5	PT-5D	471	127	344	Tmc	125	346	15	84	not determined
PT-6	PT-6D	474	137	337	Tmc	130	344	15	80	not determined
PT-7	PT-7D	560	230	330	Tmc	225	335	not present		not determined

TABLE B-4

Summary of Drilling Log Data and Site Hydrostratigraphic Units Encountered

RCRA Facility Investigation/Remedial Investigation Report (Volume 2)

PG&E Topock Compressor Station

		Boring Log: Depth & Elevation				Miocene Bedrock		Saturated Fluvial HSUs		Toa0 HSU
Well Name or Cluster ID	Location ID	Elevation Grnd Surface ft MSL	Boring Depth ft bgs	Elevation Boring Depth ft MSL	HSU at Boring Total Depth	Depth Top Bedrock ft bgs	Elevation Top Bedrock ft MSL	Depth Top Fluvial ft bgs	Depth Base Fluvial ft bgs	Depth Top Basal Alluvium ft bgs
PT-8	PT-8D	562	225	337	Tmc	224	338	not present		not determined
PT-9	PT-9D	560	225	335	Tmc	218	342	not present		not determined
PTI-1	PTI-1D	473	137	336	Tmc	135	338	15	est 75	not determined
PTR-1	PTR-1	558	210	348	est Tmc	not logged		not present		not determined
PTR-2	PTR-2	565	223	342	Tmc	218	348	not present		not determined
Smith	Smith	505	80	425	Tmc	68	437	not present		not determined
TW-1	TW-01	621	312	309	Tmc	271	350	not present		245
TW-2	TW-02D	497	180	317	Tmc	150	347	not present		140
TW-3D	TW-03D	497	158	339	Tmc	152	345	not present		140
TW-4	TW-04	483	288	195	Tmc	280	203	not present		
TW-5	TW-05	497	150	347	Toa	NDE		not present		
B-25	B-25	672	210	462	pTbr	198	474	not present		
CB-1	CB-01	471	54	417	Tmc	37	434	16	37	
CB-2	CB-02	499	34	465	fill	NDE		NDE		
CB-3	CB-03	504	37	467	fill	NDE		NDE		
CB-4	CB-04	504	37	467	fill	NDE		NDE		
CB-5	CB-05	460	50	410	Tmc	12	448	5	12	
CB-6	CB-06	460	20	440	Tmc	17	443	5	17	
CB-7	CB-07	459	102	357	Tmc	94	365	4	94	
CB-8	CB-08	460	40	420	Tmc	35	425	5	35	
CB-9	CB-09	461	105	356	Qr0	NDE		6	NDE	
CB-10	CB-10	459	117	342	Qr0	NDE		4	NDE	
CB-11	CB-11	459	57	402	Qr2	NDE		6	NDE	
CB-12	CB-12	458	125	333	Tmc	73	385	3	73	
CB-13	CB-13	458	81	377	Tmc	79	379	3	79	
CB-14	CB-14	458	110	348	Tmc	78	380	3	78	
XMW-9	XMW-9	536	78	458	pTbr	63	473	not present		

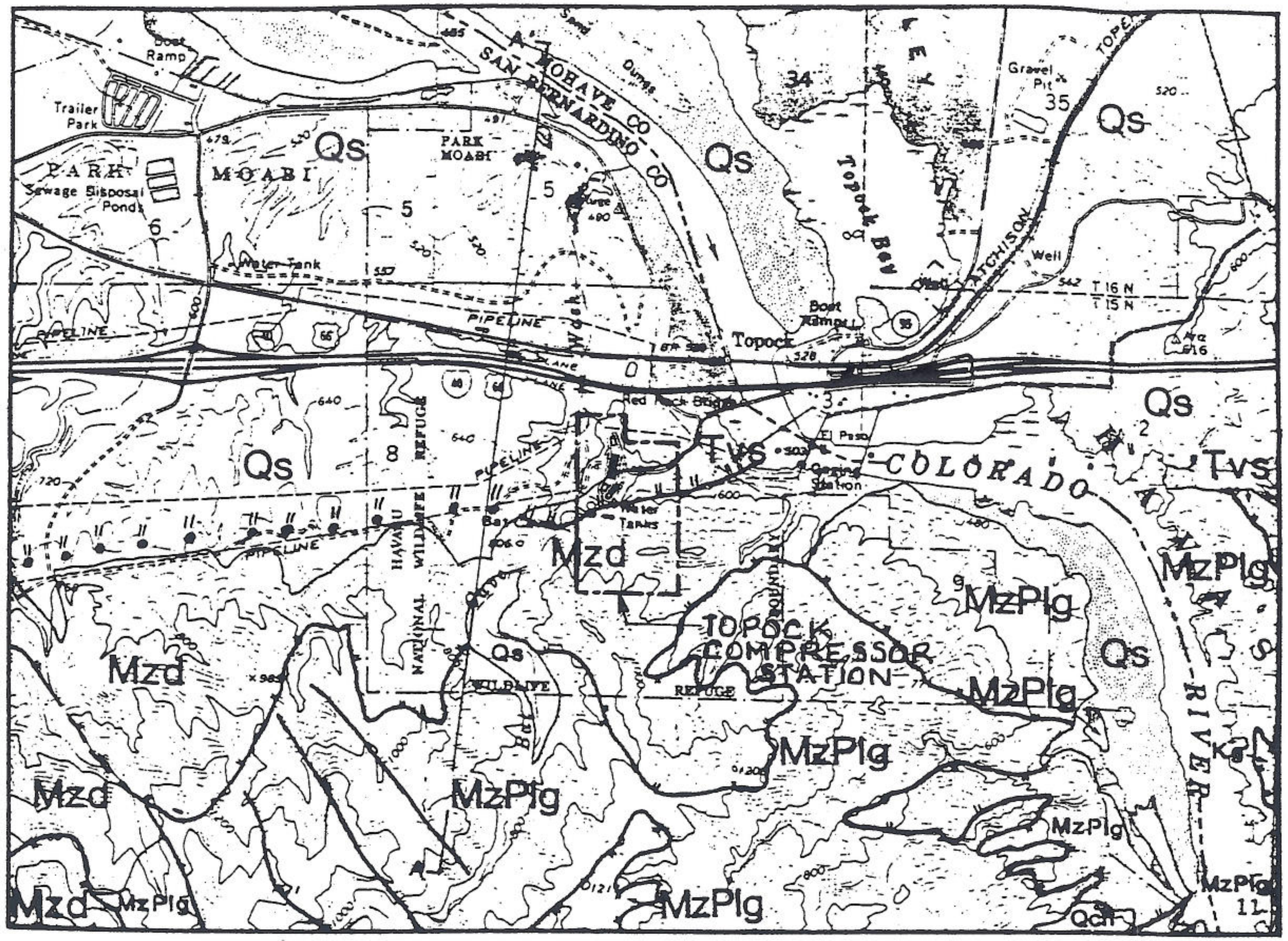
Notes:

1. Hydrostratigraphic units (HSUs): Quaternary fluvial deposits (Qr0, Qr1, Qr2, Qr3), Tertiary Older Alluvium (Toa), Tertiary Basal Alluvium (Toa0), Miocene Conglomerate bedrock (Tmc), pre-Tertiary metamorphic and igneous bedrock (pTbr)

2. Ground surface and drilling elevations in feet above mean sea level (MSL); rounded to whole foot for presentation.
   Depths in feet below ground surface (bgs)
   NDE denotes the boring was not drilled deep enough to encounter the HSU.
   The HSU depths and elevations at selected locations were estimated (est) from projections from site cross-sections.

est - estimated value or characterization

B5 Pre-RFI Geological and Geotechnical Studies Conducted for Topock Compressor Station Evaporation Pond Sites



Explanation

Qs	Surficial Deposits (Quaternary)–Alluvium, colluvium, dissected older alluvium, dune, and marsh deposits.
Qch	Chemehuevi formation (Pleistocene ?)–Sand, silt, clay, and river gravel (pebbles, cobbles, and boulders)
Tvs	Volcanic and Sedimentary Deposits(Miocene and Oligocene ?)–Flows and flow breccia, ash-flow tuff, sedimentary volcaniclastic breccia, fanglomerate, sandstone, and siltstone.
Kg	Granite(Cretaceous)–Monzogranite to granodiorite.
Mzd	Foliated Plutonic Rocks (Mesozoic) – Metadiorite
MzPlg	Layered Gneiss and Migmatite (Mesozoic? and Proterozoic?).

Symbols

Contact

Fault

Low-Angle Normal Fault (Detachment)–Dashed where approximate, dotted where concealed, and hachures on upper plate (sic.).

A A′ Cross Section (see lower left for this figure)

0 2000′ 4000′
Scale Feet

Cross Section A-A′

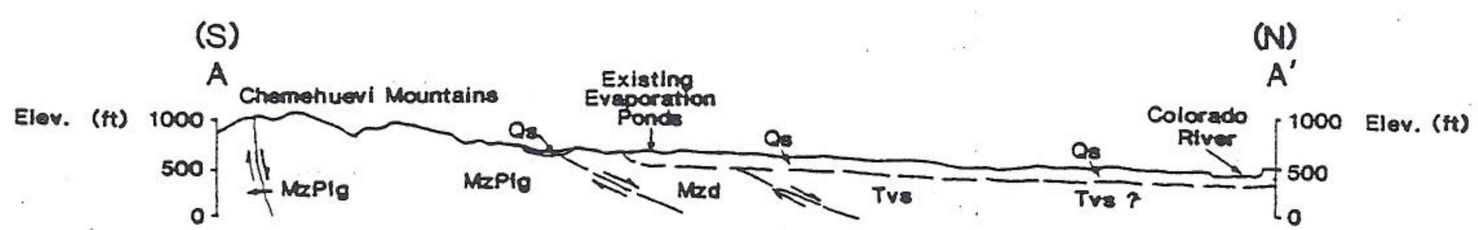


FIGURE 4–2

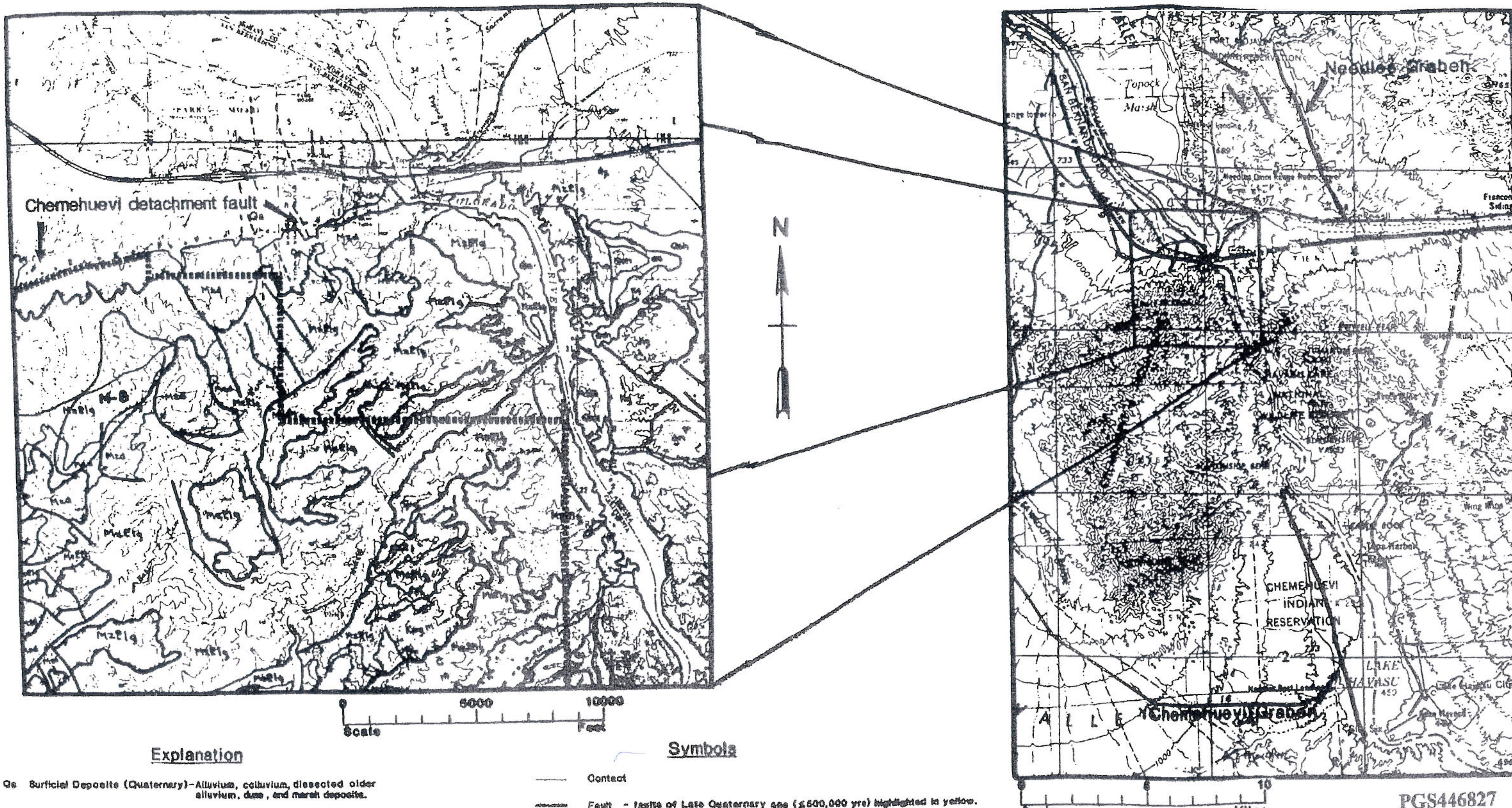
AREA GEOLOGY MAP

BAT CAVE WASH PROJECT
PACIFIC GAS AND ELECTRIC COMPANY
TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

PROJECT NO. 10–320

ALISTO ENGINEERING GROUP
WALNUT CREEK, CALIFORNIA

SOURCE: ALPHA GEOTECHNICAL CONSULTANTS, INC., APRIL 1986, FIGURE 3



Explanation

- Qs Surficial Deposits (Quaternary)–Alluvium, colluvium, dissected older alluvium, dune, and marsh deposits.
- Qch Chemehuevi formation (Pleistocene ?)–Sand, silt, clay, and river gravel (pebbles, cobbles, and boulders)
- Tvs Volcanic and Sedimentary Deposits(Miocene and Oligocene ?)–Flows and flow breccia, ash-flow tuff, sedimentary volcaniclastic breccia, fanglomerate, sandstone, and siltstone.
- Kg Granite(Cretaceous)–Monzogranite to granodiorite.
- Mzd Foliated Plutonic Rocks (Mesozoic) – Metadiorite
- MzPig Layered Gneiss and Migmatite (Mesozoic? and Proterozoic?).

Symbols

- Contact
- Fault – faults of Late Quaternary age (≤500,000 yrs) highlighted in yellow. No faults of Holocene age shown on Nakata, et al. (1982).
- Low-Angle Normal Fault (Detachment)–Dashed where approximate, dotted where concealed, and hachures on upper plate (etc.).
- Photolineament

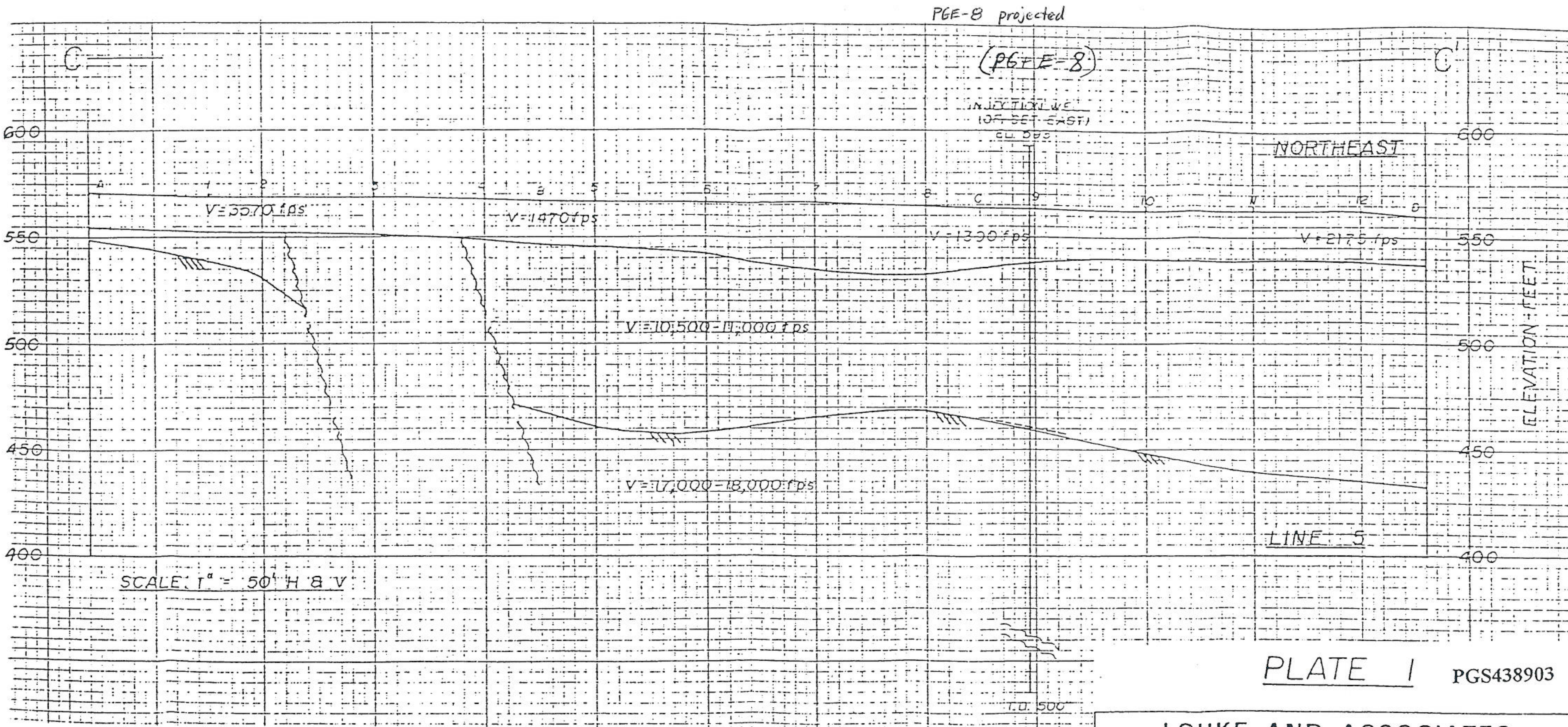
From: Alpha Geotechnical Consultants Inc. (1986)

PGS446827

Regional Fault & Photolineament Map

SCALE: as shown	APPROVED BY:	DRAWN BY DSK
DATE: 3/86		REVISED

Proposed Evaporation Pond Sites
Topock Compressor Station
San Bernardino County, California



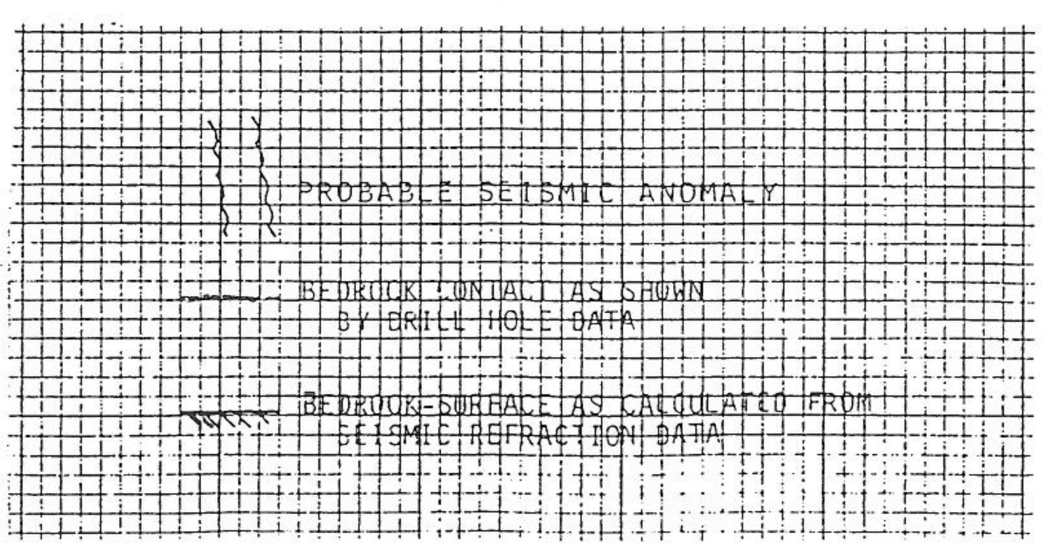


PLATE 1 PGS438903

LOUKE AND ASSOCIATES

GEOLOGY AND GEOPHYSICS

SEISMIC SECTIONS
LINES 1 THROUGH 5
TOPOCK COMPRESSOR STATION
EVAPORATION PONDS
SAN BERNARDINO, CALIFORNIA

FILE NO: 8510 DATE: December 1985

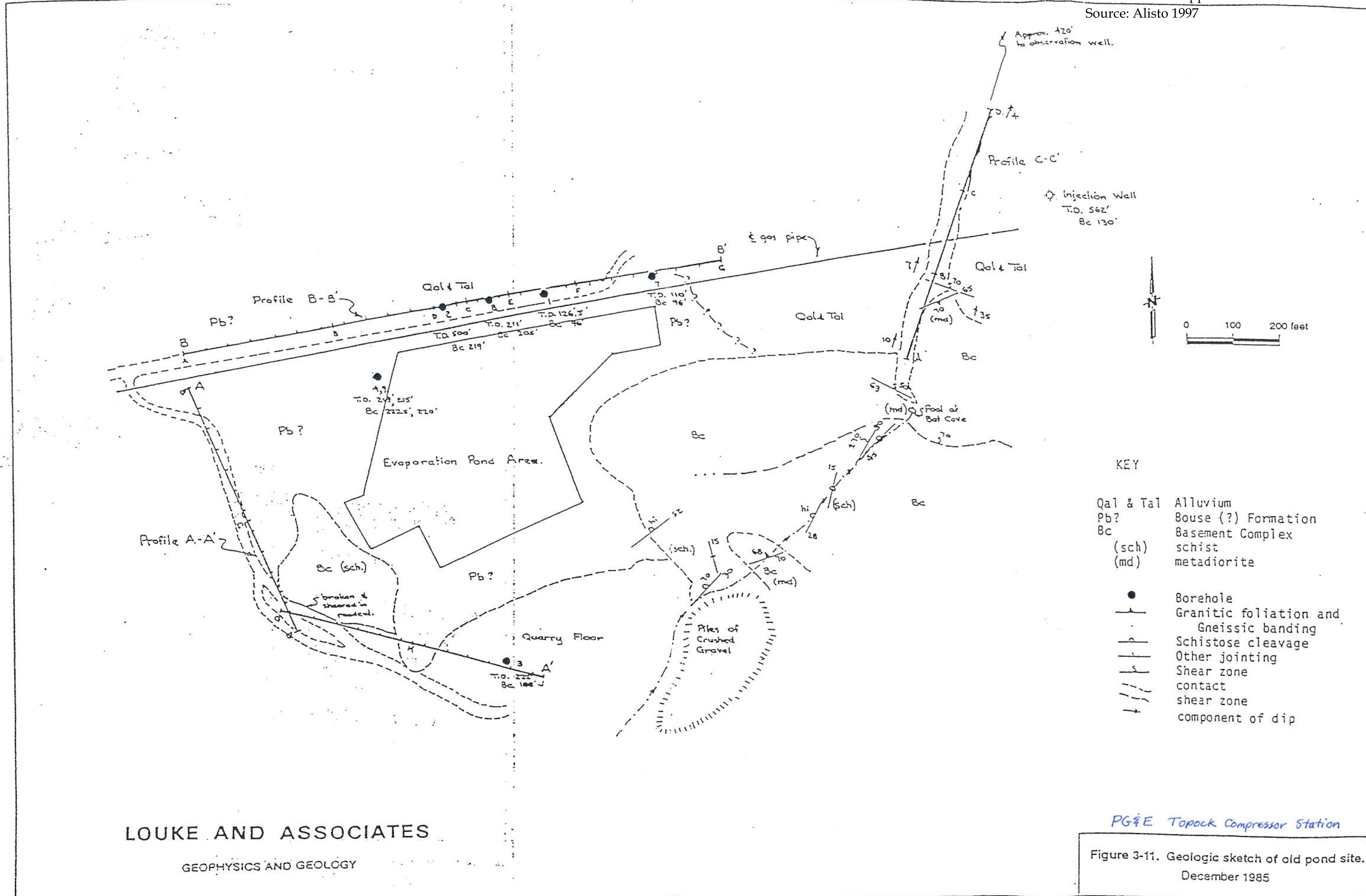


Figure 3-11. Geologic sketch of old pond site.
December 1985

John, B. E., and Foster, D. A., 1993, Structural and thermal constraints on the initiation angle of detachment faulting in the southern Basin and Range: The Chemehuevi Mountains case study: Geological Society of America Bulletin, v. 105, p. 1091–1108.

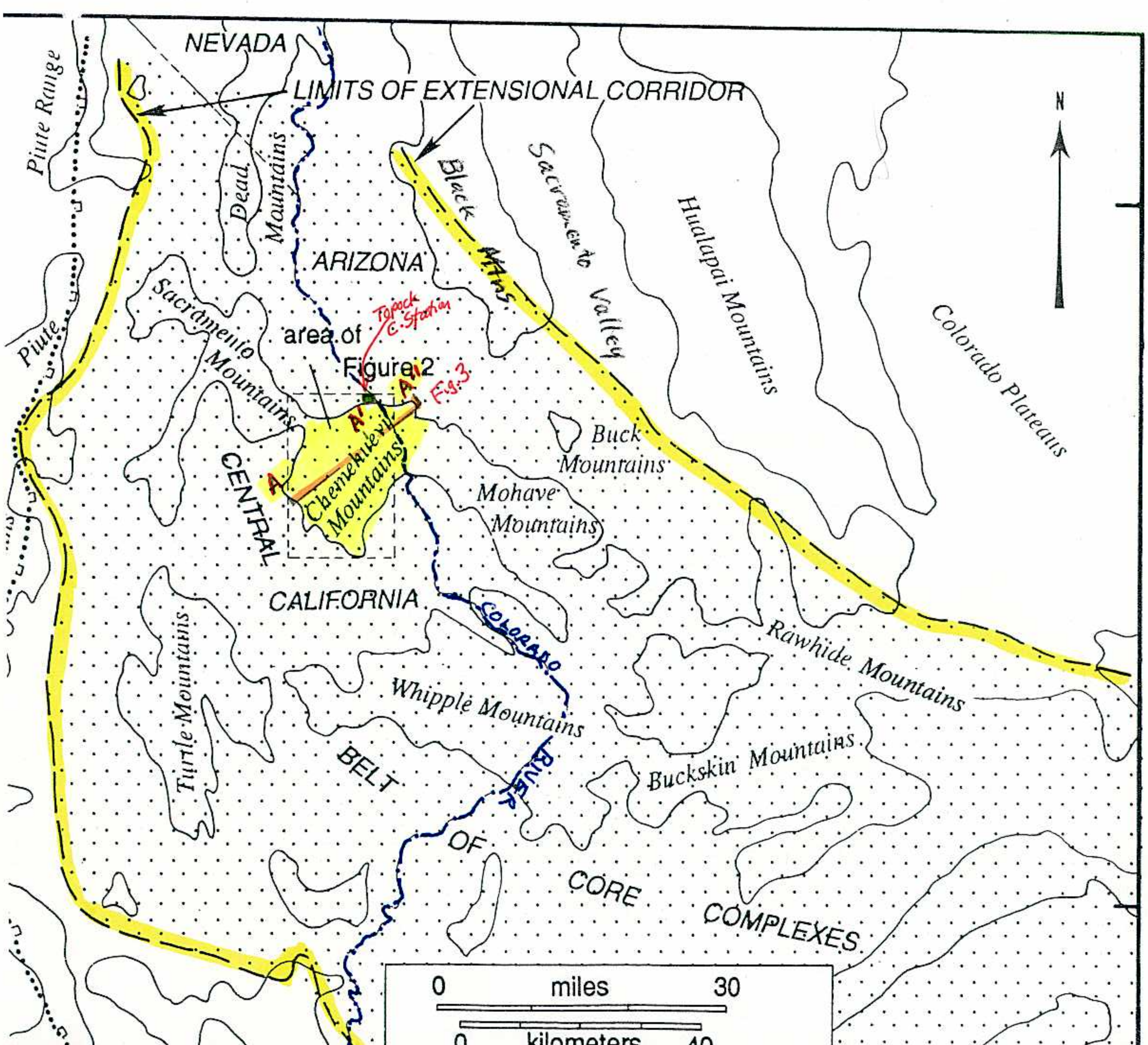


FIGURE 1

Map of the Colorado River extensional corridor, southeastern California, western Arizona, and southern Nevada (Howard and
Heavy dashed lines indicate the limit of the extensional corridor at the present level of exposure. Dotted line with boxes indicates the breakaway region of the Tertiary fault system before erosion. Alluviated basins intervene between the named mountain ranges.

SW - NE Structure Section Across Chemehuevi Mtns. (see Fig. 1 for location)

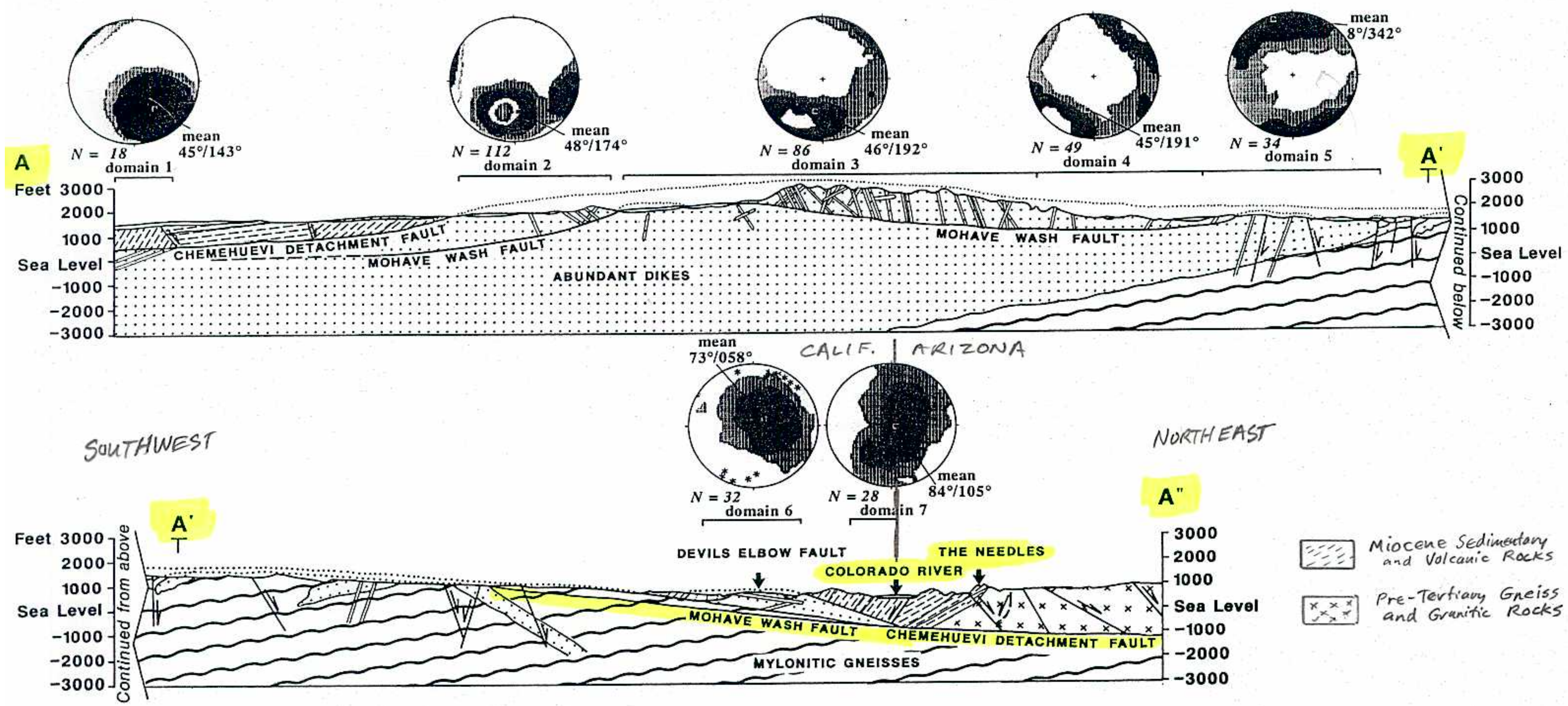
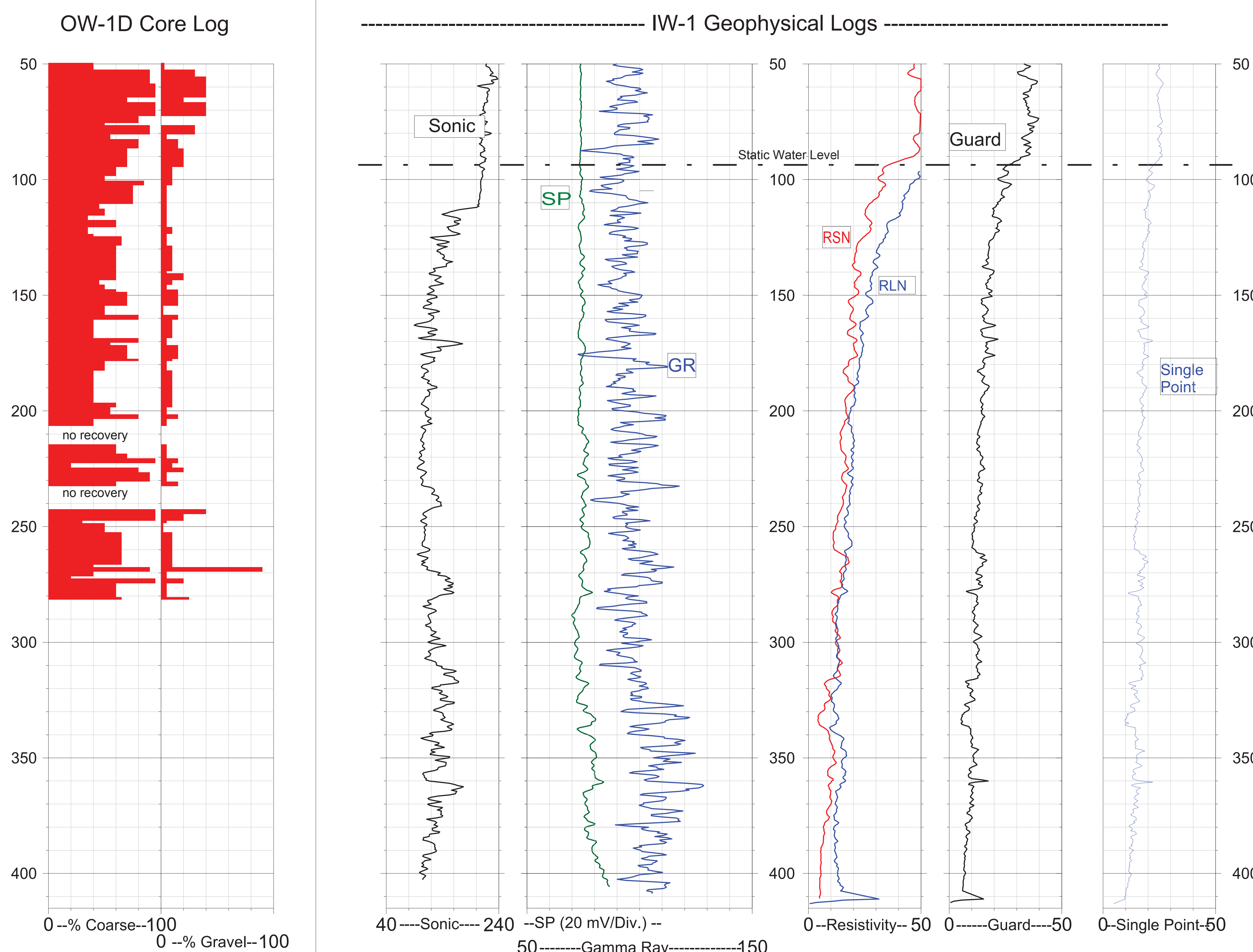


Figure 3. Cross section across the Chemehuevi Mountains drawn in the direction of slip along the three detachment faults. Section indicates the geometry of the three faults and syntectonic dike orientations. Contoured equal-area plots of poles to measured dikes within each of the five domains in the footwall to the Chemehuevi detachment fault. In domains 6 and 7, the dikes crop out in the east-central Chemehuevi Mountains, structurally above the Chemehuevi detachment fault. Stars indicate the poles to Middle Proterozoic diabase sheets in the same structural position above the Chemehuevi detachment fault. Contouring based on the method of Kamb (1959), as used in the program by Allmendinger (1989). Fields of point density in 2σ intervals, with the mean for each domain shown. Patterns shown are the same as in Figure 2.

from John & Foster (1993)

Appendix C
Geophysical Logging and Seismic Investigation Data

C1 Geophysical Logs for Test, Extraction and Injection Wells



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole adjacent to IW location. Core log depths adjusted to match ground surface datum for IW logs.

Pilot Boring Geophysical Log November 19, 2004

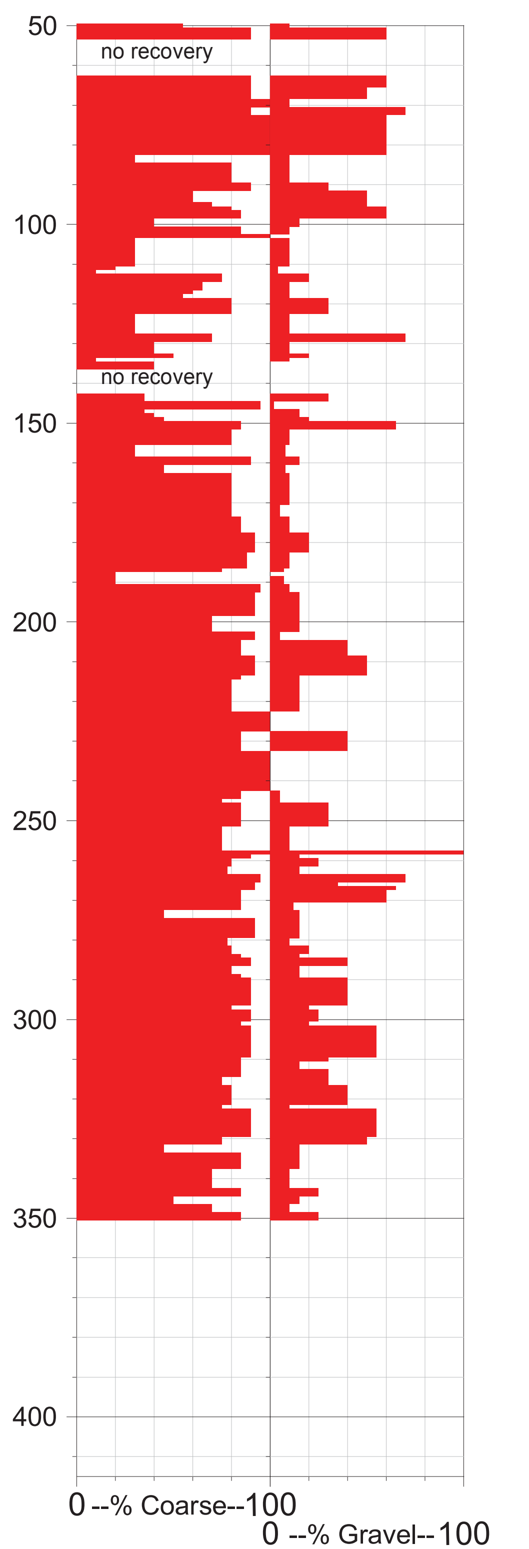
Log Units:
Sonic (μsecs/ft), SP (mV/div.), Gamma Ray (API units), Resistivity (RLN = 64" Normal (ohm/m), RSN = 16" Normal (ohm/m))
Guard (ohm/m), Single point resistivity (ohms))

APPENDIX C-1A
SUMMARY OF HYDROGEOLOGIC LOGGING AND TESTING FOR BORING IW-1V

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

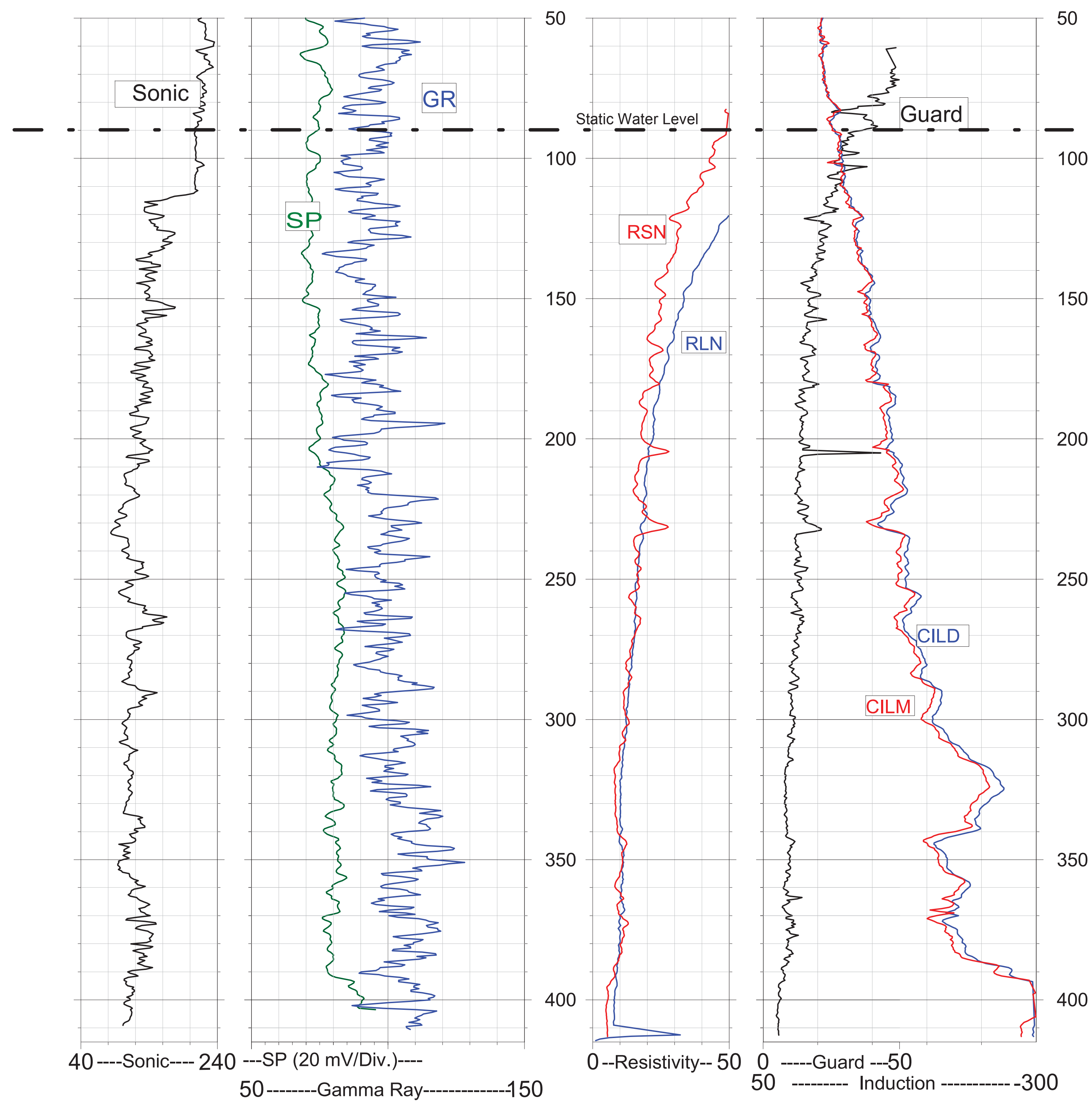
CH2MHILL

OW-2D Core Log



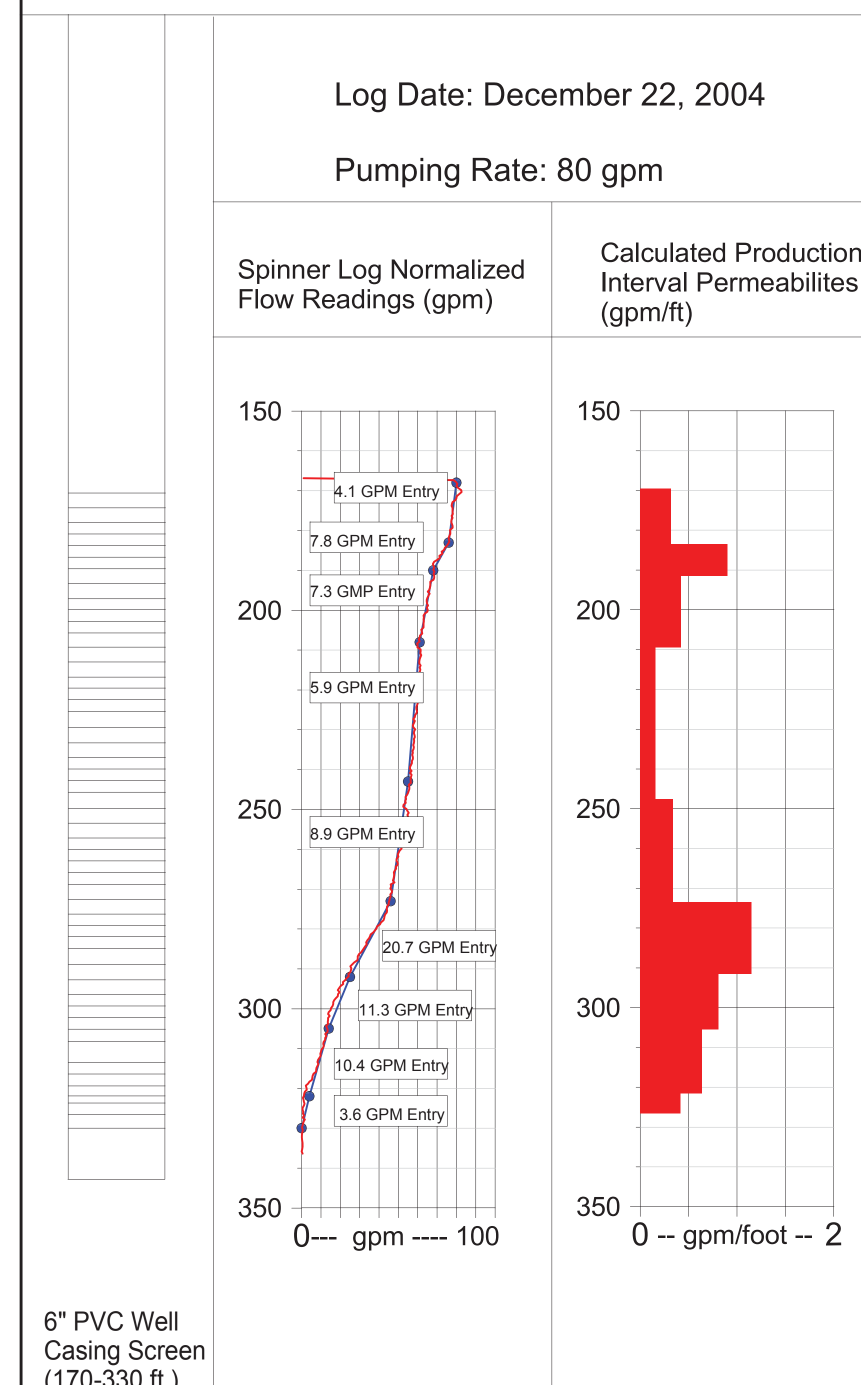
Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole adjacent to IW location. Core log depths adjusted to match ground surface datum for IW logs.

--- IW-2 Geophysical Logs ---



Pilot Boring Geophysical Log Complete December 6, 2004
Log Units:
Sonic (μsecs/ft), SP (mV/div.), Gamma Ray (API units),
Resistivity (RLN = 64" Normal (ohm/m), RSN = 16" Normal (ohm/m))
Guard (ohm/m), Induction (μS/m)

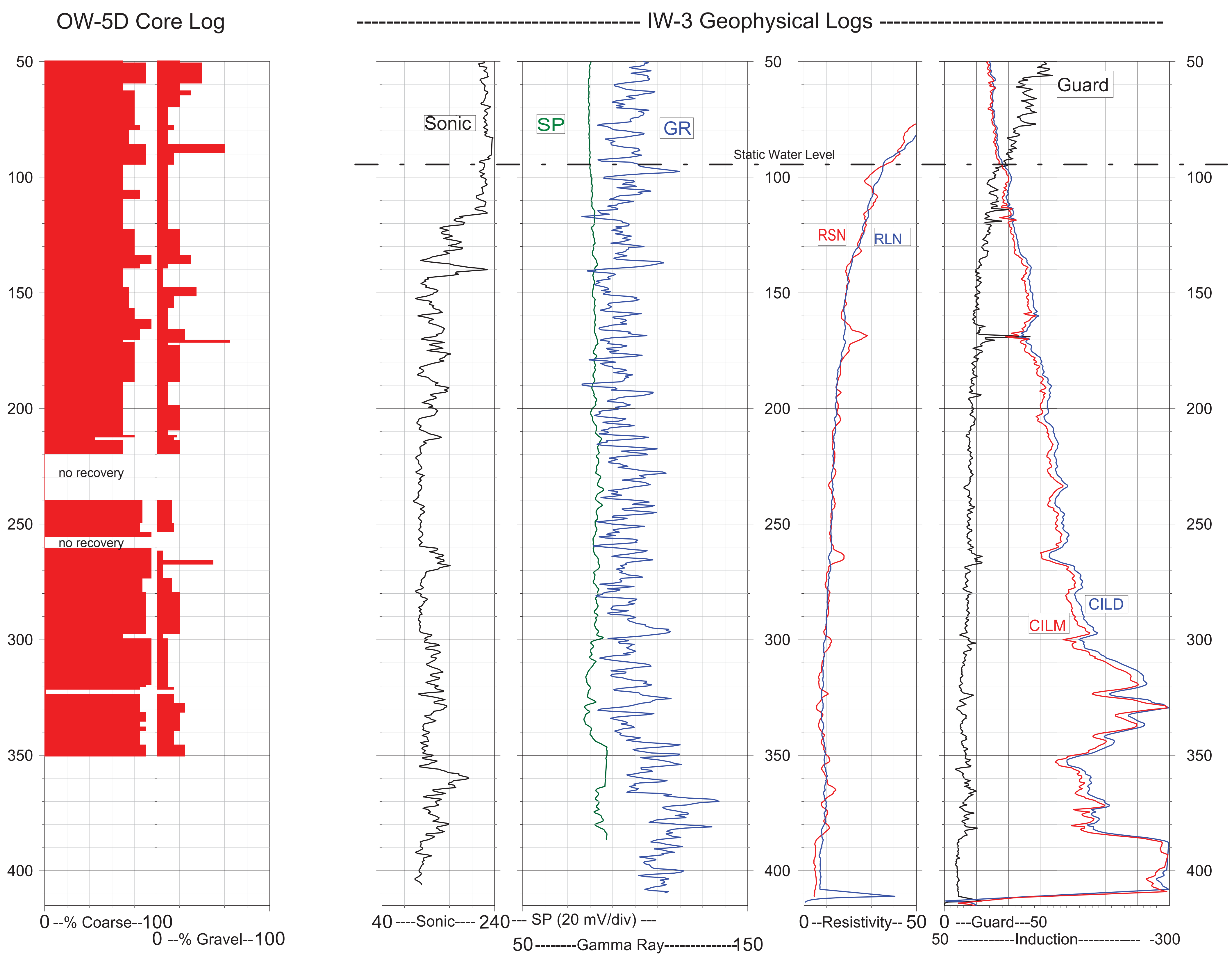
---- Well IW-2 Production Spinner Log ----



APPENDIX C-1B
SUMMARY OF HYDROGEOLOGIC LOGGING AND TESTING FOR BORING IW-2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

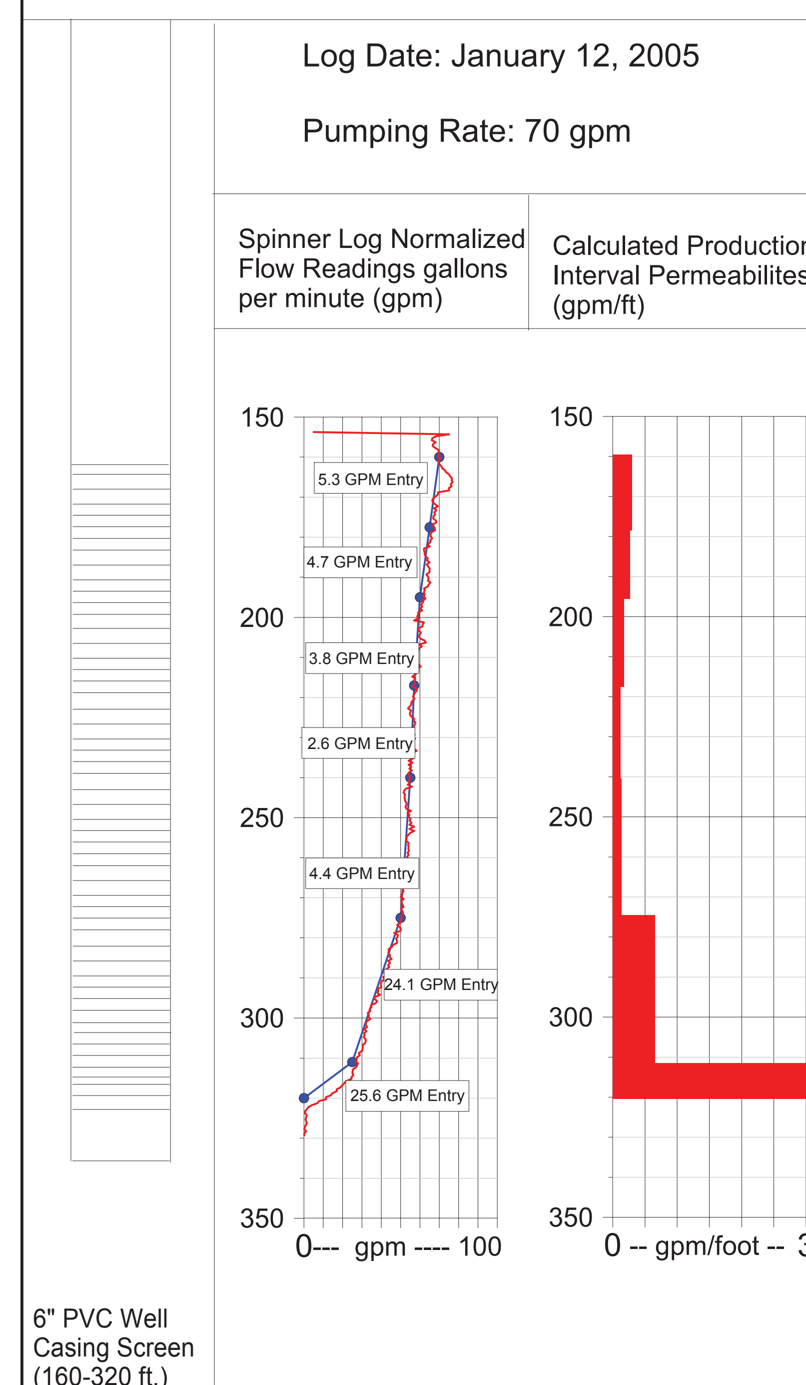


Plot shows percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole adjacent to IW location. Core log depths adjusted to match ground surface datum for IW logs.

Pilot Boring Geophysical Log November 19, 2004

Log Units:
Sonic (μsecs/ft), SP (mV/div.), Gamma Ray (API units), Resistivity (RLN = 64" Normal (ohm/m), RSN = 16" Normal (ohm/m))
Guard (ohm/m), Induction (μS/m)

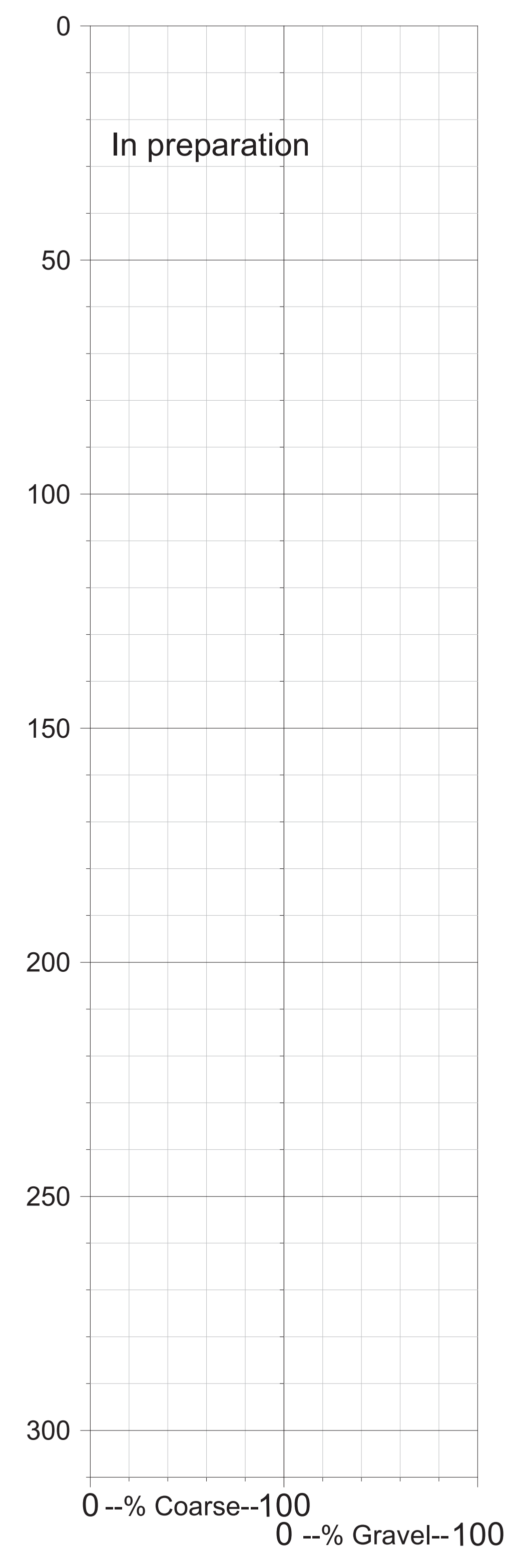
Well IW-3 Production Spinner Log



APPENDIX C-1C
SUMMARY OF HYDROGEOLOGIC LOGGING AND TESTING FOR BORING IW-3
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

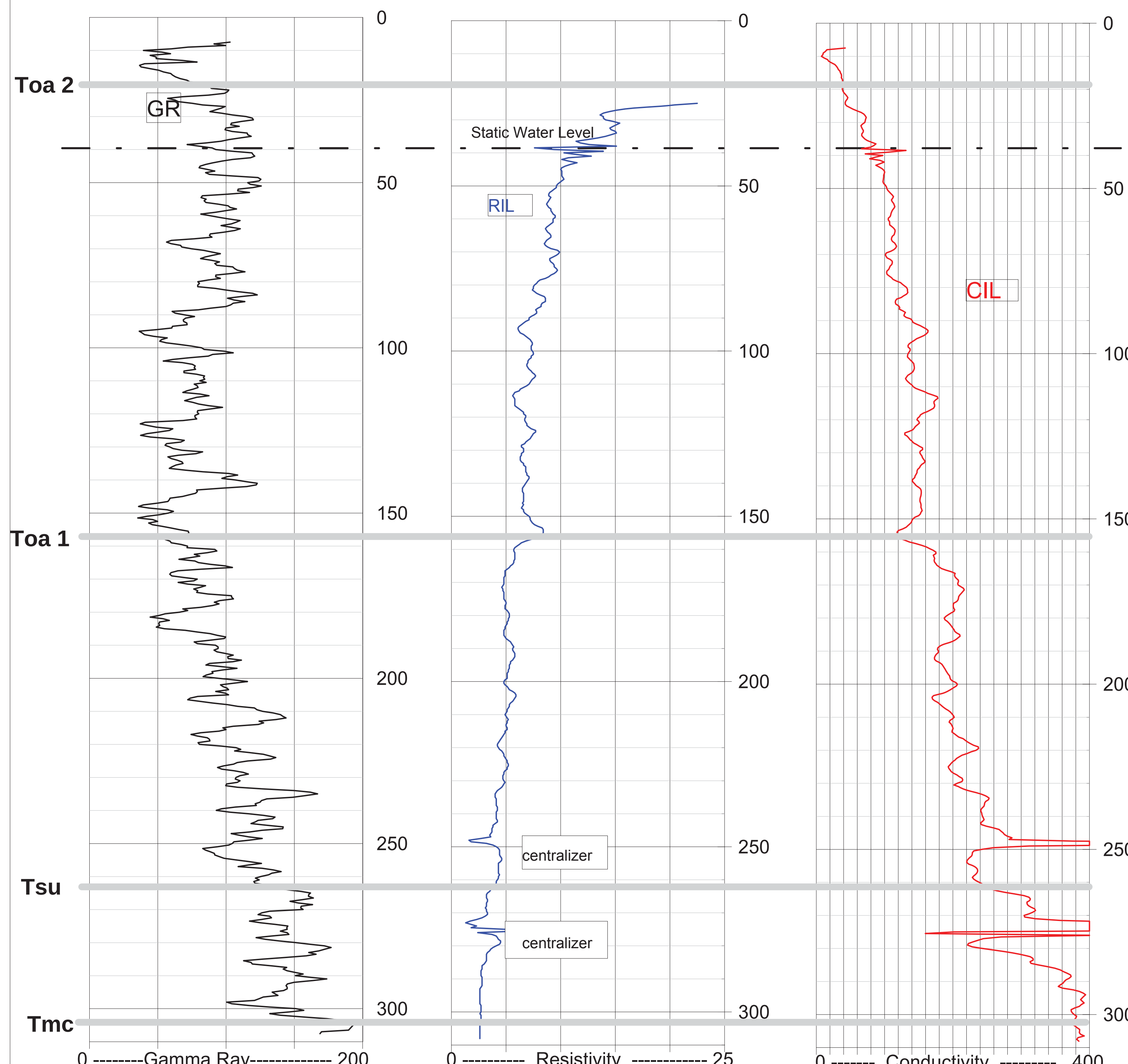
CH2MHILL

MW-41D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in MW-41D core.

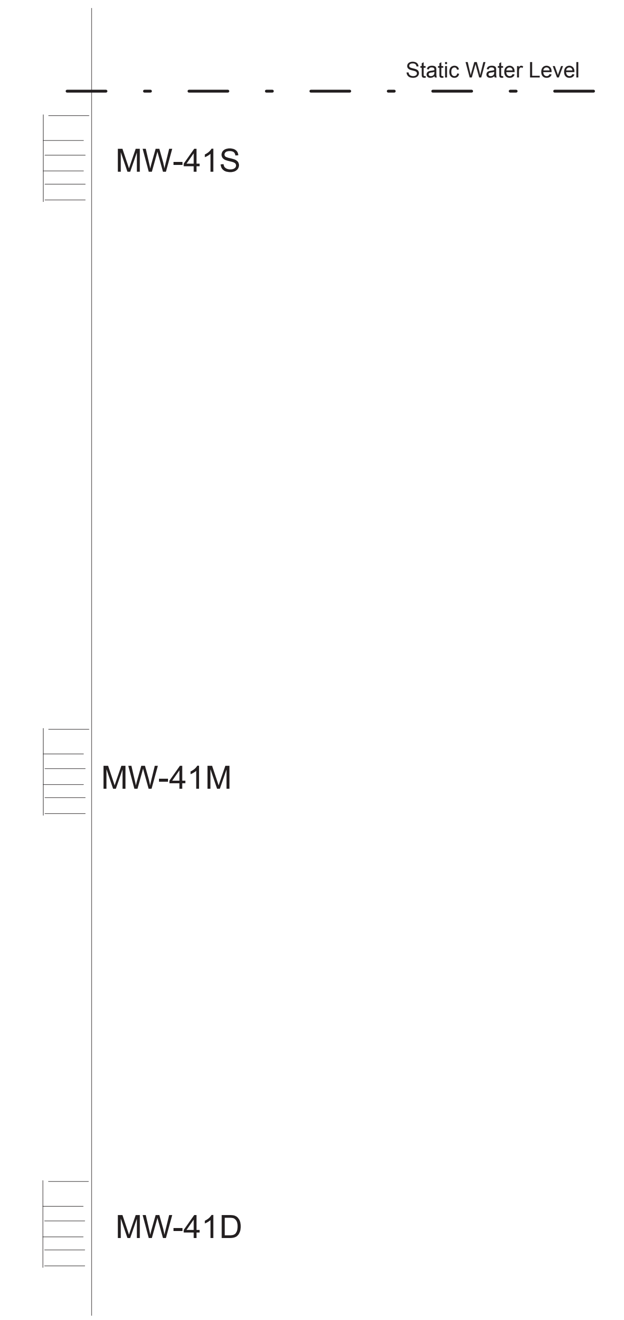
-- MW-41D Geophysical Logs --



Cased Well Geophysical Log November 5, 2004

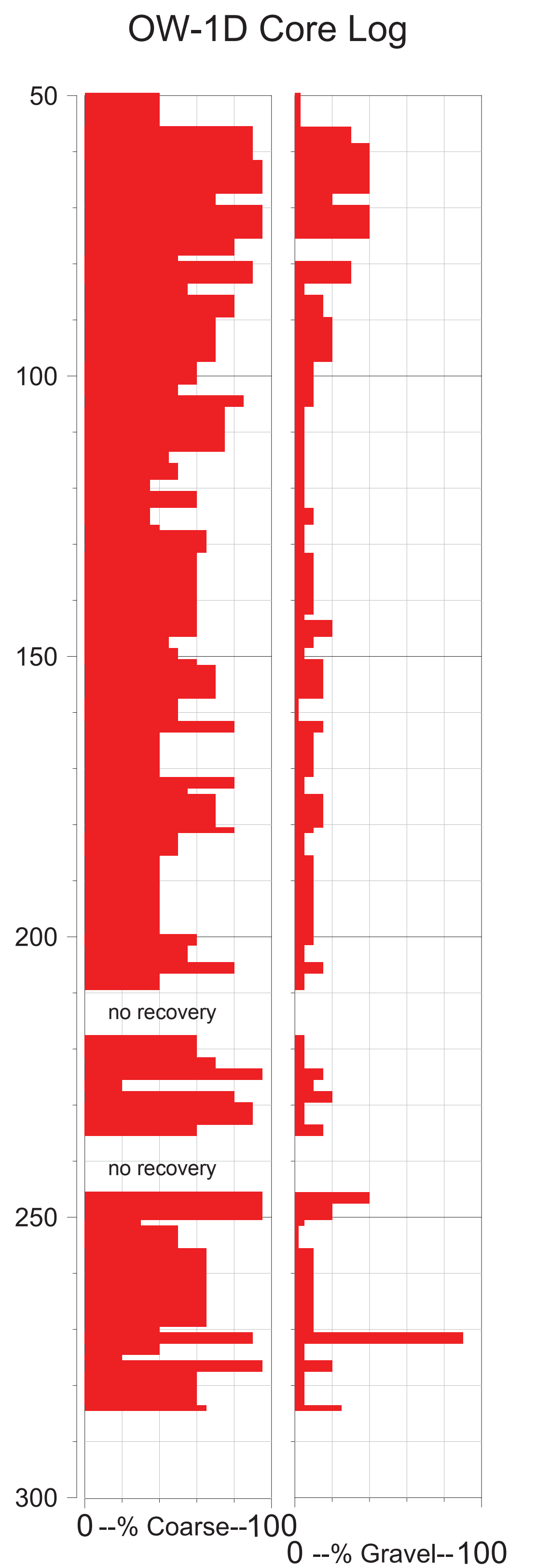
Log Units: Gamma Ray (API units), Induction Resistivity (ohm/m), Induction Conductivity (µS/cm)

MW-41 Well Cluster

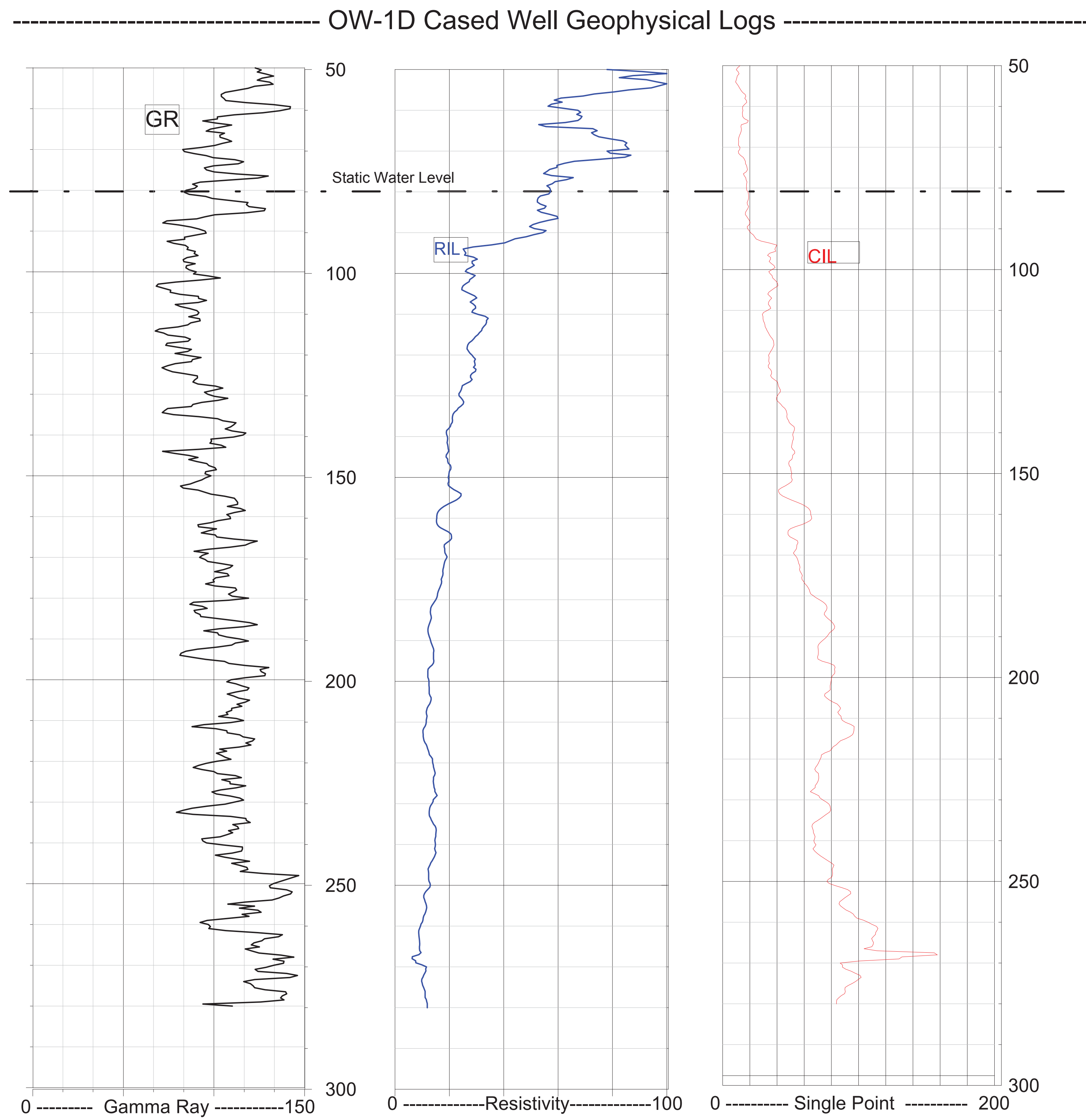


APPENDIX C-1D
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-41 WELL CLUSTER
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

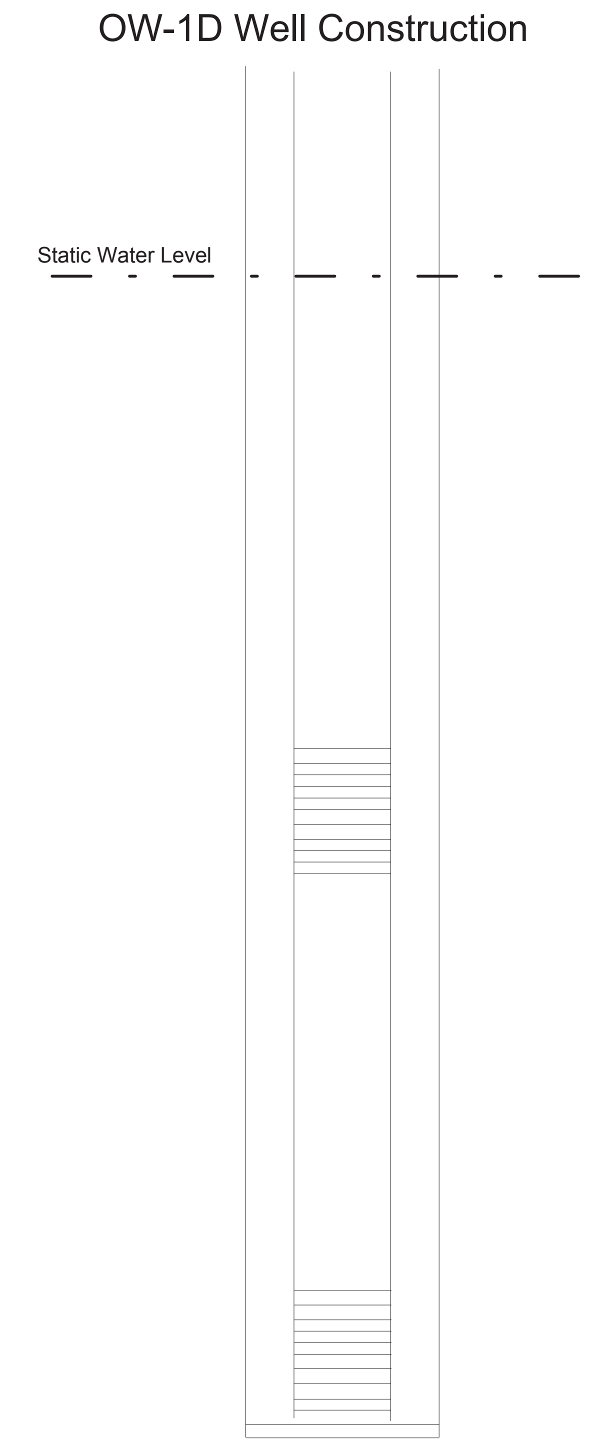


Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.



Pilot Boring Geophysical Log Complete November 10, 2004

Log Units: Gamma Ray (API units), Induction Resistivity (ohm/m), Induction Conductivity (single point resistivity (µS/cm))

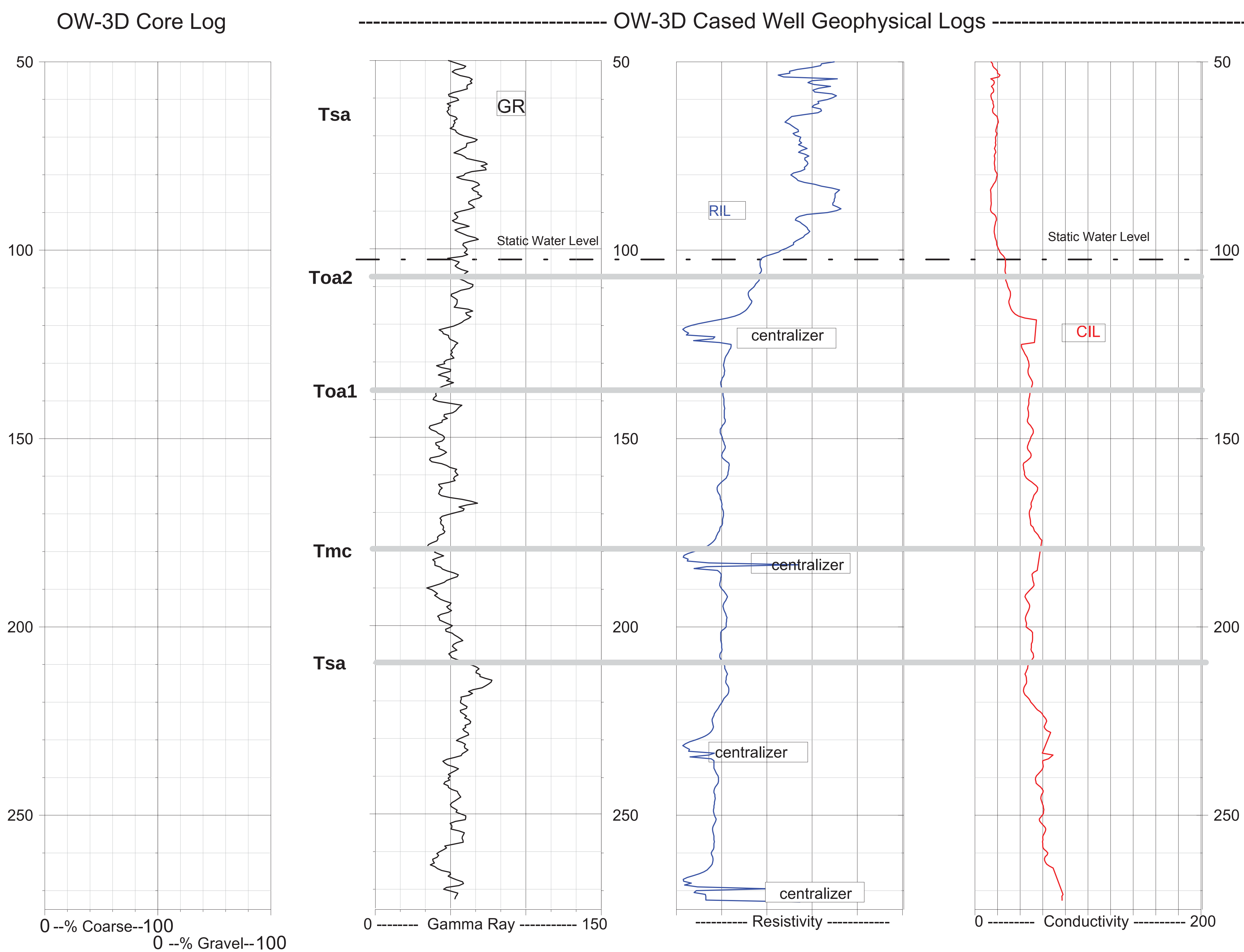


APPENDIX C-1E
SUMMARY OF HYDROGEOLOGIC LOGGING
OW-1 WELL CLUSTER

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Well Construction OW-3 Cluster



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

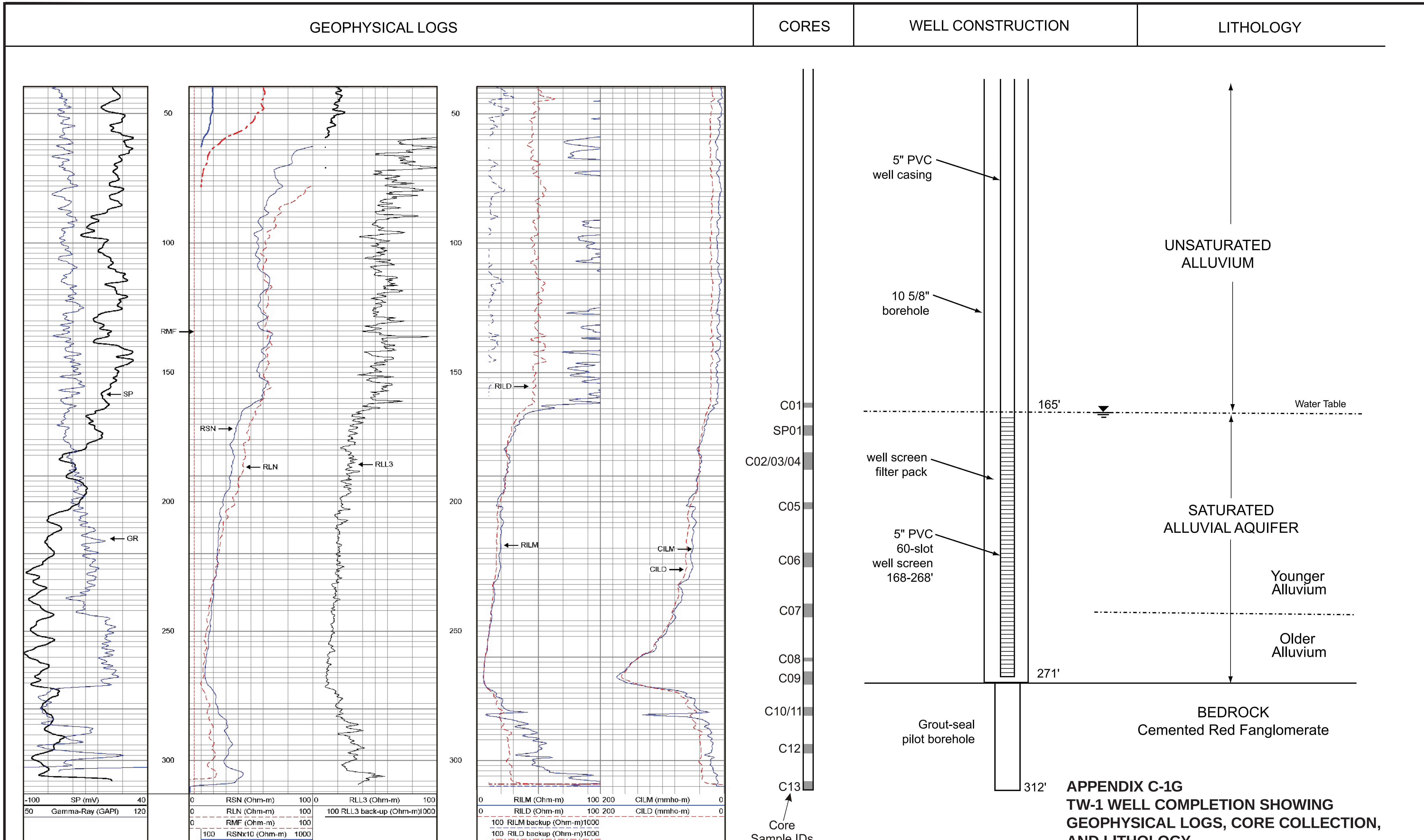
OW-3D Geophysical Log November 10, 2004

Log Units: Gamma Ray (API units), Induction Resistivity (ohm/m), Induction Conductivity (STET)

APPENDIX C-1F
SUMMARY OF HYDROGEOLOGIC LOGGING FOR OW-3D WELL

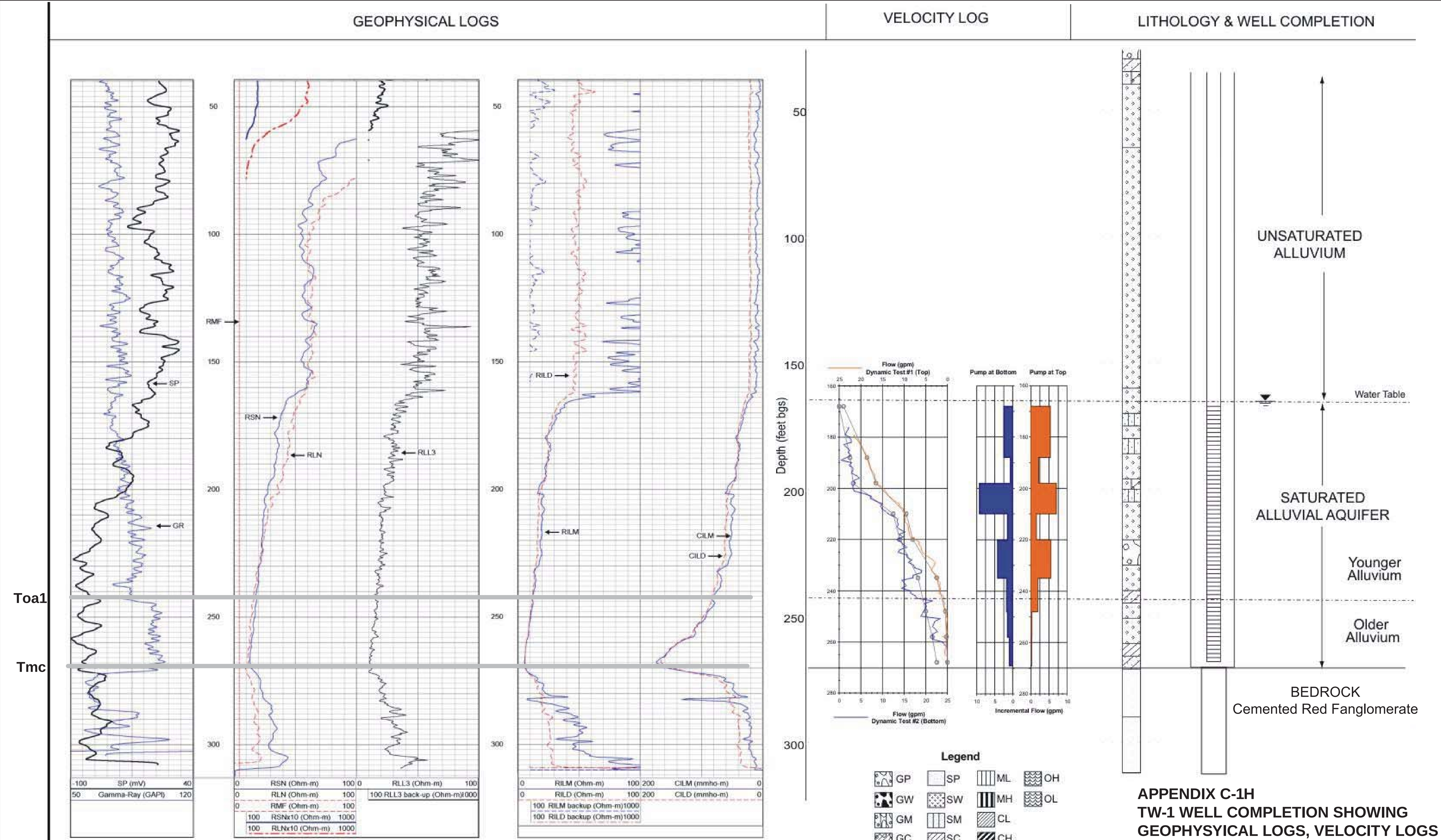
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX C-1G
TW-1 WELL COMPLETION SHOWING GEOPHYSICAL LOGS, CORE COLLECTION, AND LITHOLOGY
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

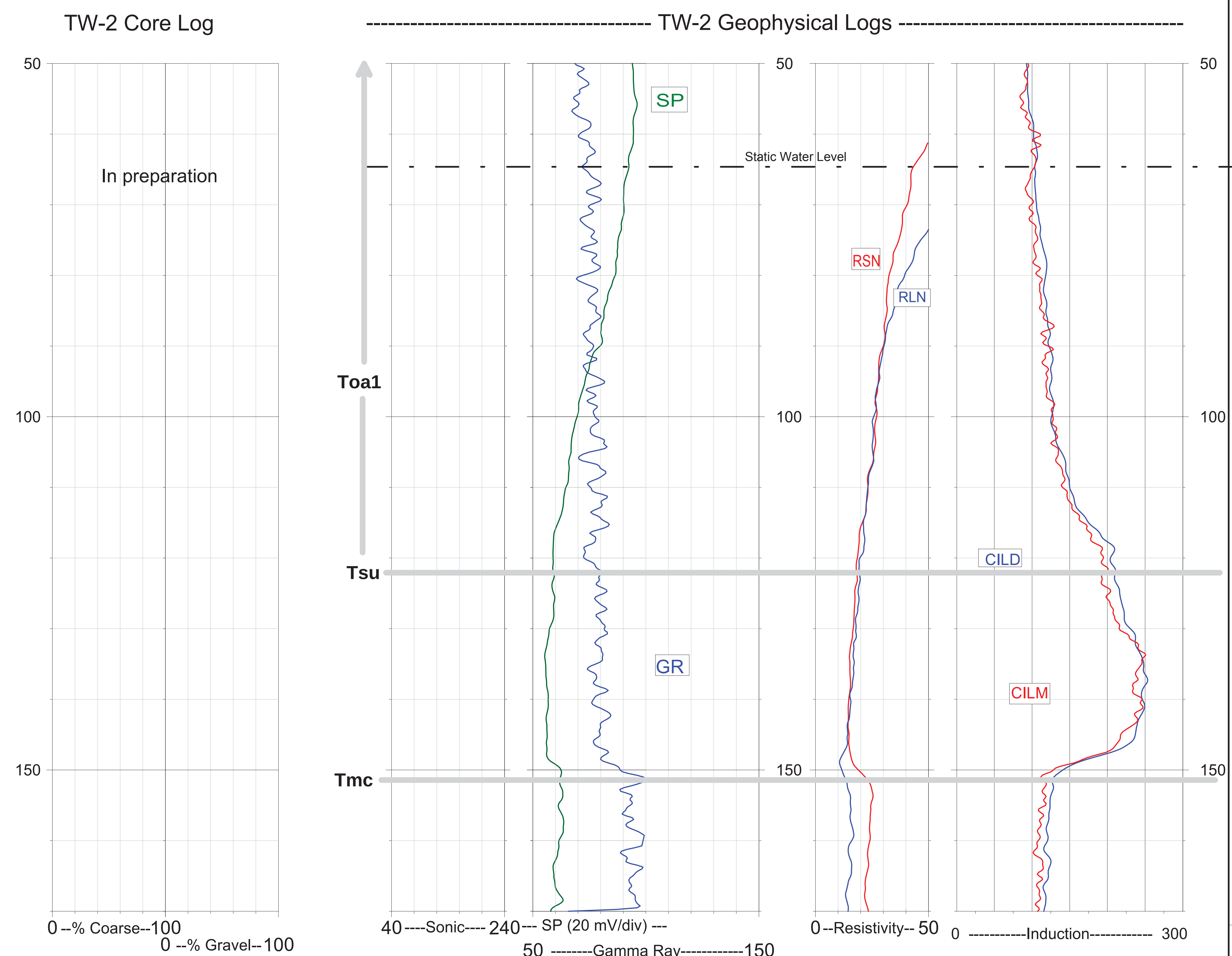


APPENDIX C-1H
TW-1 WELL COMPLETION SHOWING GEOPHYSICAL LOGS, VELOCITY LOGS AND LITHOLOGY

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

ES102007005BAO_Appendix_C_figures.indd_022708_lho



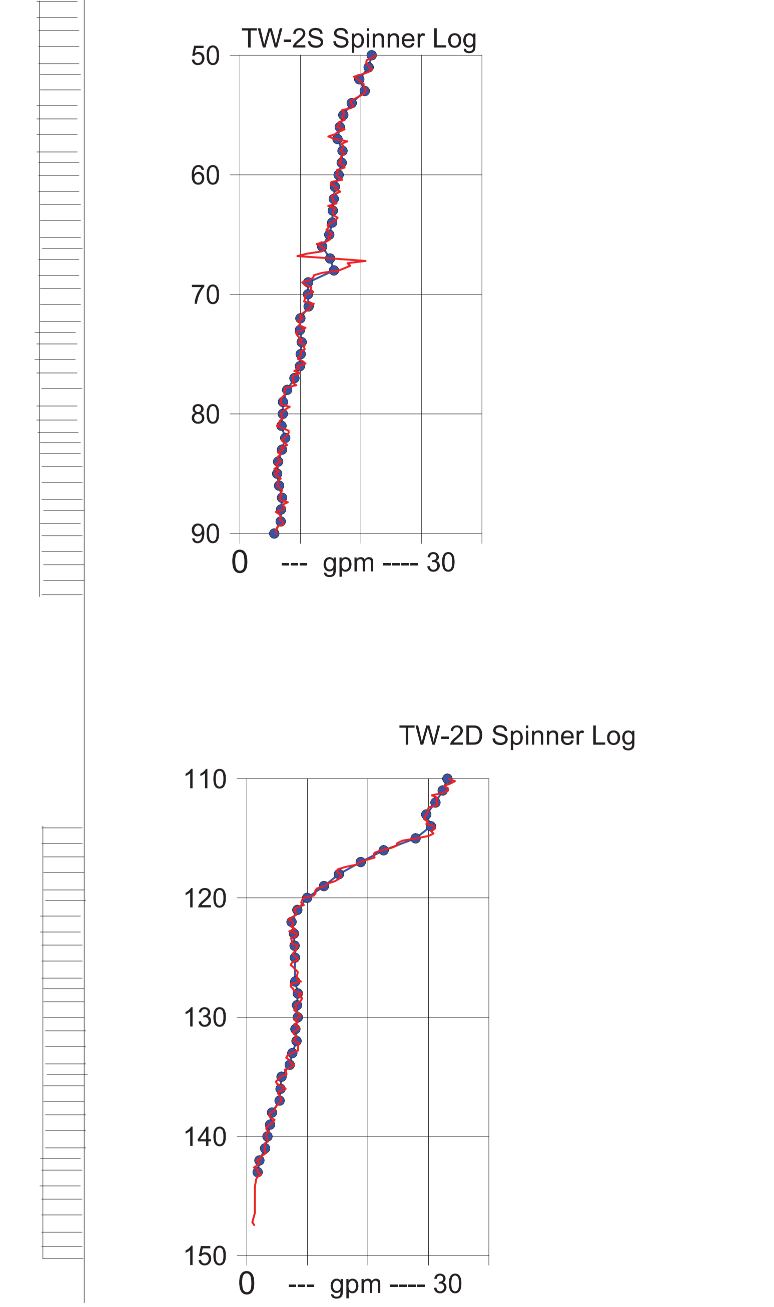
Plot shows percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole adjacent to IW location. Core log depths adjusted to match ground surface datum for IW logs.

Cased Well Geophysical Log April 1, 2004

Log Units:
Sonic (µsecs/ft), SP (mV/div.), Gamma Ray (API units), Resistivity (RLN = 64" Normal (ohm/m), RSN = 16" Normal (ohm/m)), Induction (µS/m)

Well TW-2 Production Spinner Log

Log Date: May 10, 2004

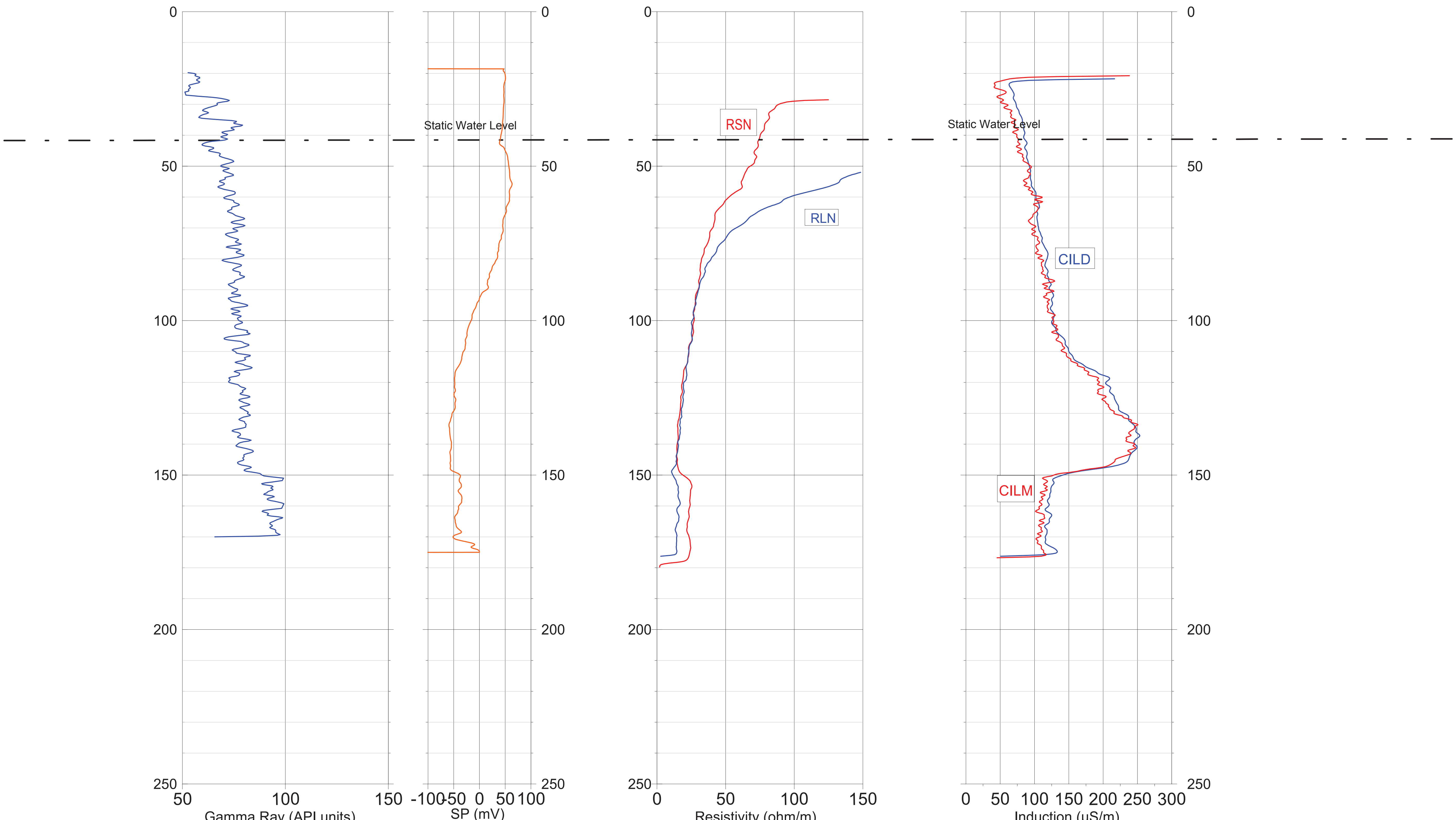


Spinner Logs Represent a combination of data from two Spinner tests. One in TW-2S and one in TW-2D

TW-2S (screen 42-93 ft bgs) pumped at 18 pgm, pump at about 50 feet bgs
TW-2D (screen 113-148 ft bgs) pumped at 33 gpm, pump at about 80 ft bgs

APPENDIX C-1I
SUMMARY OF HYDROGEOLOGIC LOGGING AND TESTING FOR WELL TW-2
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

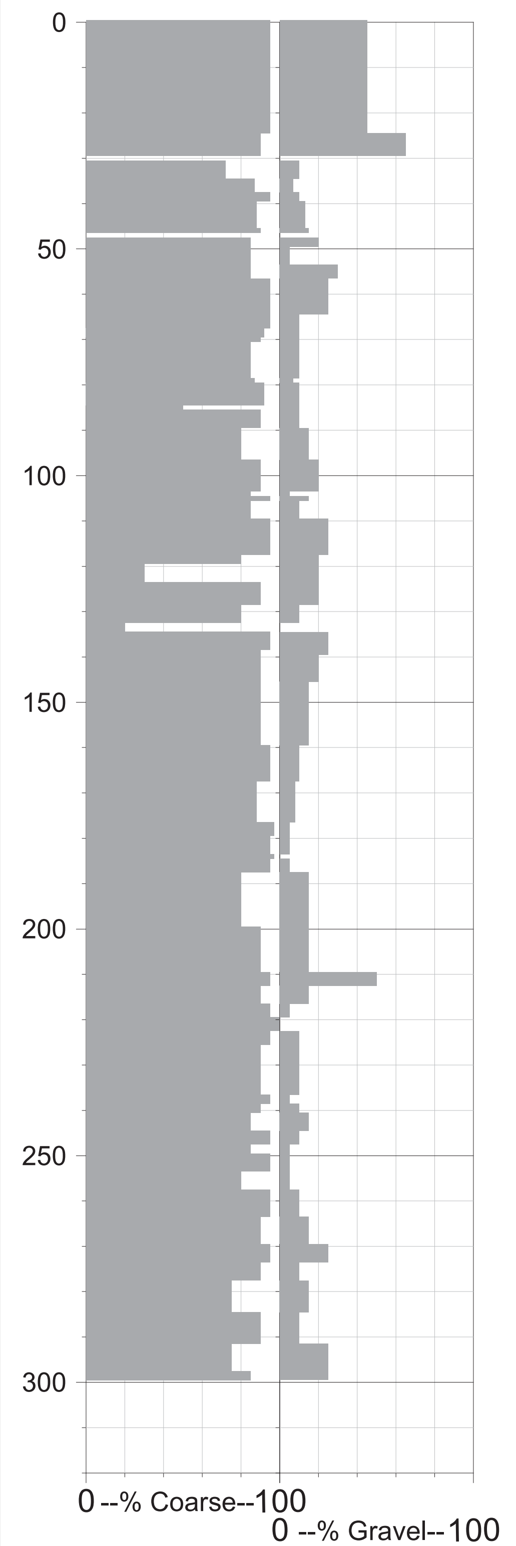


APPENDIX C-1J
TW-2 GEOPHYSICAL LOGS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

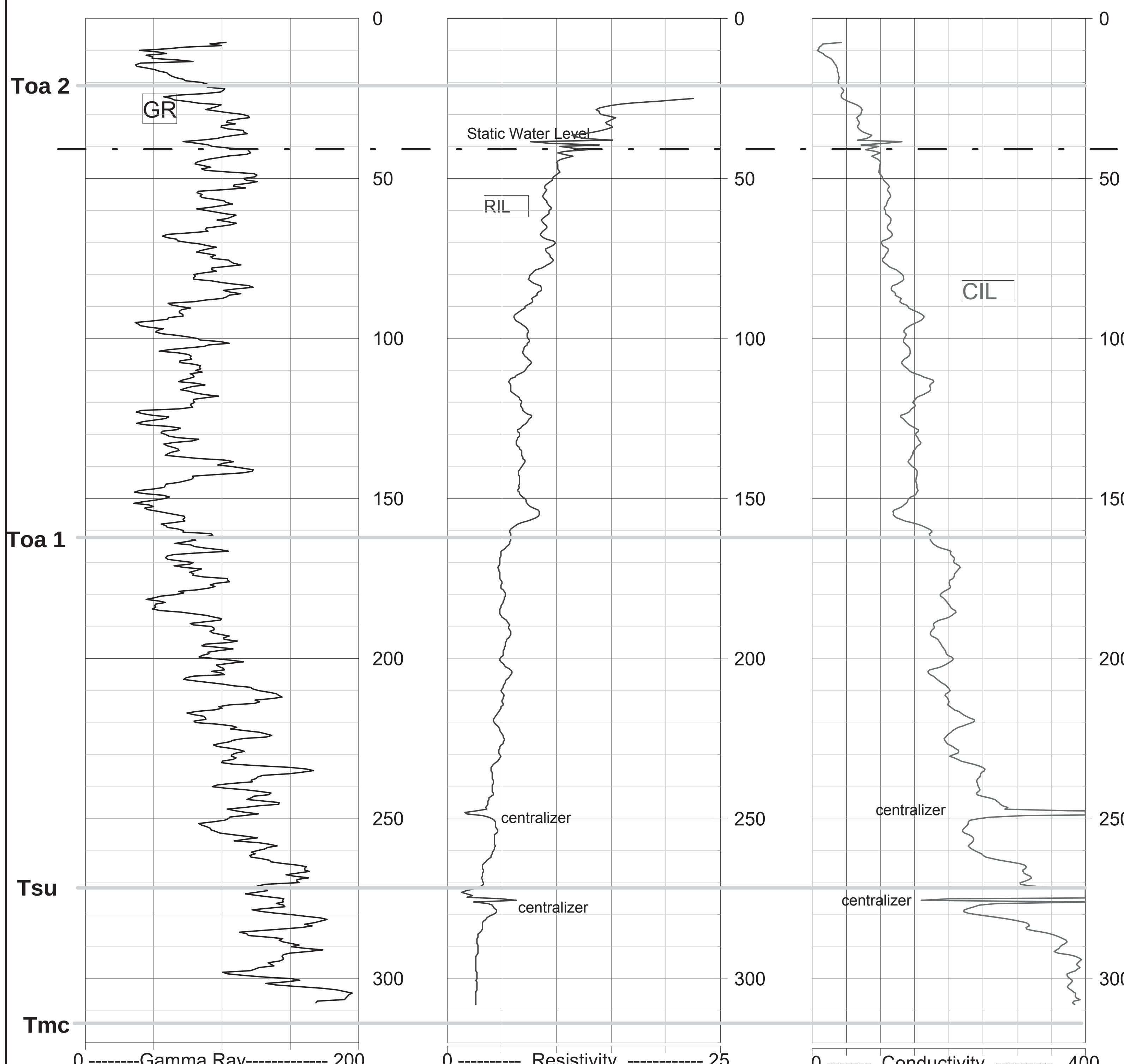
C2 Cased-Hole Geophysical Logs for Selected Monitoring Wells

MW-41D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in MW-41D core.

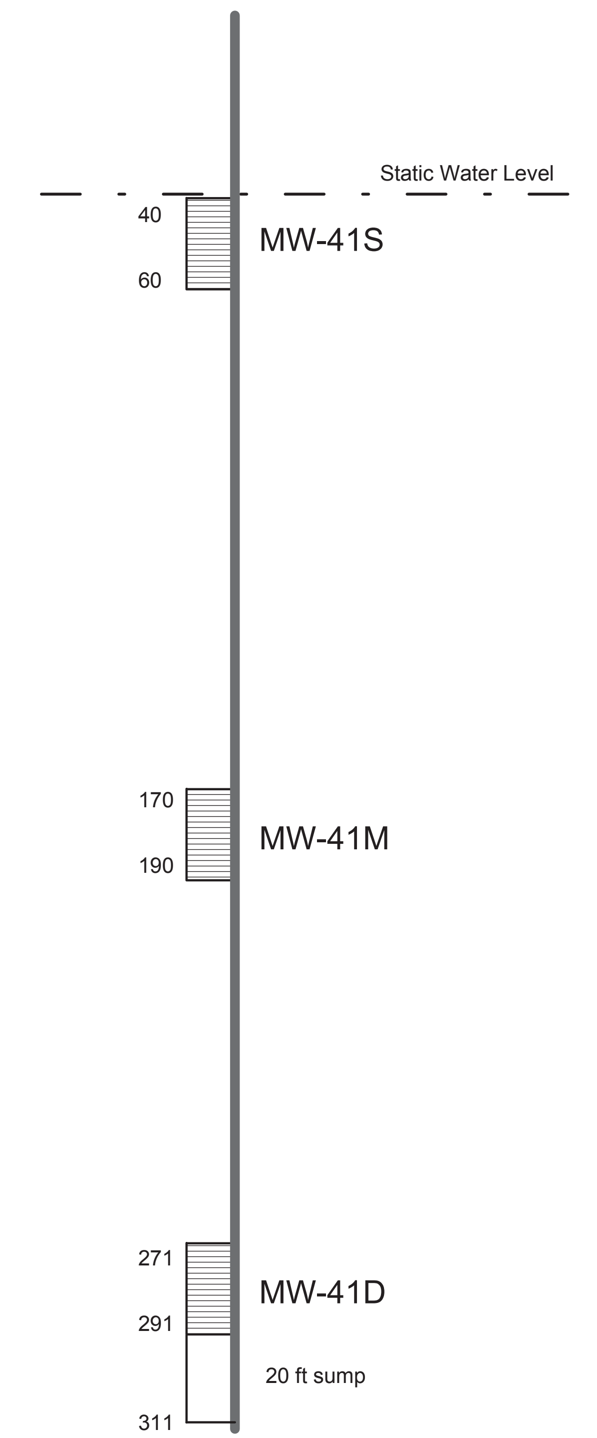
-------------------------- MW-41D Cased Well Geophysical Logs --------------------------



Cased Well Geophysical Log November 5, 2004

Log Units: Gamma Ray (API units), Induction Resistivity (ohm/m), Induction Conductivity (µS/cm)

Monitoring Well Cluster MW-41

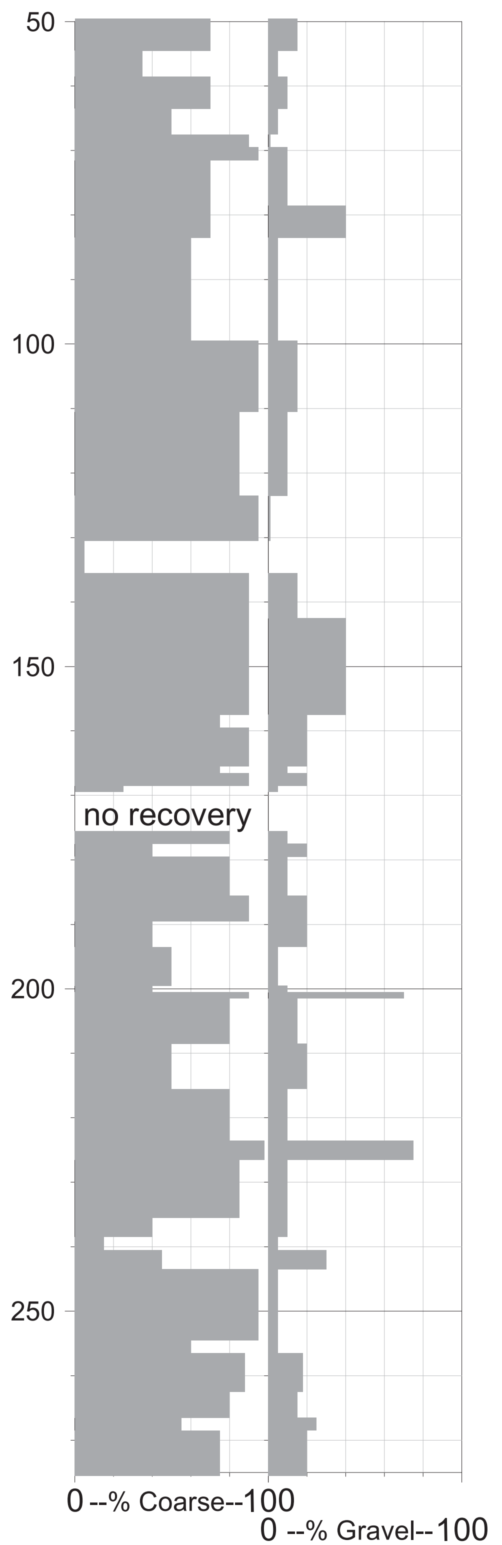


APPENDIX C-2A
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-41 WELL CLUSTER

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

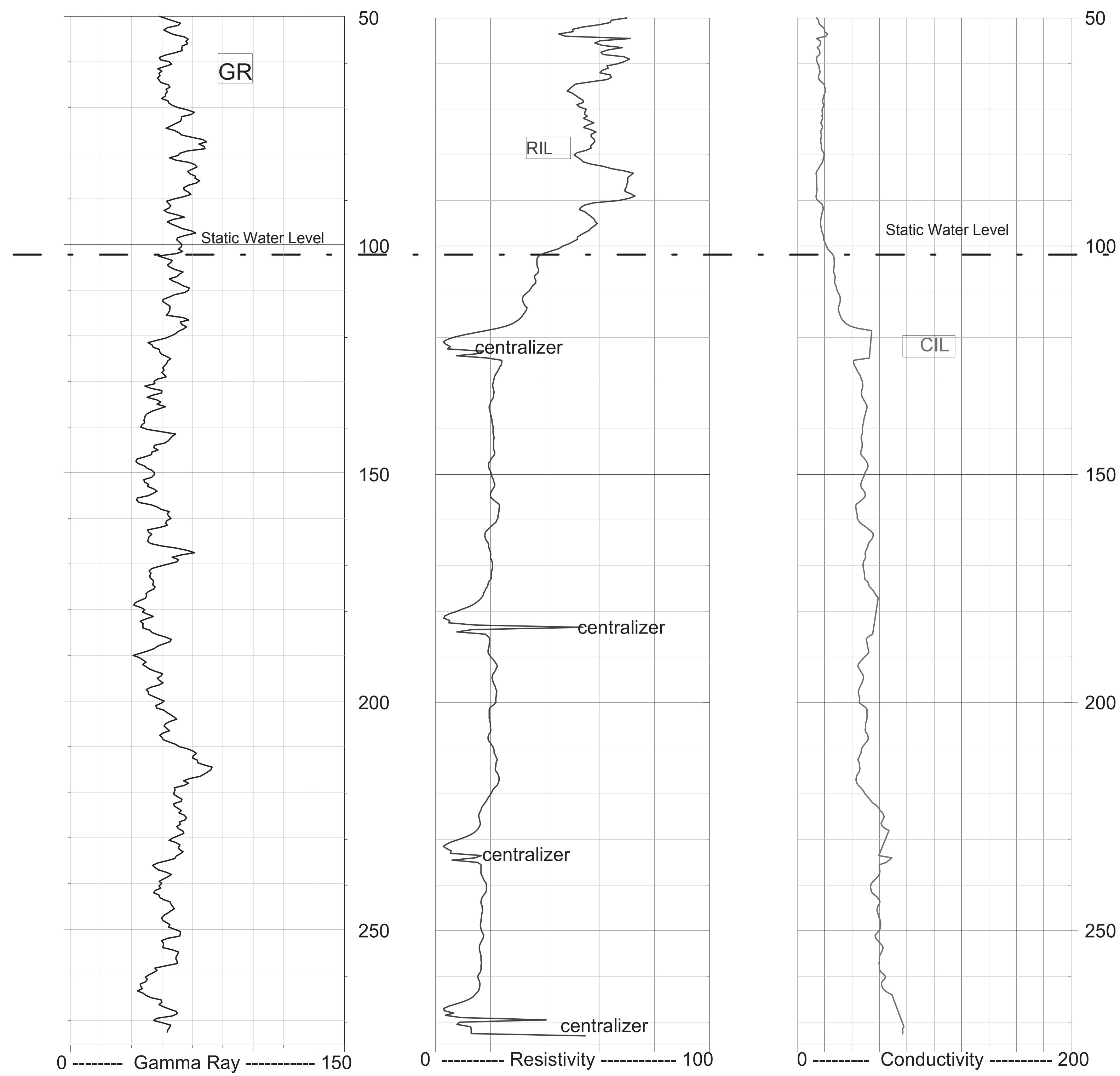
CH2MHILL

OW-3D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

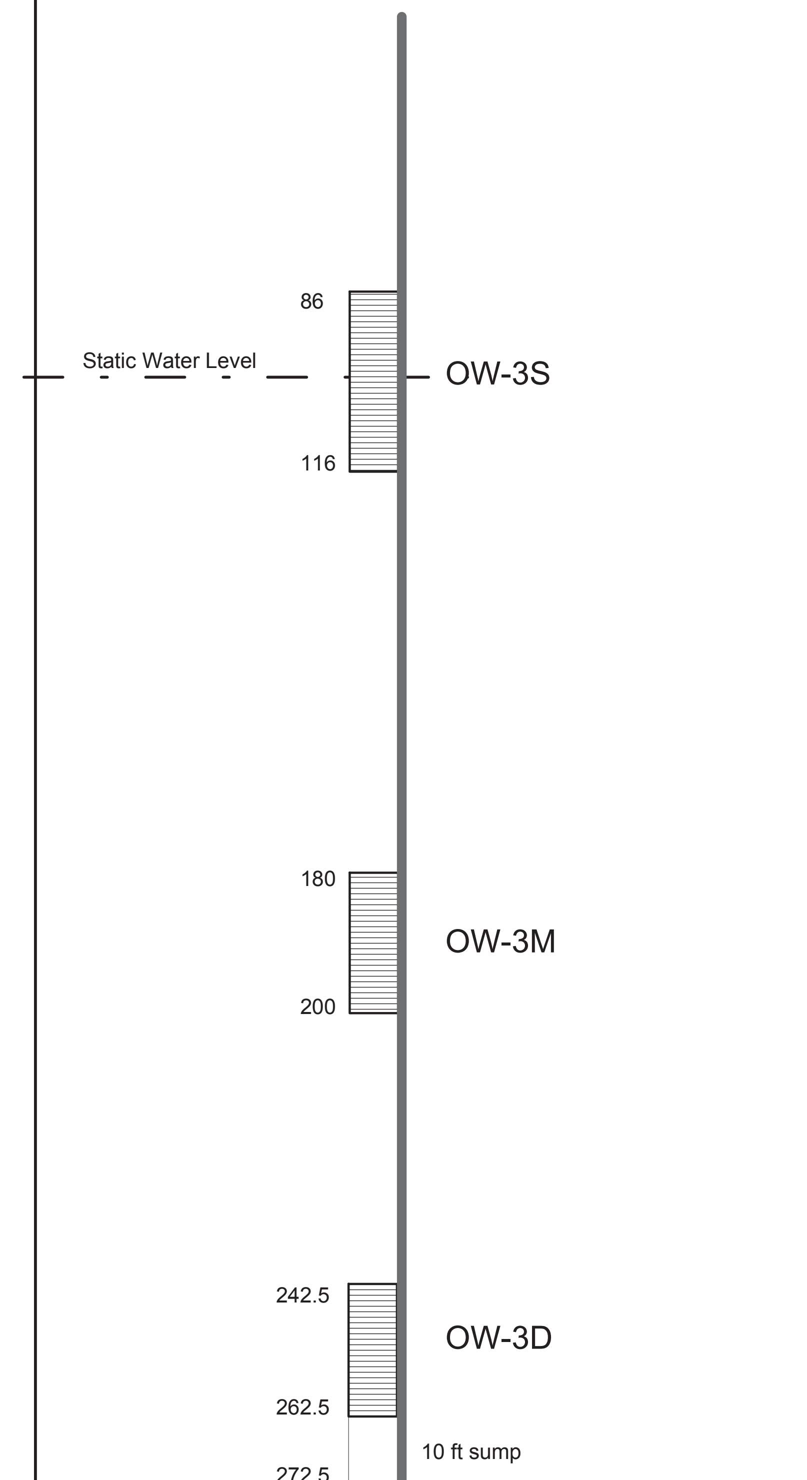
---------------------------------- OW-3D Cased Well Geophysical Logs ------------------------------------



OW-3D Geophysical Log November 10, 2004

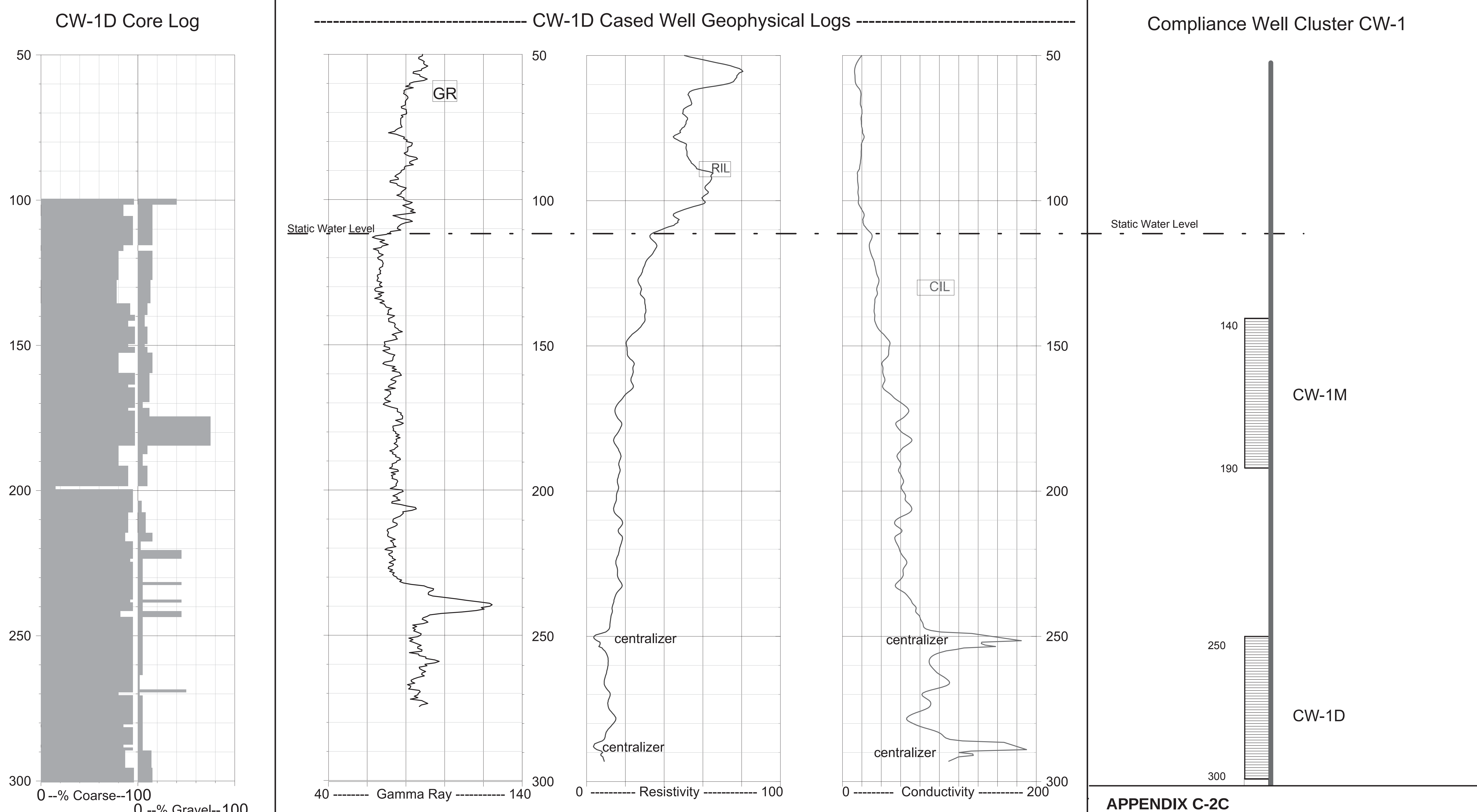
Log Units: Gamma Ray (GR, API units), Induction Resistivity (RIL, ohm/m), Induction Conductivity (CIL, uS/cm)

Observation Well Cluster OW-3



APPENDIX C-2B
SUMMARY OF HYDROGEOLOGIC LOGGING FOR OW-3 WELL CLUSTER
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

CW1 Geophysical Log March 2, 2005

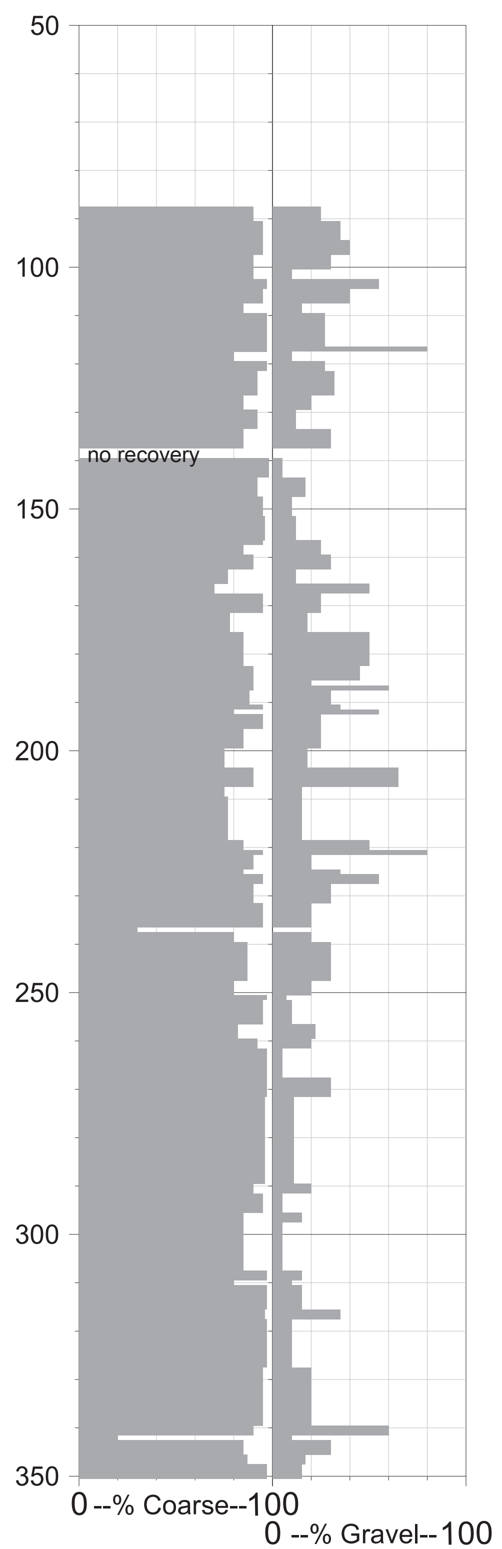
Log Units: Gamma Ray (GR, API units), Resistivity (RIL, ohm/m), Conductivity (CIL, mS/cm)

APPENDIX C-2C
SUMMARY OF HYDROGEOLOGIC LOGGING FOR CW-1 COMPLIANCE WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

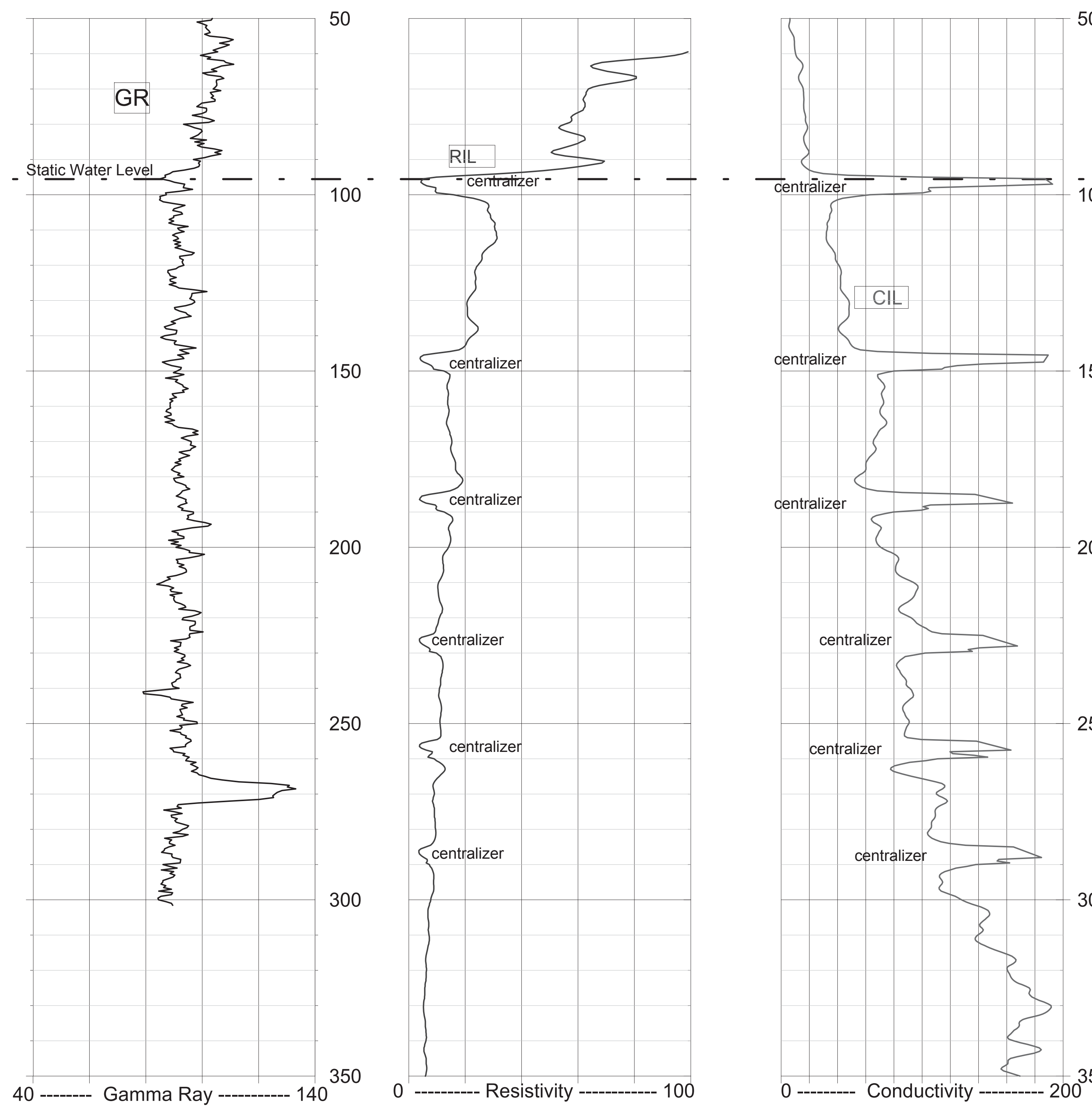
CH2MHILL

CW-2D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

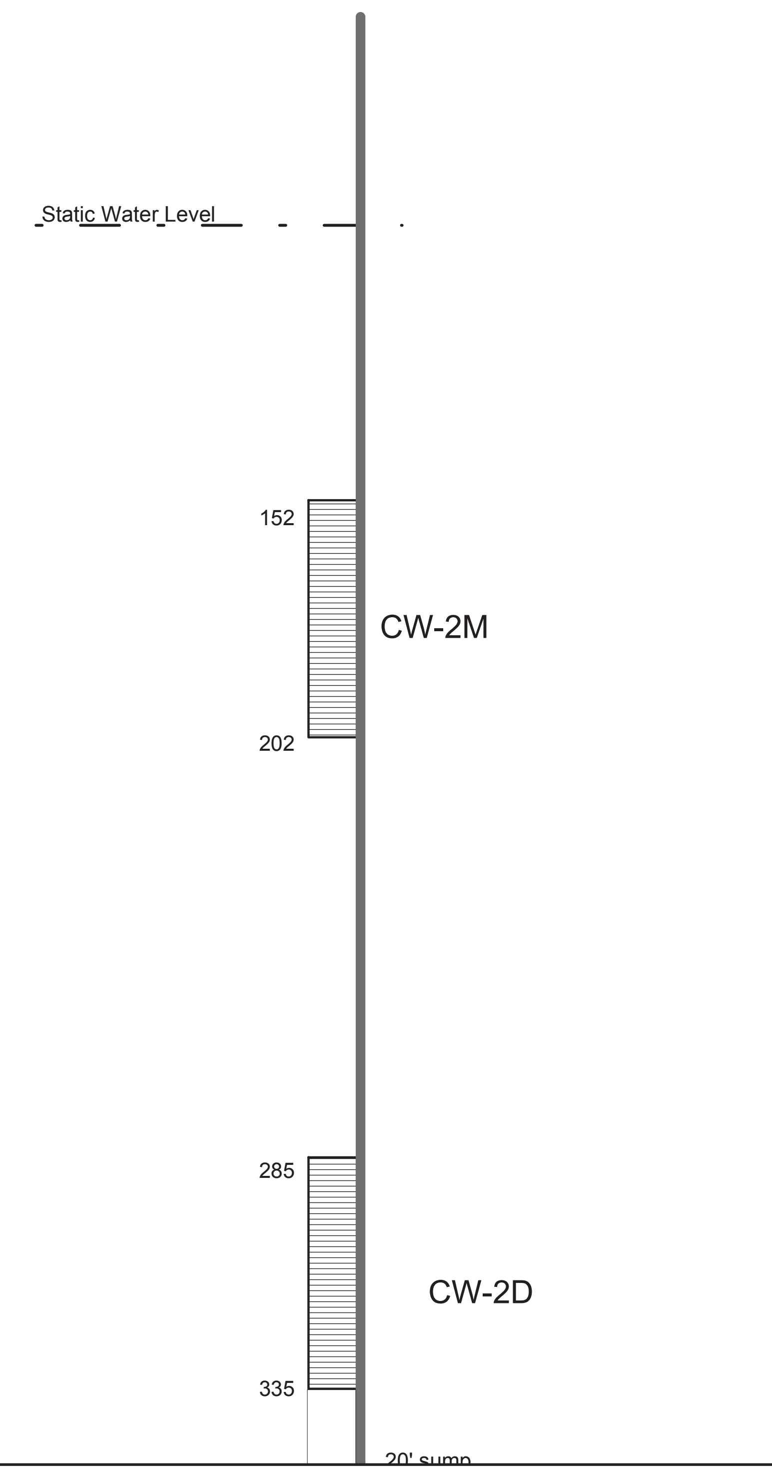
CW-2D Cased Well Geophysical Logs



CW2-D Geophysical Log March 2, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL,ohm/m), Conductivity (CIL, mS/cm)

Compliance Well Cluster CW-2

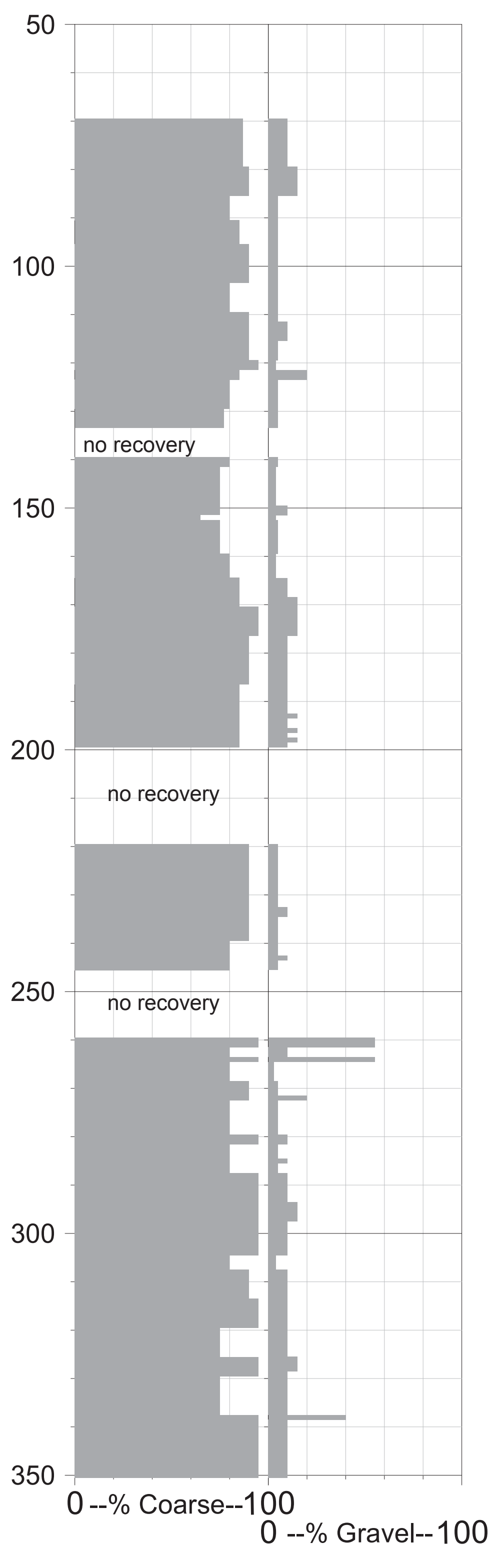


APPENDIX C-2D
SUMMARY OF HYDROGEOLOGIC LOGGING FOR CW-2 COMPLIANCE WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

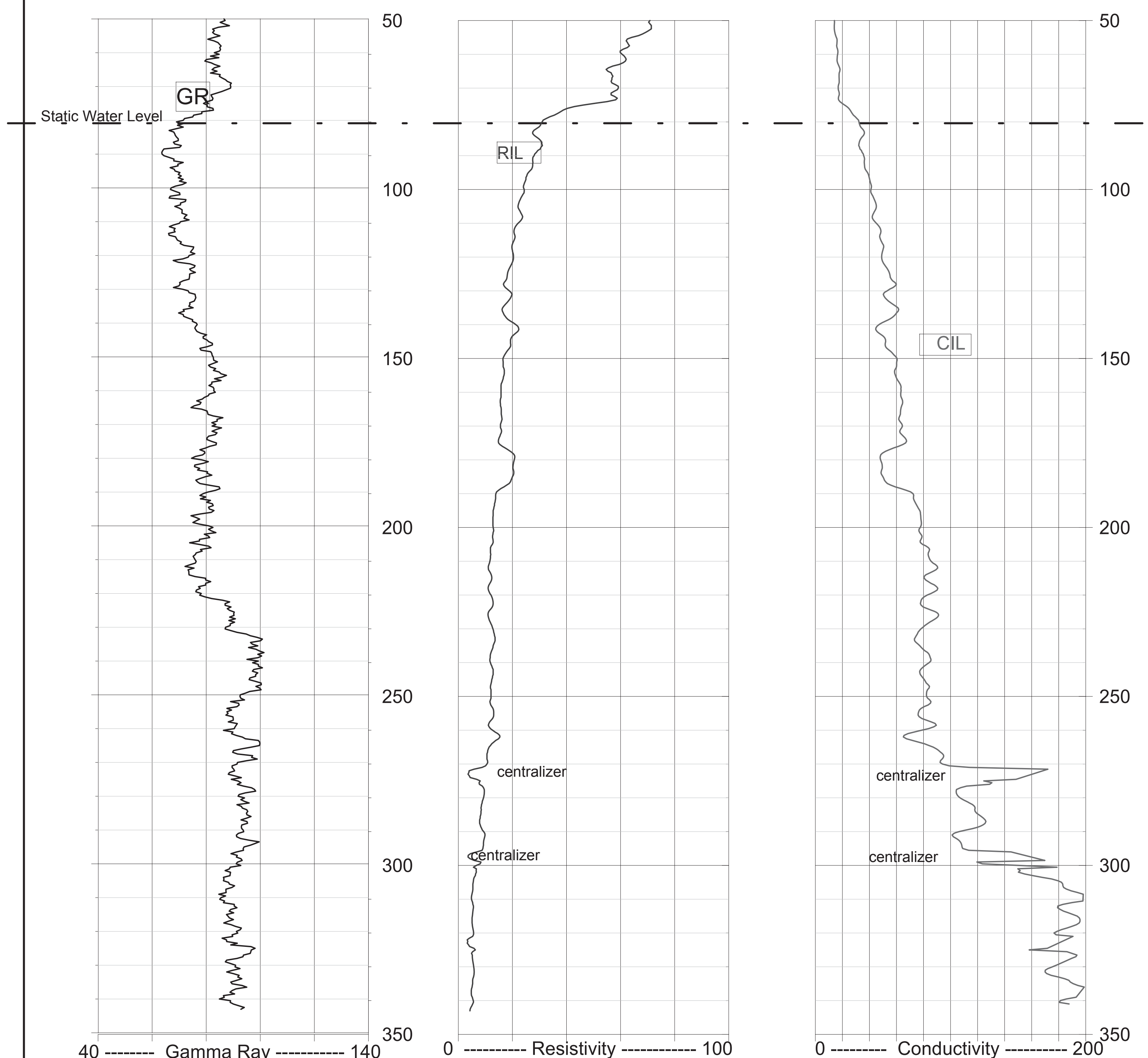
CH2MHILL

CW-3D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

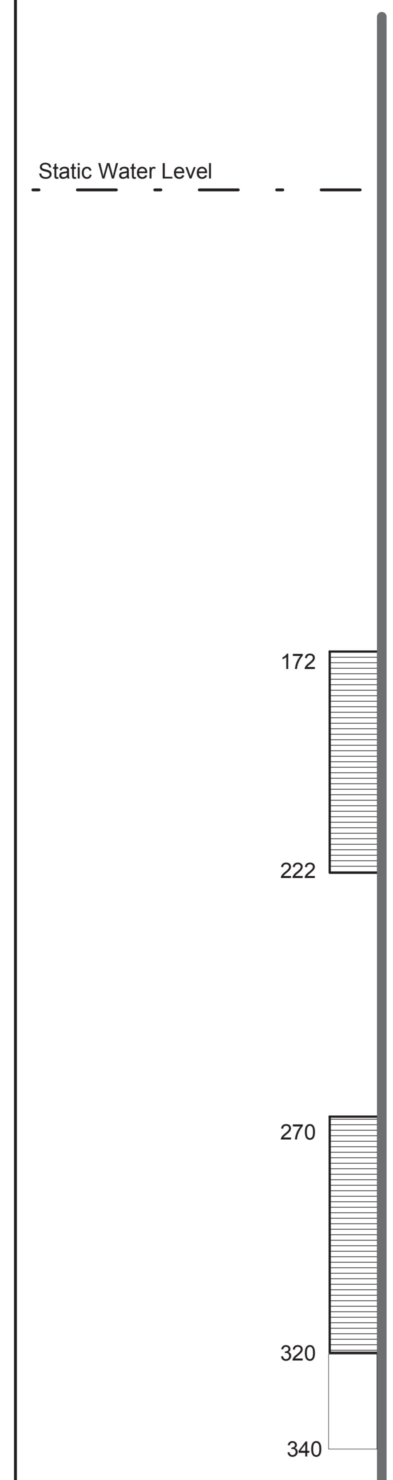
---------------------------------- CW-3D Cased Well Geophysical Logs ----------------------------------



CW3-D Geophysical Log March 2, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL,ohm/m), Conductivity (CIL, mS/cm)

Compliance Well Cluster CW-3

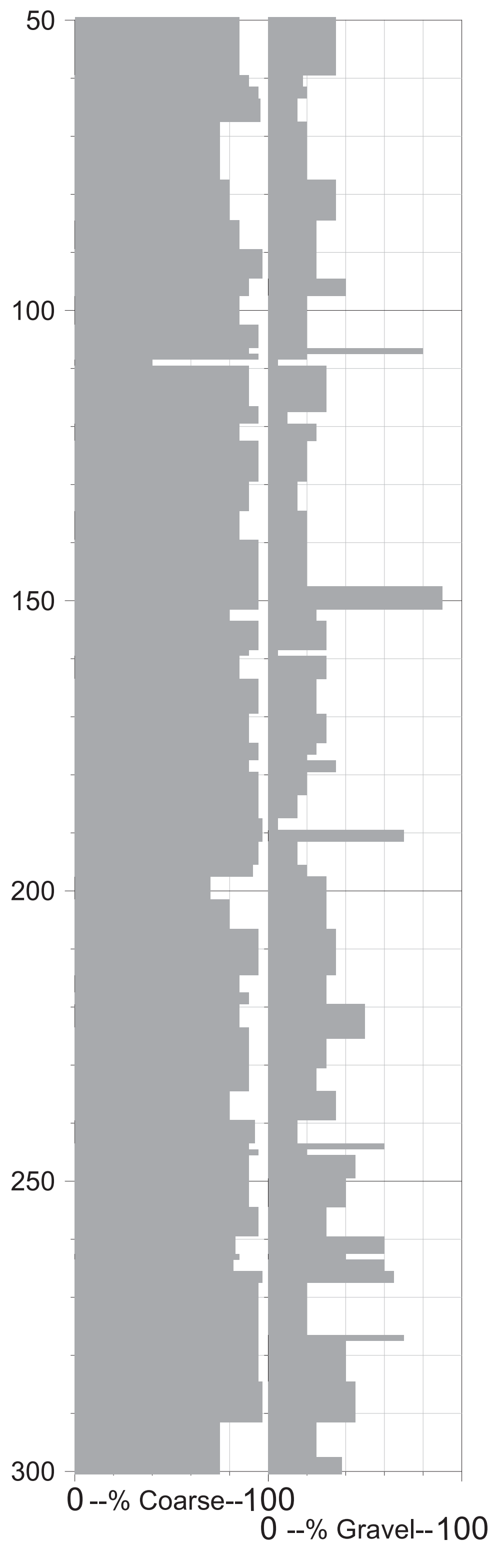


APPENDIX C-2E
SUMMARY OF HYDROGEOLOGIC LOGGING FOR CW-3 COMPLIANCE WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

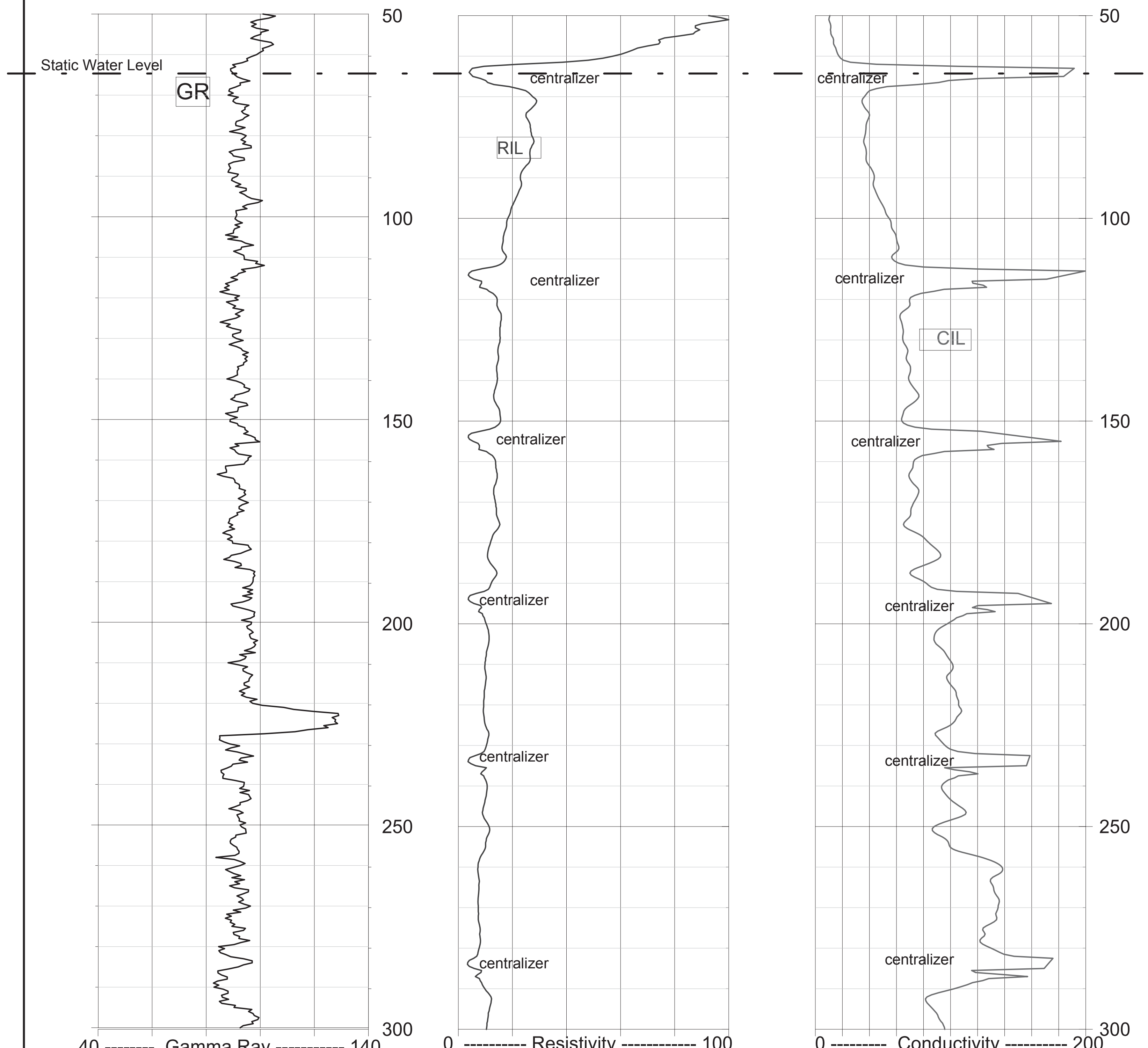
CH2MHILL

CW-4D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

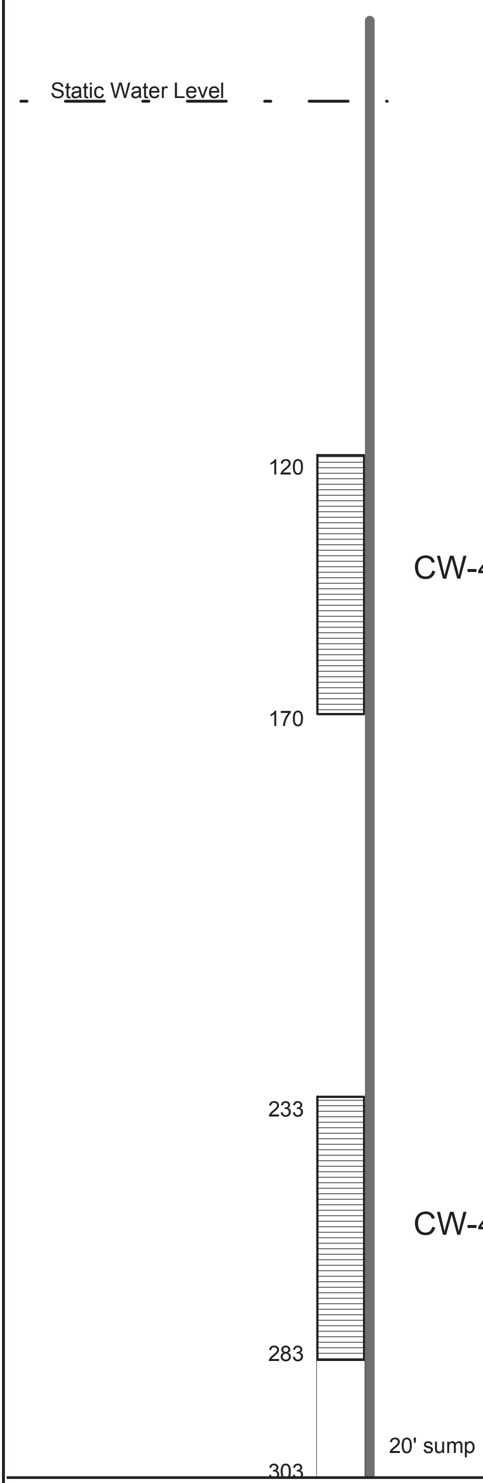
---------------------------------- CW-4D Cased Well Geophysical Logs ------------------------------------



CW4-D Geophysical Log March 2, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL, ohm/m), Conductivity (CIL, mS/cm)

Compliance Well Cluster CW-4



APPENDIX C-2F
SUMMARY OF HYDROGEOLOGIC LOGGING FOR CW-4 COMPLIANCE WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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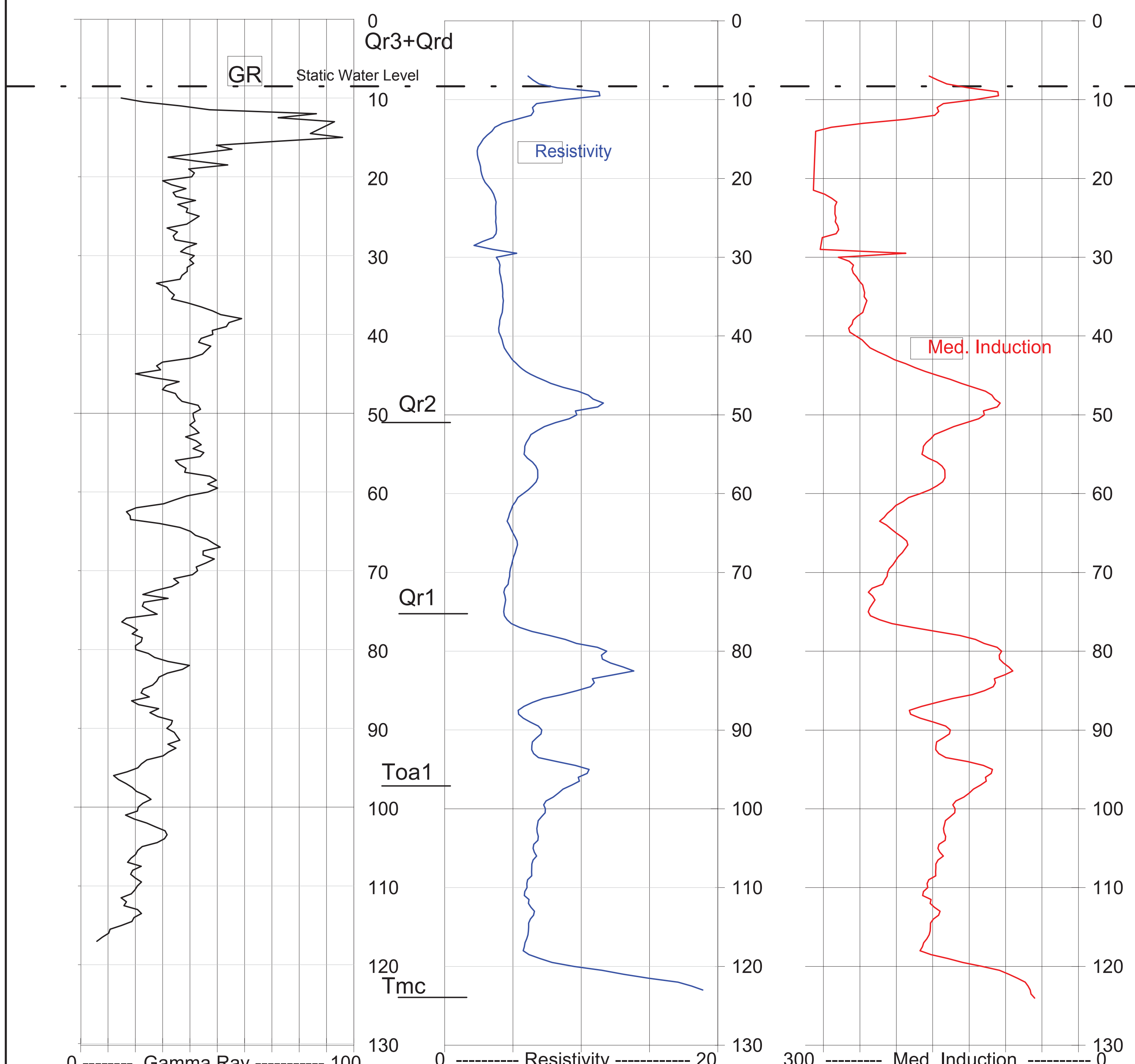
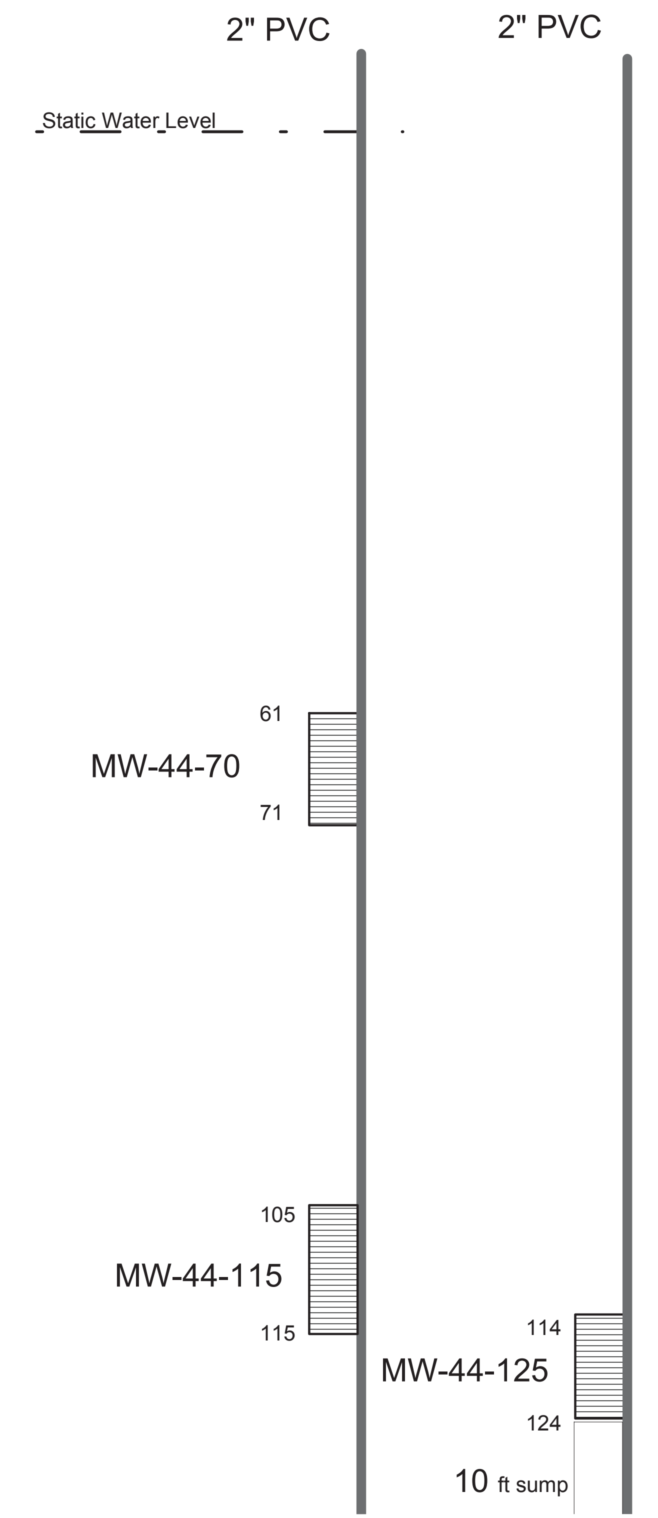
MW-44 Cased Well Geophysical Logs



Well Cluster MW-44



MW-44 Geophysical Log April 27, 2006

Log Units: Gamma Ray (GR, API units), Resistivity (ohm/m), Med. Induction (mS/m)

APPENDIX C-2G
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-44 WELL
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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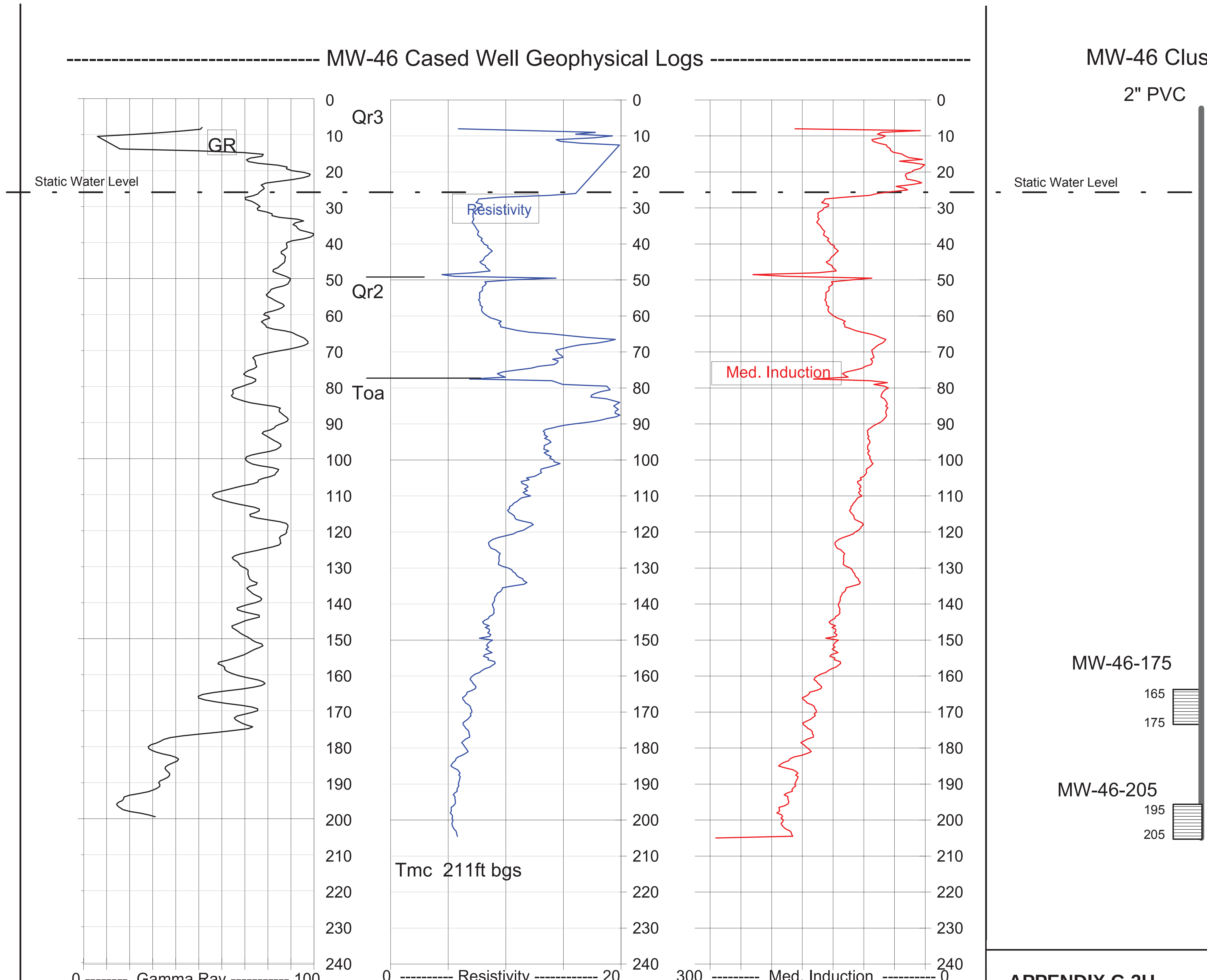

MW-46 Geophysical Log May 11, 2006

Log Units: Gamma Ray (GR, API units), Resistivity (ohm/m), Med. Induction (mS/m)

APPENDIX C-2H
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-46 WELLS

RCRA FACILITY INVESTIGATION/
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NEEDLES, CALIFORNIA

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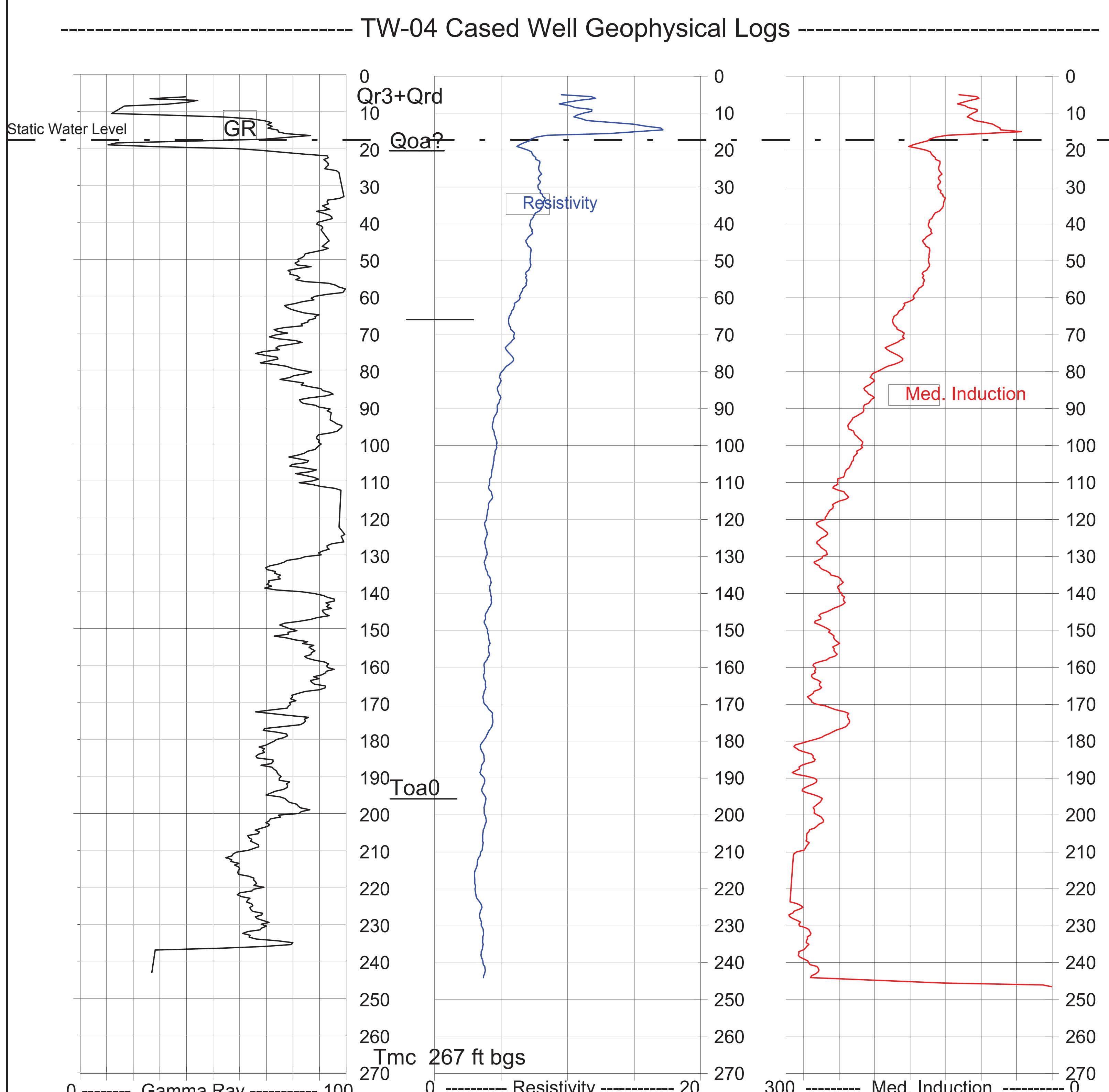
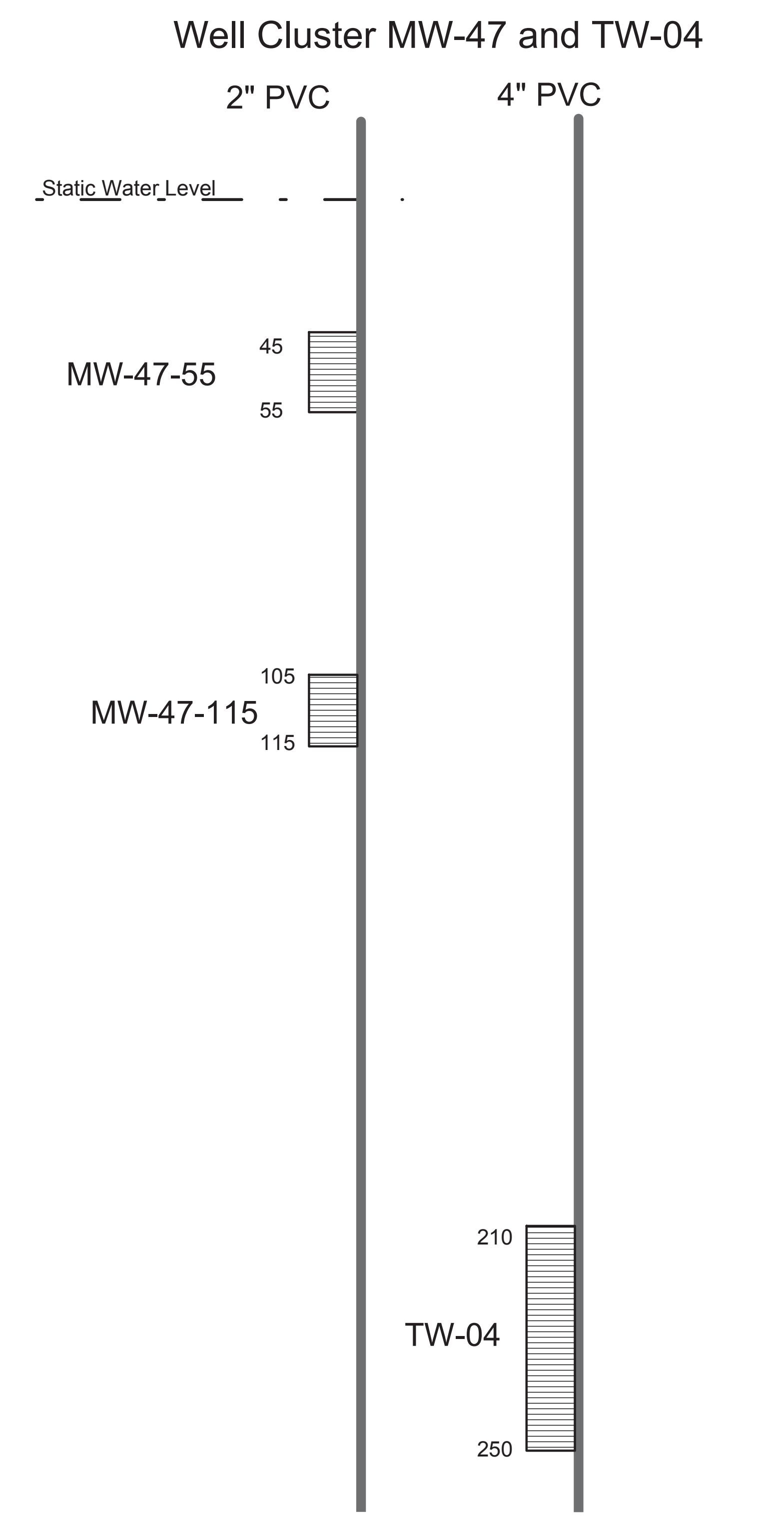




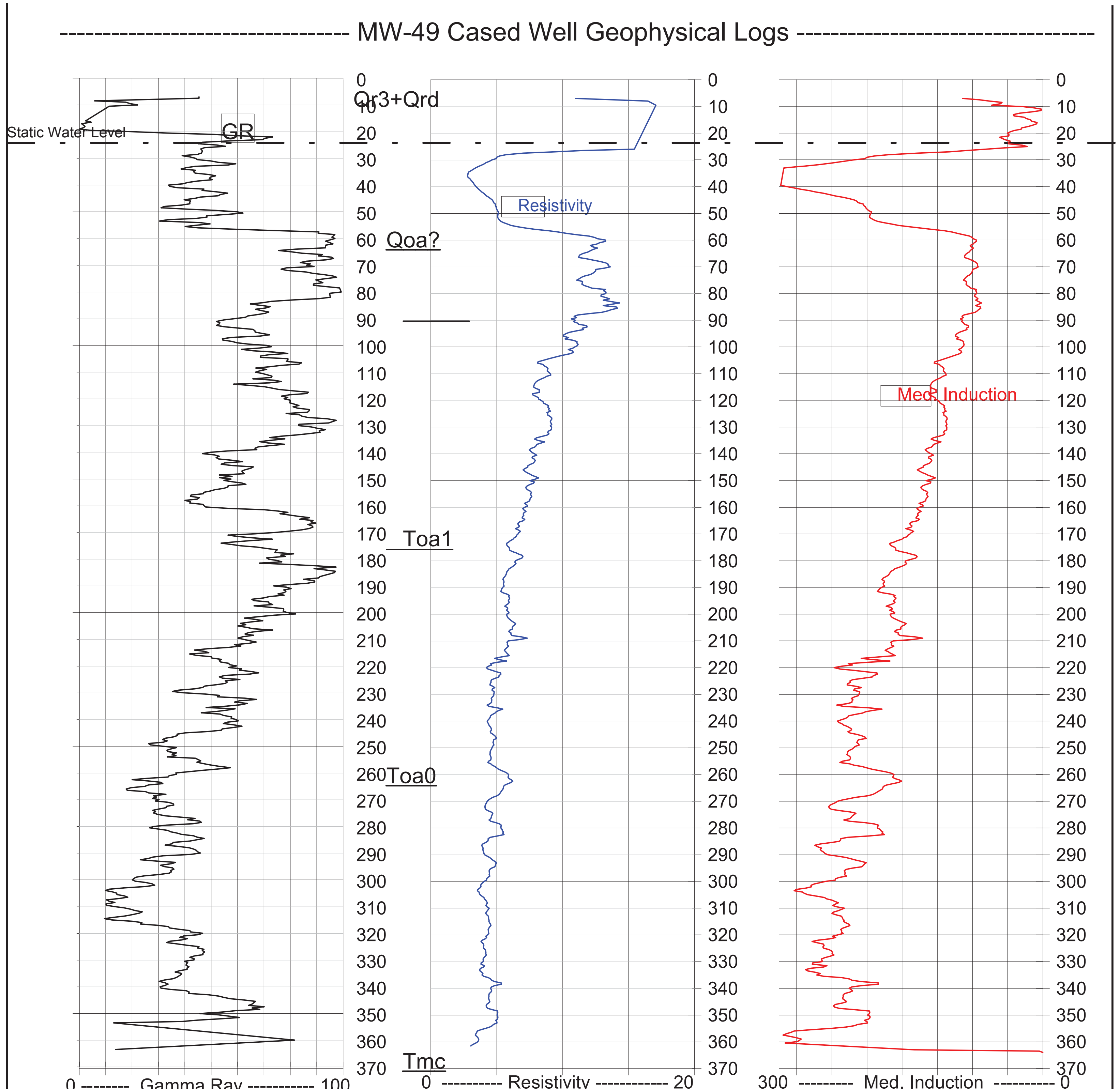
TW-04 Geophysical Log April 27, 2006

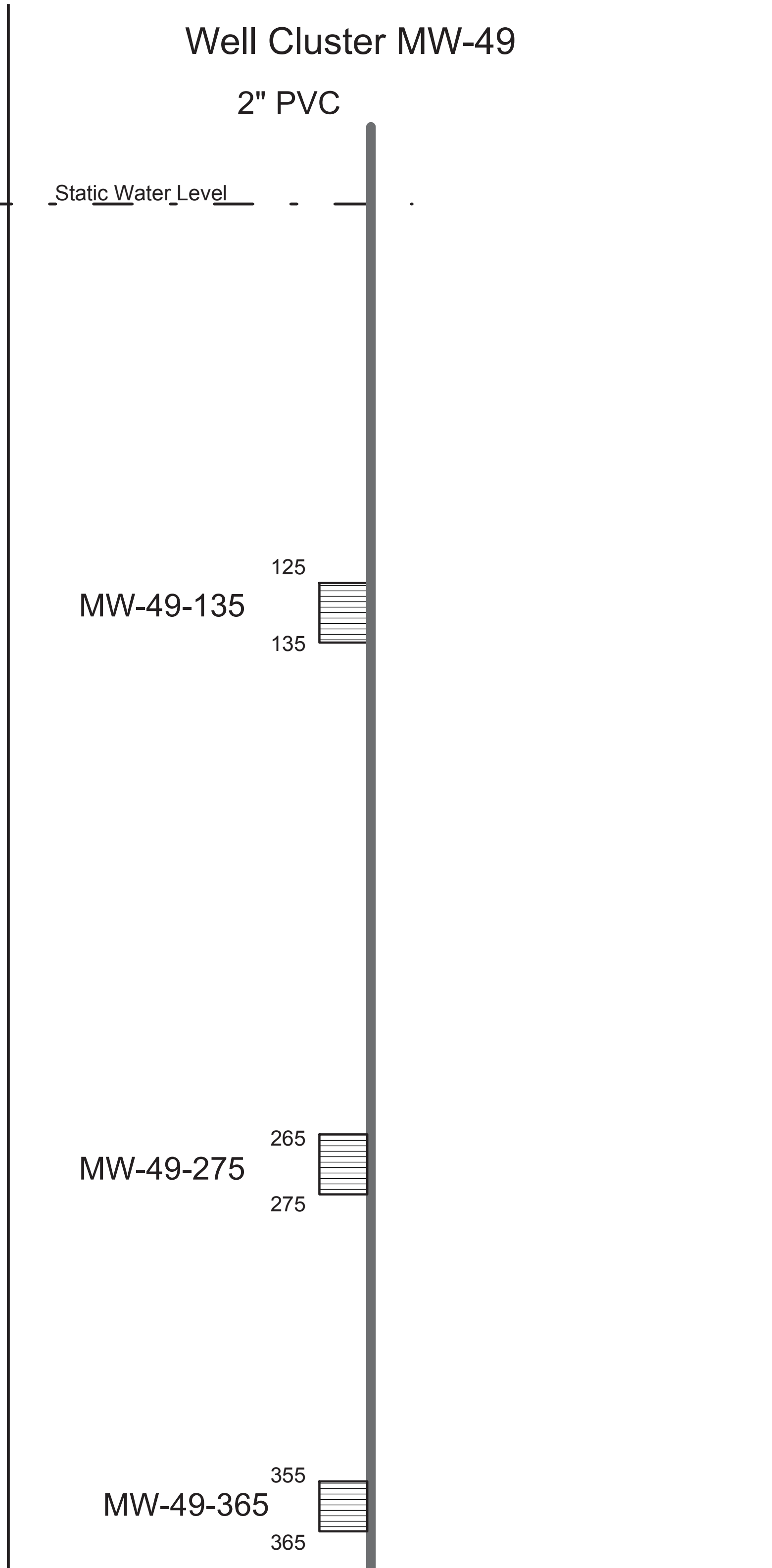
Log Units: Gamma Ray (GR, API units), Resistivity (ohm/m), Med. Induction (mS/m)

APPENDIX C-2I
SUMMARY OF HYDROGEOLOGIC LOGGING FOR TW-04 WELL
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

ES102007005BAO_Appendix_C_figures.indd_022708_lho





MW-49 Geophysical Log April 27, 2006

Log Units: Gamma Ray (GR, API units), Resistivity (ohm/m), Med. Induction (mS/m)

APPENDIX C-2J
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-49 WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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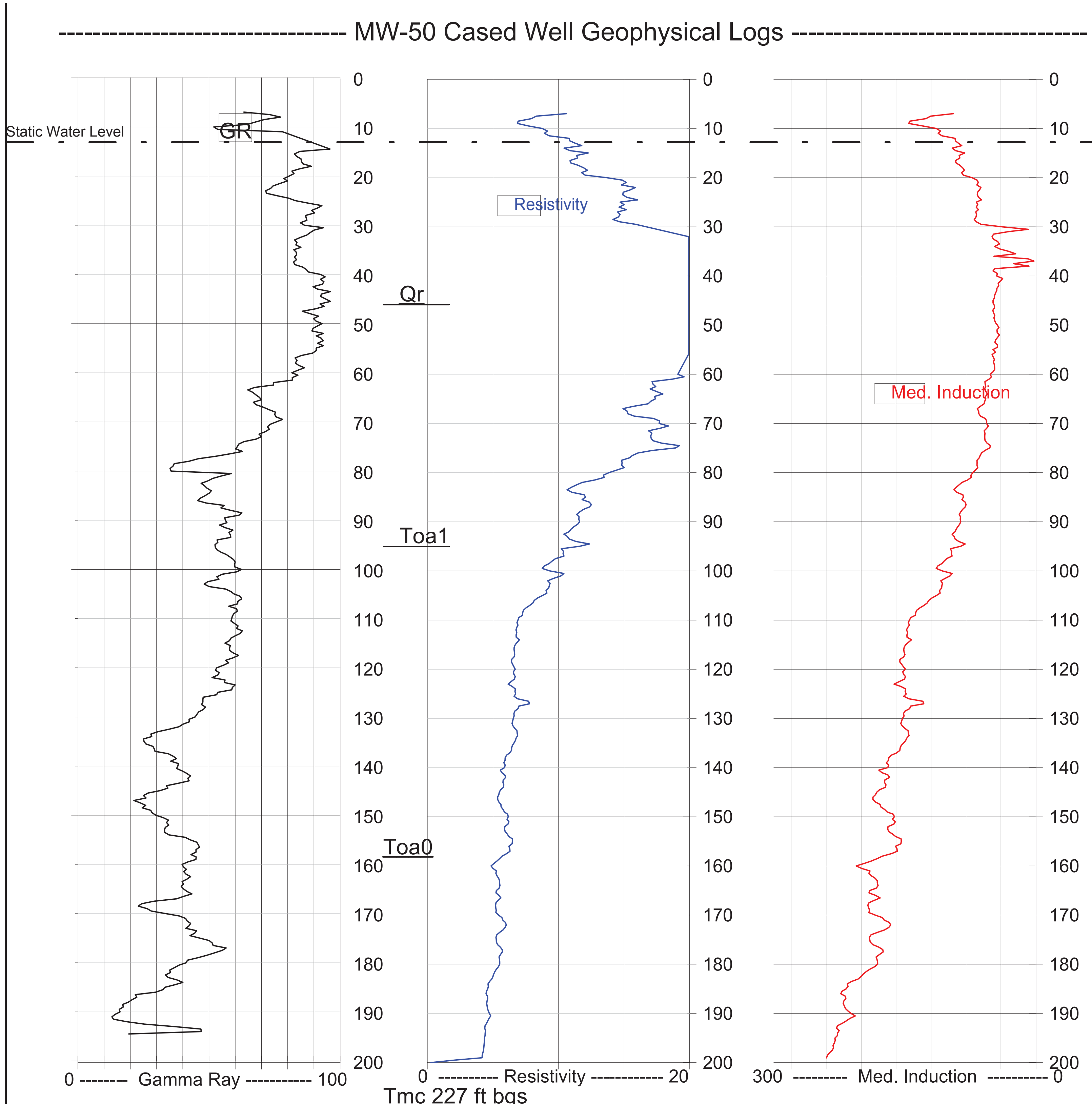

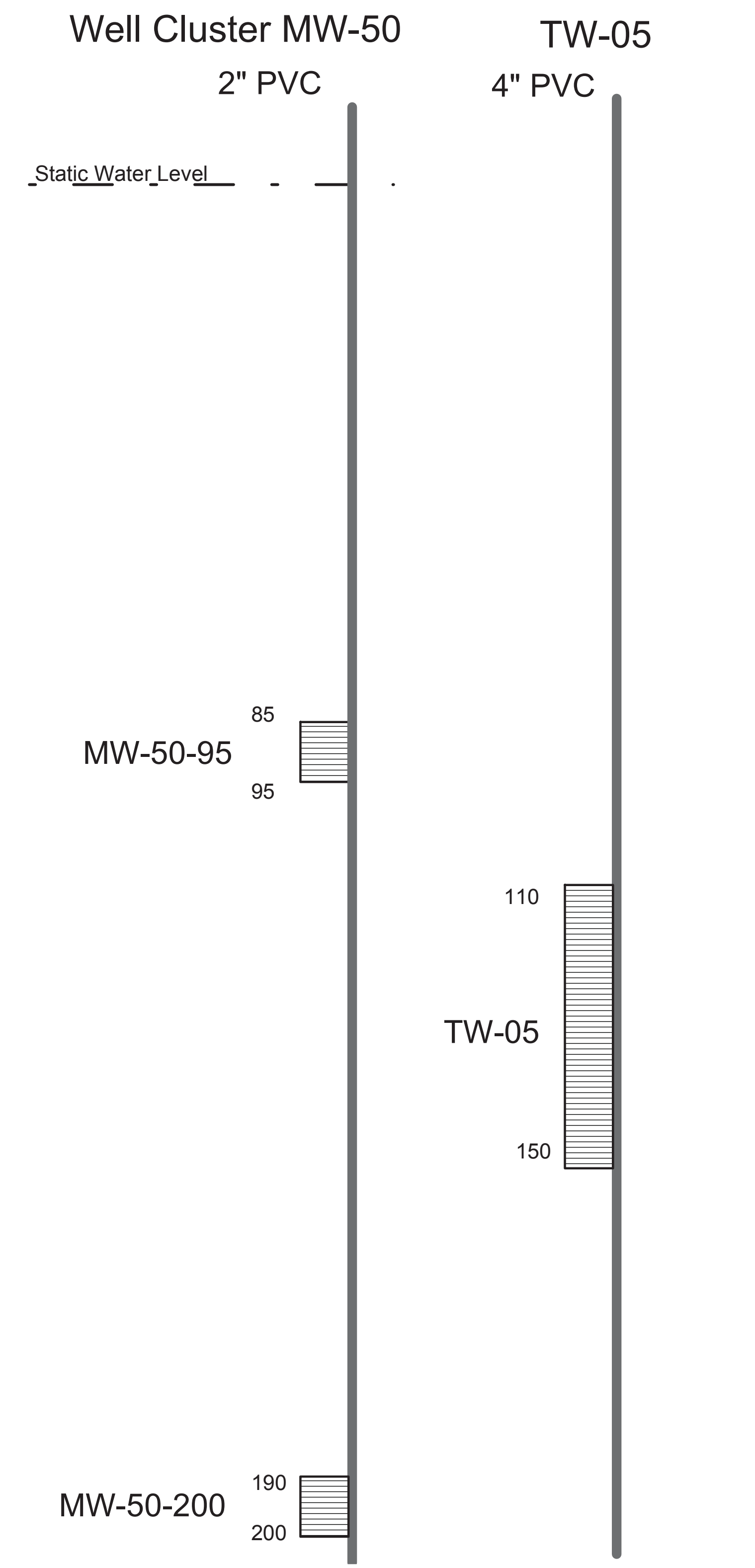

MW-50 Geophysical Log April 27, 2006

Log Units: Gamma Ray (GR, API units), Resistivity (ohm/m), Med. Induction (mS/m)

APPENDIX C-2K
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-50 WELLS

RCRA FACILITY INVESTIGATION/
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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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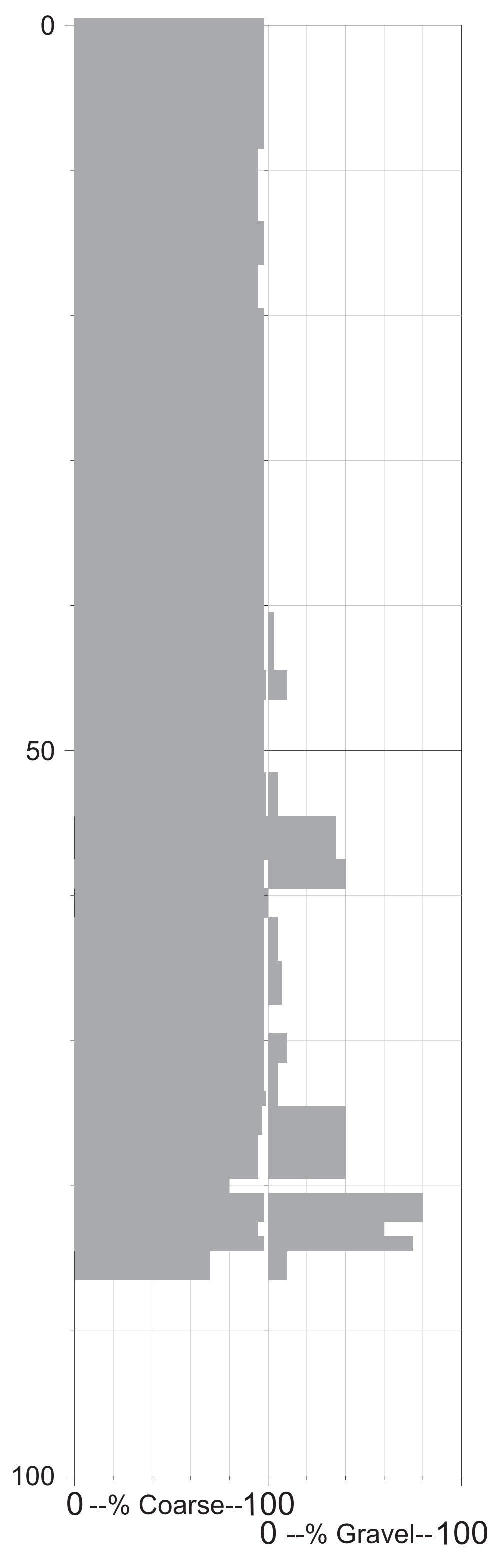
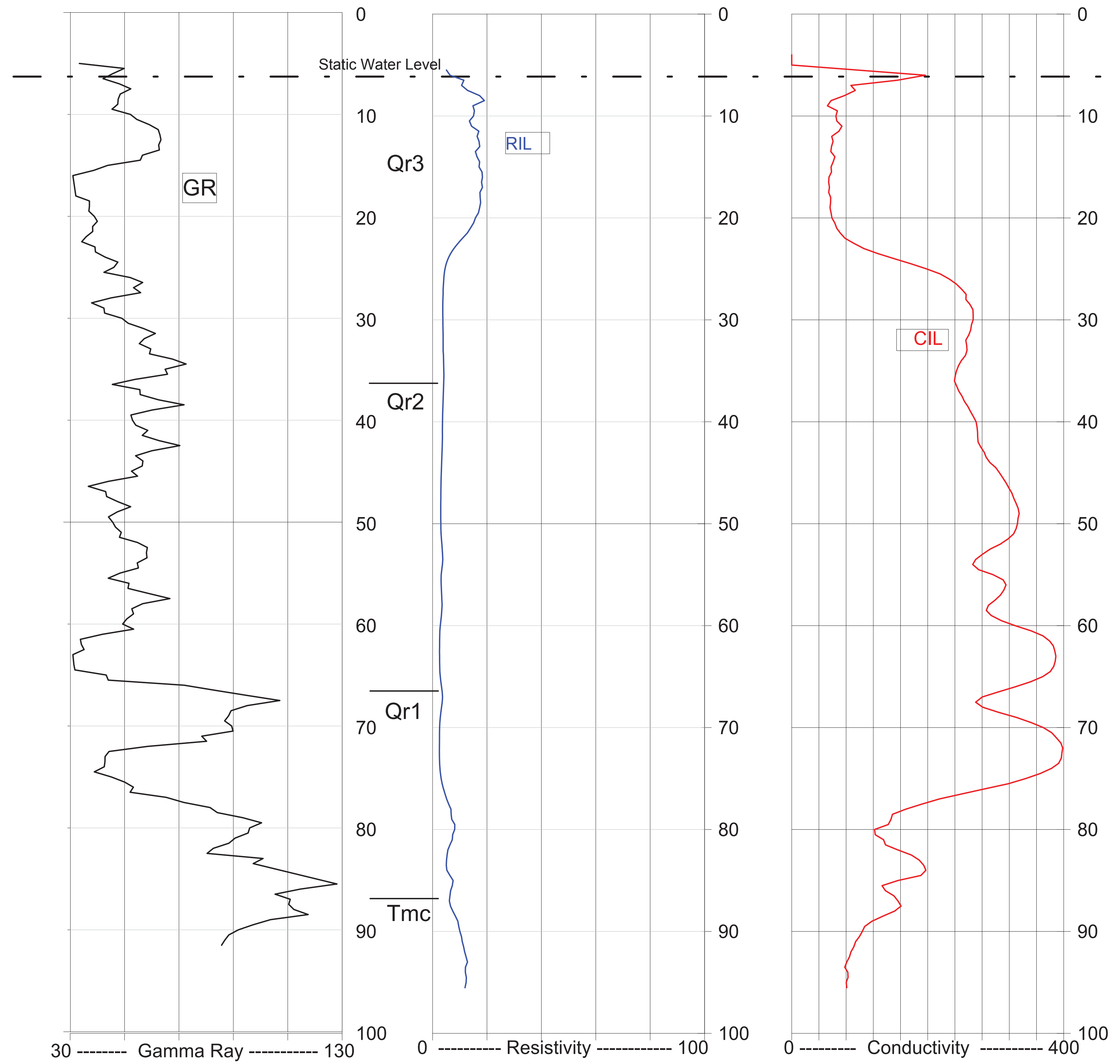
MW-27D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

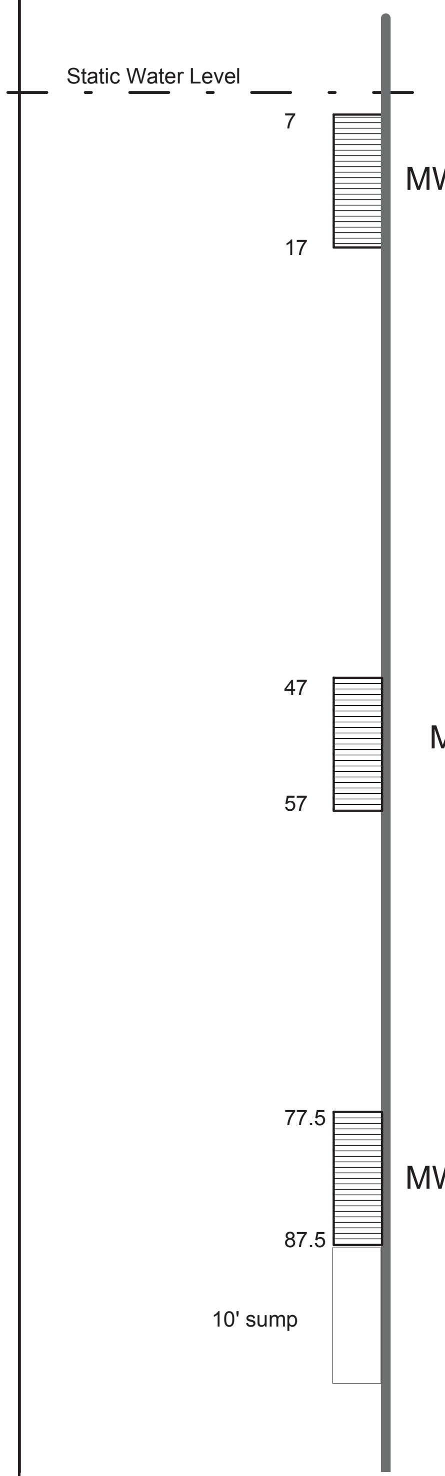
MW-27D Cased Well Geophysical Logs



MW-27D Geophysical Log March 1, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL, ohm/m), Conductivity (CIL, µS/cm)

Well Cluster MW-27



APPENDIX C-2L
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-27 WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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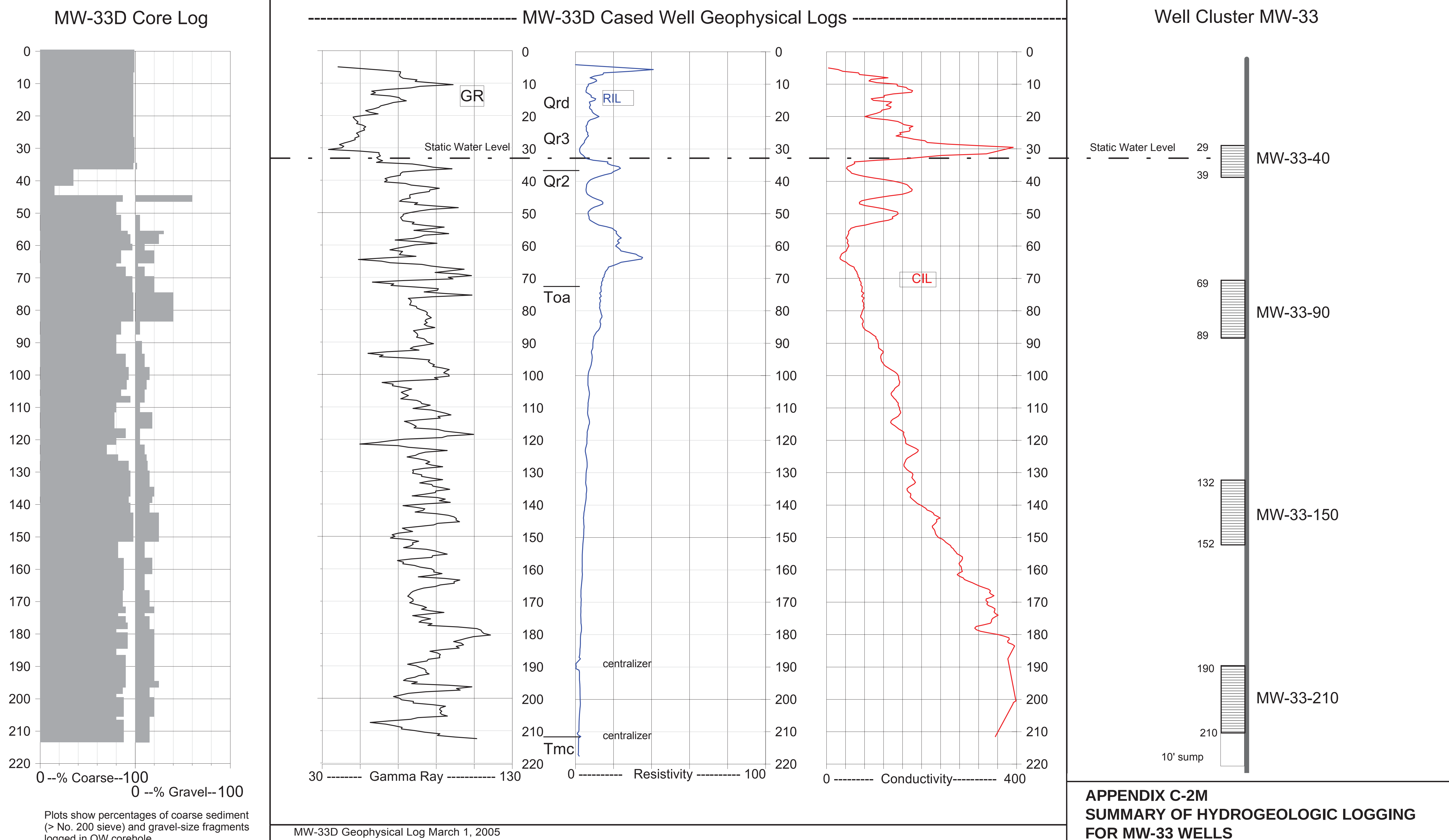

MW-33D Geophysical Log March 1, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL, ohm/m), Conductivity (CIL, μS/cm)

APPENDIX C-2M
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-33 WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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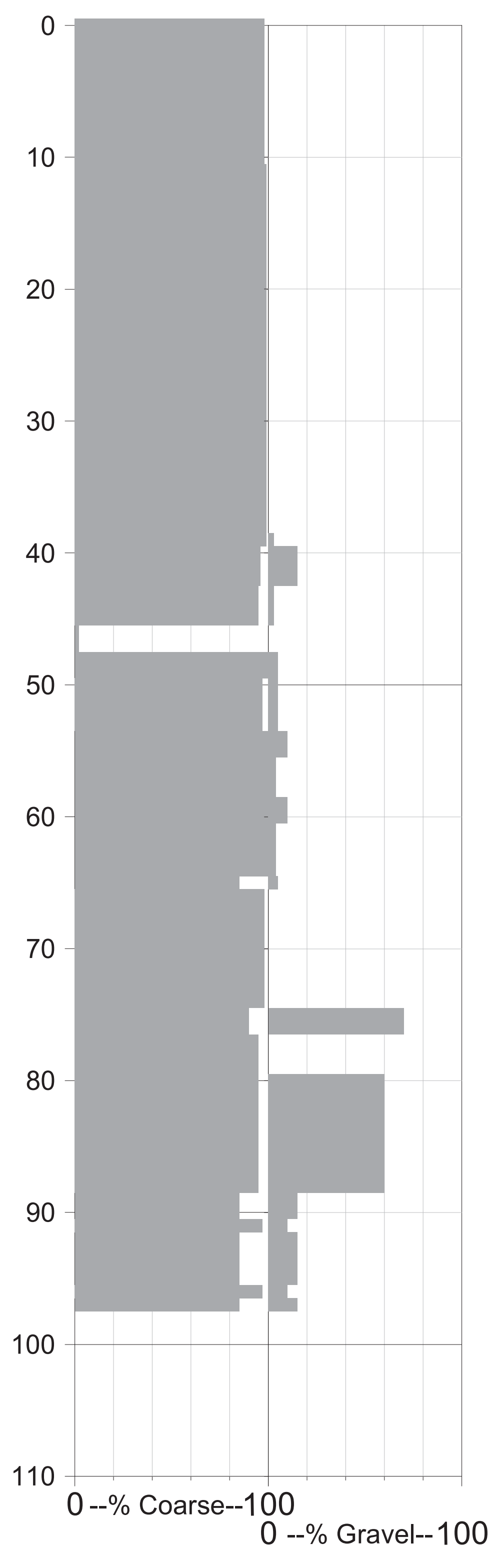
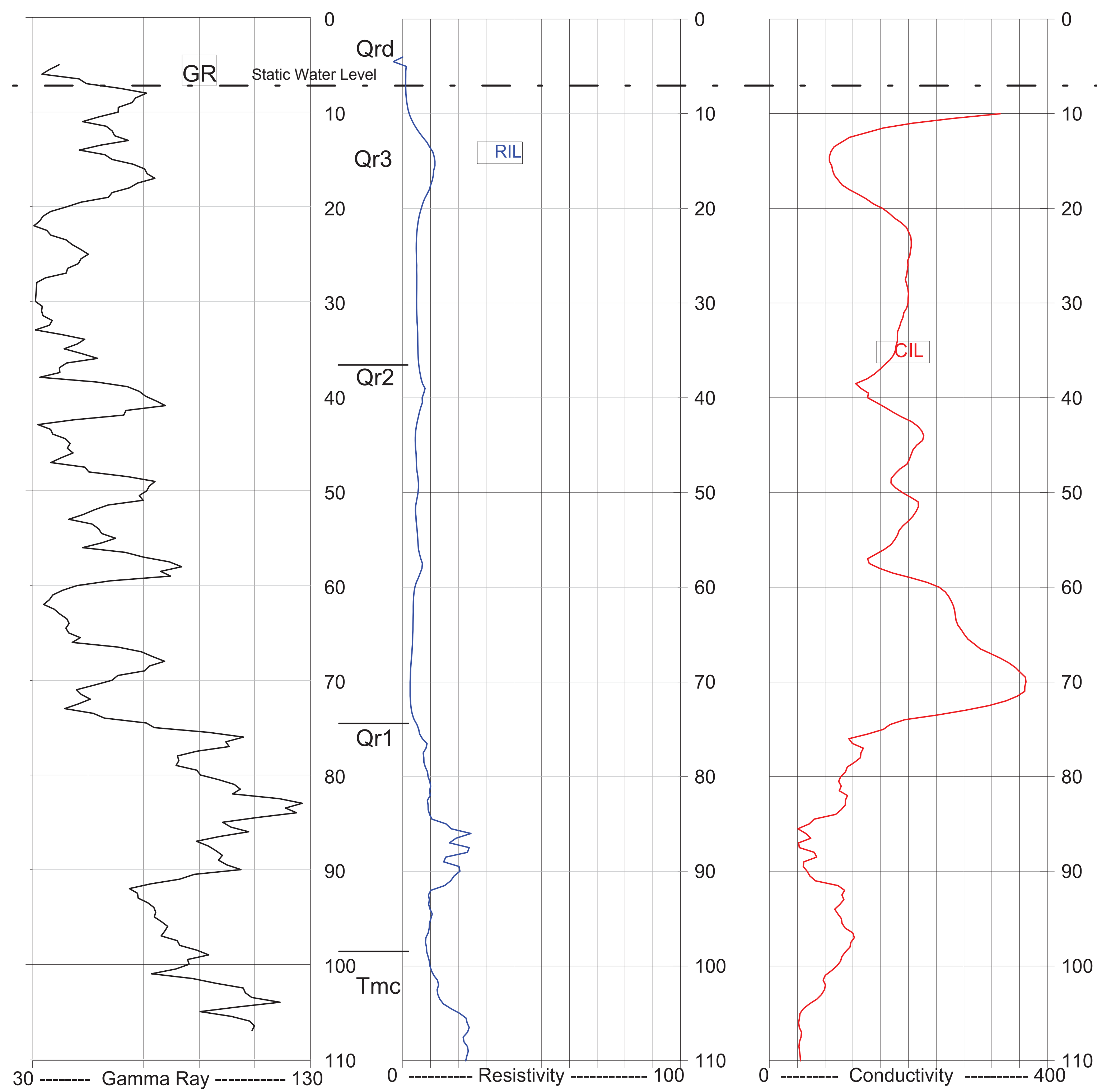
MW-34D Core Log



Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.

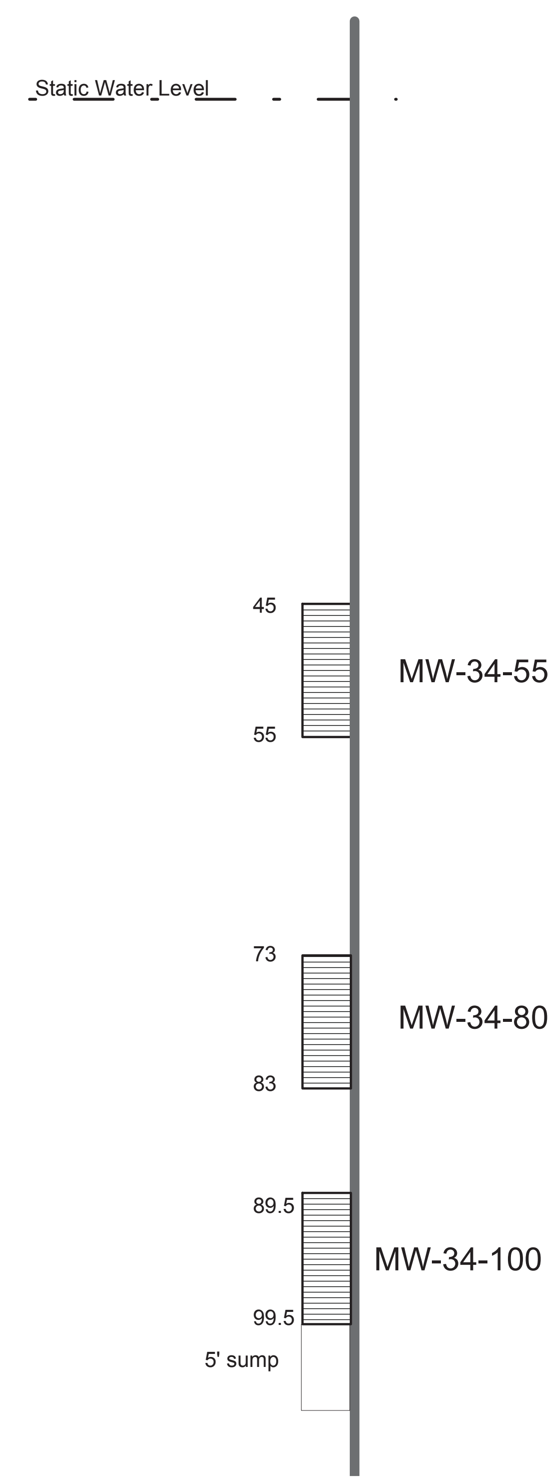
MW-34D Cased Well Geophysical Logs



MW-34DGeophysical Log March 1, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL, ohm/m), Conductivity (CIL, μS/cm)

Well Cluster MW-34



APPENDIX C-2N
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-34 WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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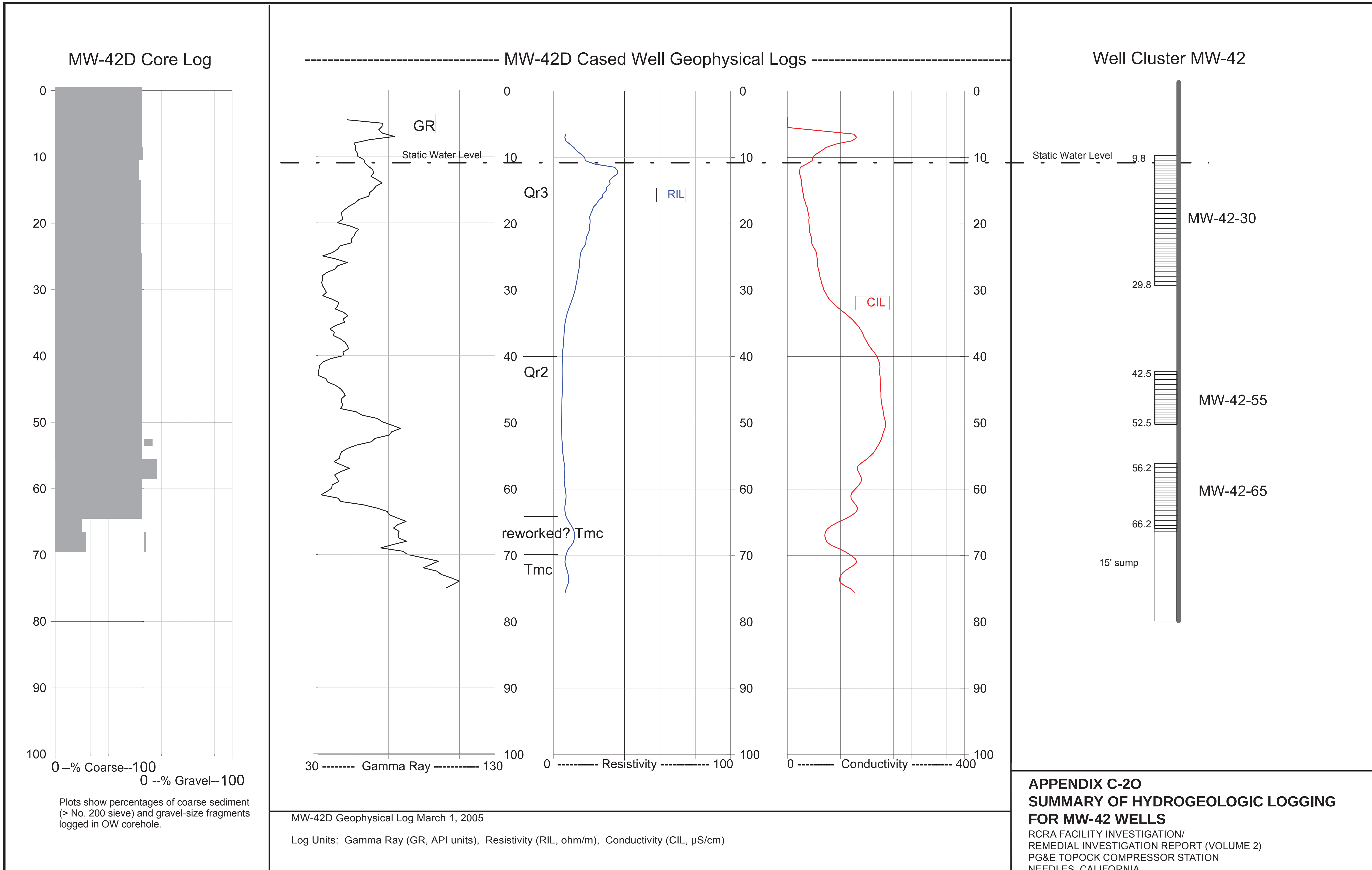

APPENDIX C-2O
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-42 WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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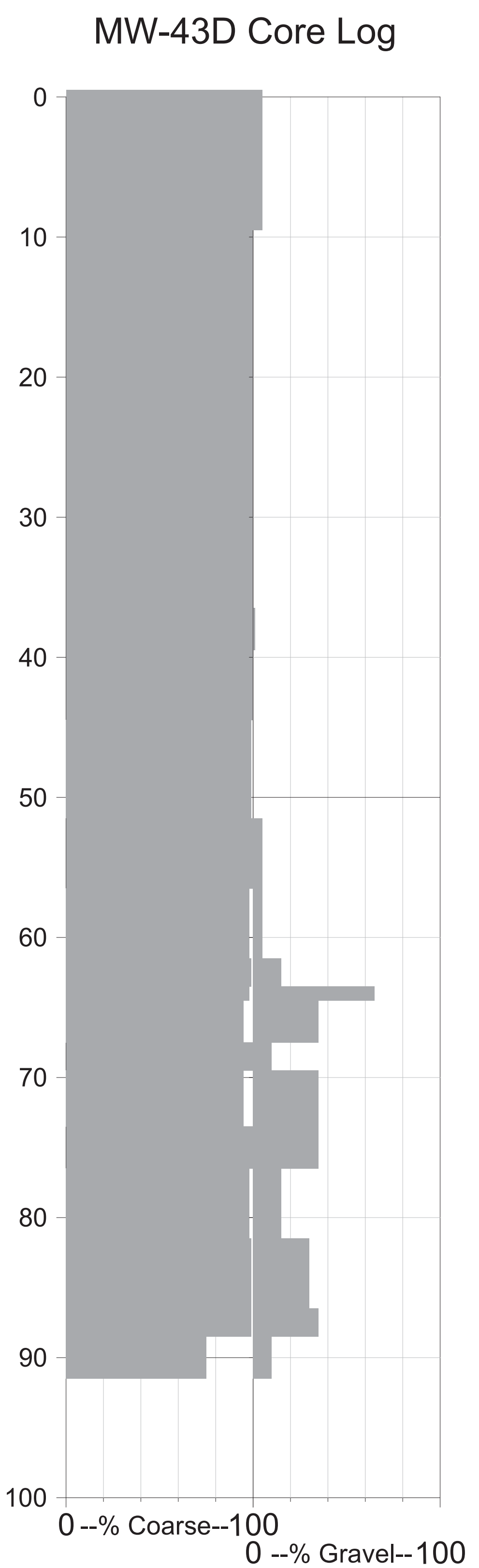
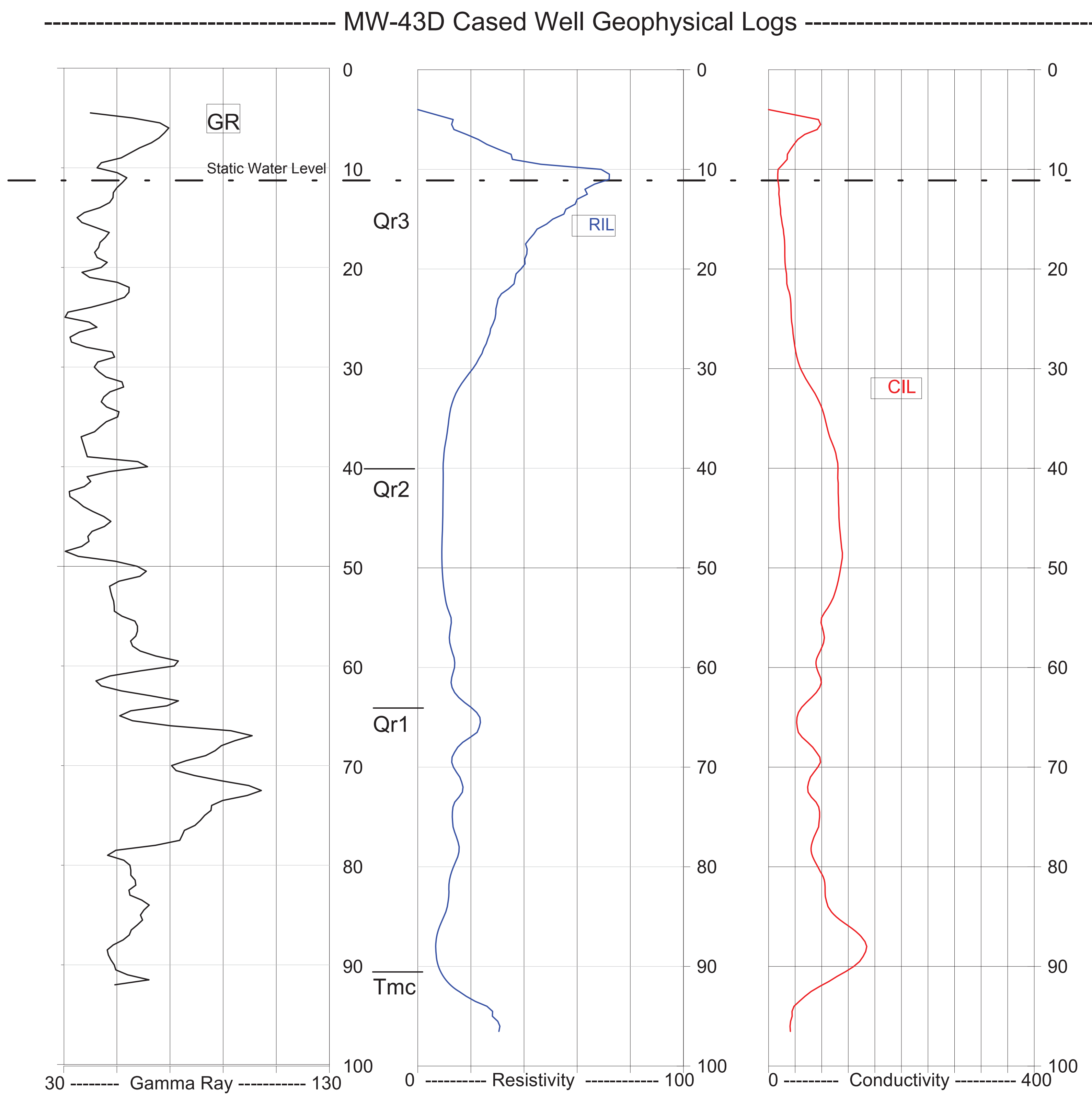
ES102007005BAO_Appendix_C_figures.indd_022708_lho

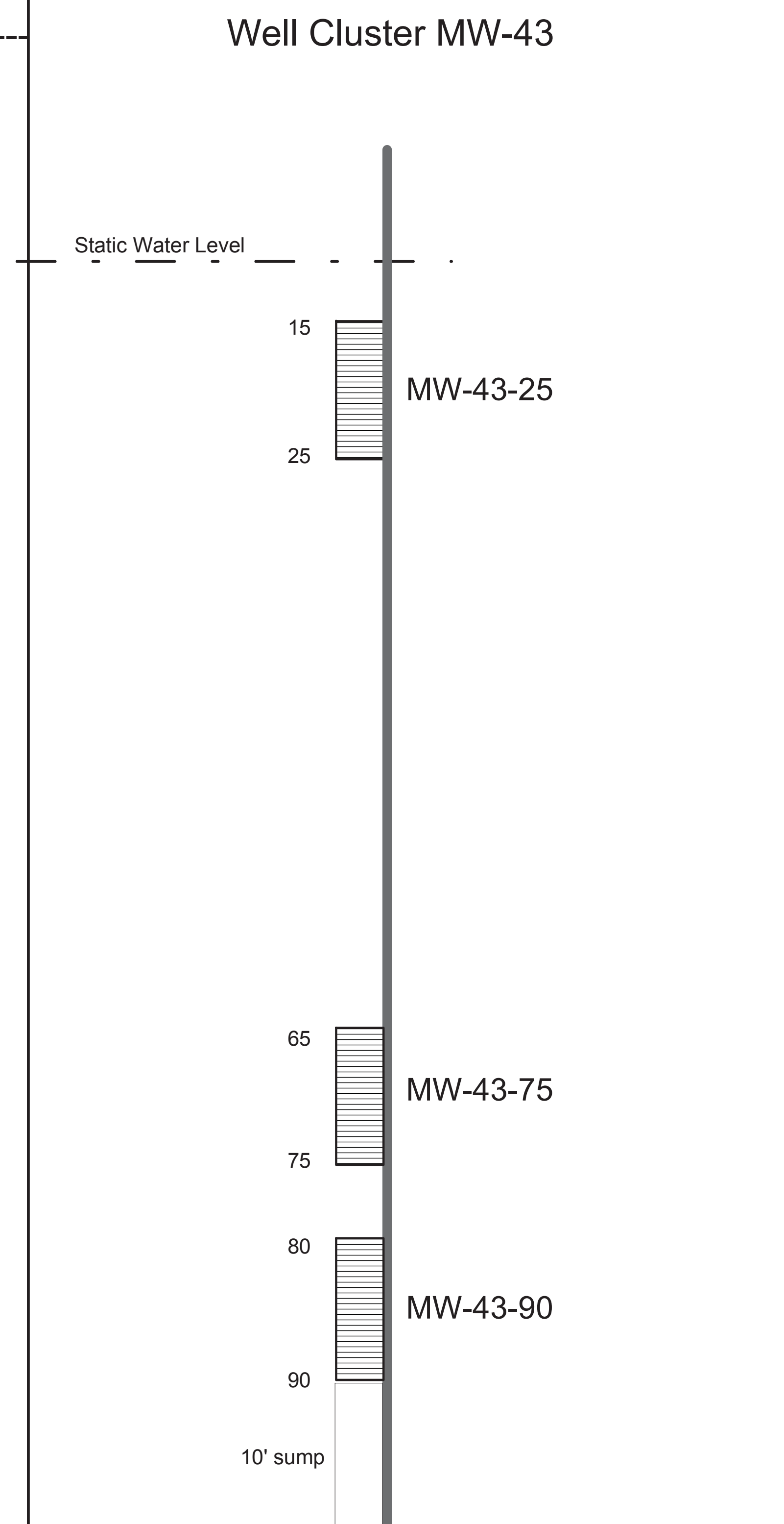


Plots show percentages of coarse sediment (> No. 200 sieve) and gravel-size fragments logged in OW corehole.



MW-43D Geophysical Log March 1, 2005

Log Units: Gamma Ray (GR, API units), Resistivity (RIL, ohm/m), Conductivity (CIL, µS/cm)



APPENDIX C-2P
SUMMARY OF HYDROGEOLOGIC LOGGING FOR MW-43 WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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C3 Summary Data for USGS Seismic Surveys of Colorado River Channel

SEISMIC PROFILING METHODS AND RESULTS

Continuous seismic profiling methods were used on the Colorado River near Topock, Arizona to map the river bottom and the fluvial deposits/bedrock interface. Continuous seismic profiling equipment is towed at slow speeds (> 5 km/hour) behind a boat and an acoustic pulse is emitted from the transmitting array at regular intervals. Reflected pulses are recorded by hydrophones and the acoustic pressure waves are converted to electrical signals. The onboard acquisition computer processes and displays the recorded signals as a seismic-reflection record. The seismic-reflection record is an acoustic profile of the ship's survey track and subbottom structure. Subsurface structure and geology are interpreted from the seismic information.

The two principle characteristics of continuous seismic profiling data are: depth of penetration and resolution. Both of these characteristics depend on the frequency content and bandwidth of transmitted pulses. There is an inverse relationship between penetration and resolution. Higher frequencies have increased resolution but decreased penetration while lower frequencies have decreased resolution but increased penetration.

For this project, continuous seismic profiling data was collected with two seismic sources; a low-frequency boomer plate system and a high-frequency chirp system. The low-frequency boomer plate, with a center frequency of about 1,000 Hertz, is an analog system that uses capacitors connected in series as its power source. The source is an electromechanical device that is towed on the water surface and consists of a piston and plate. The power source is used to fire the piston into the plate at regular intervals. Acoustic signals are recorded by a hydrophone array towed behind the boomer plate.

The high-frequency chirp is a frequency modulated digital system that sweeps from 2,000 to 10,000 hertz. The chirp has transmitter and receiver arrays that are housed in a common tow vehicle and towed about 0.75 meters below the water surface. Acoustic signals are recorded by a hydrophone array housed in the tow vehicle.

The locations of the seismic profiles are presented on figure 1. Figure 1A shows the location of the high-frequency chirp profiles, Figure 1B shows the location of the low-frequency boomer profiles, and Figure 1C shows the location of selected interpreted profiles presented in Figure 2. Figure 2 shows seismic profiles Y-Y' and A-A'. Figure 3 shows the high-frequency chirp profiles and Figure 4 shows the low-frequency boomer profiles. Because the tow vehicle does not move at a constant rate, the horizontal scales of the profiles are not constant. Numbered reference points are presented on the location maps (Figure 1) and on selected seismic profiles (Figures 2-4) to spatially locate the profiles. Figure 5 presents the interpreted river bottom and the bottom of the fluvial deposits for selected profiles with a corrected horizontal scale.

Figure 1A: High-Frequency Chirp Seismic Survey

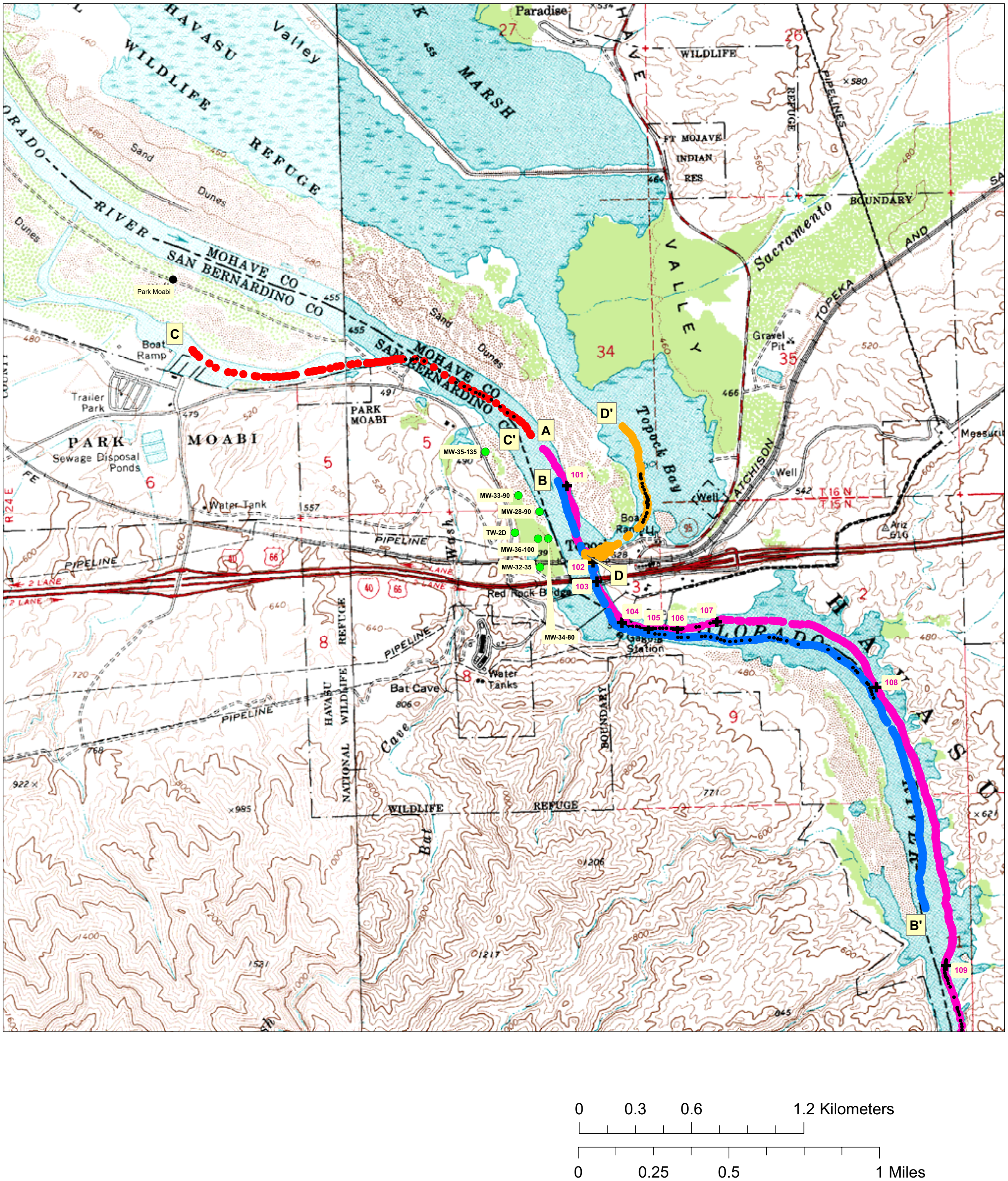
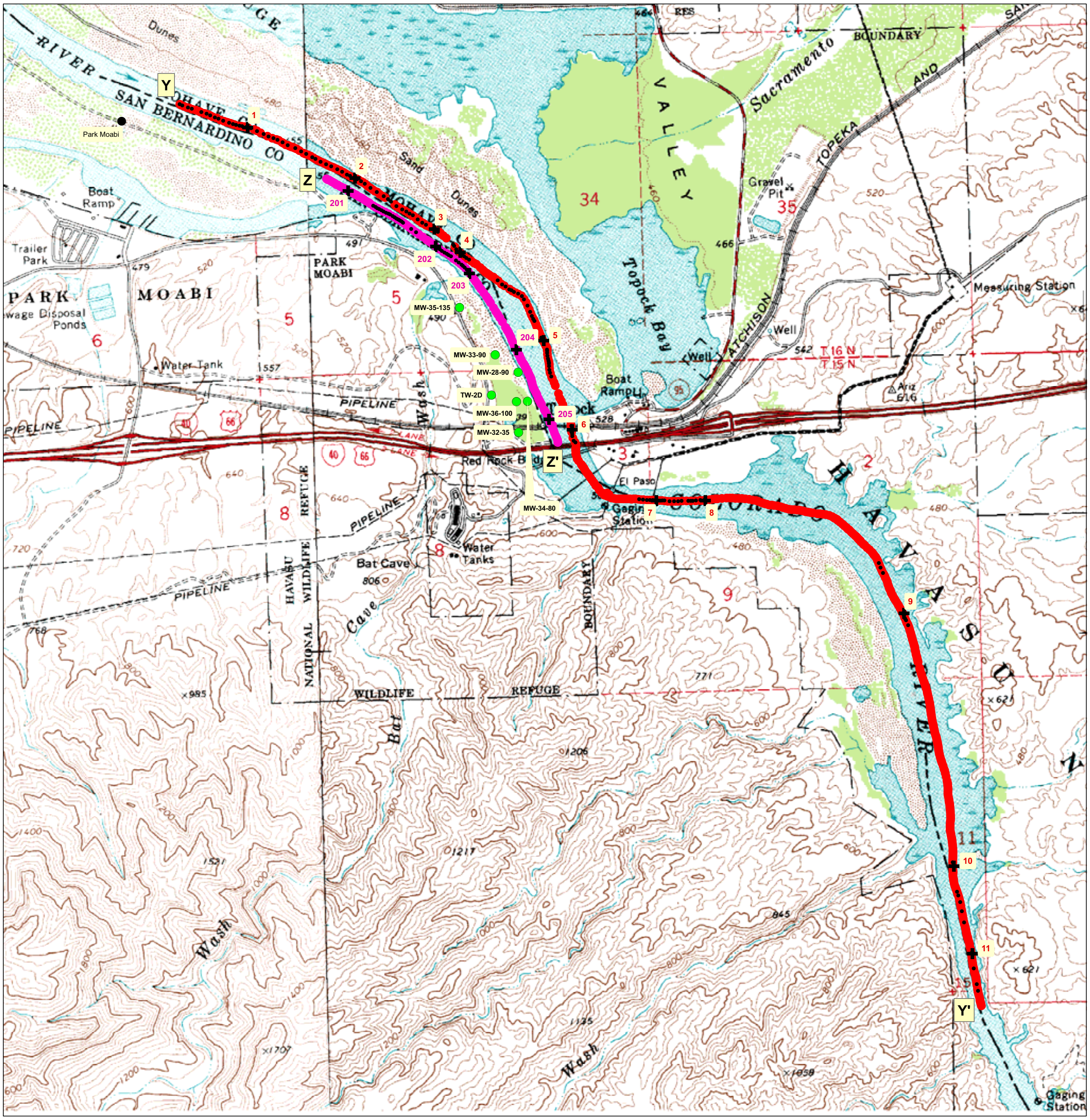


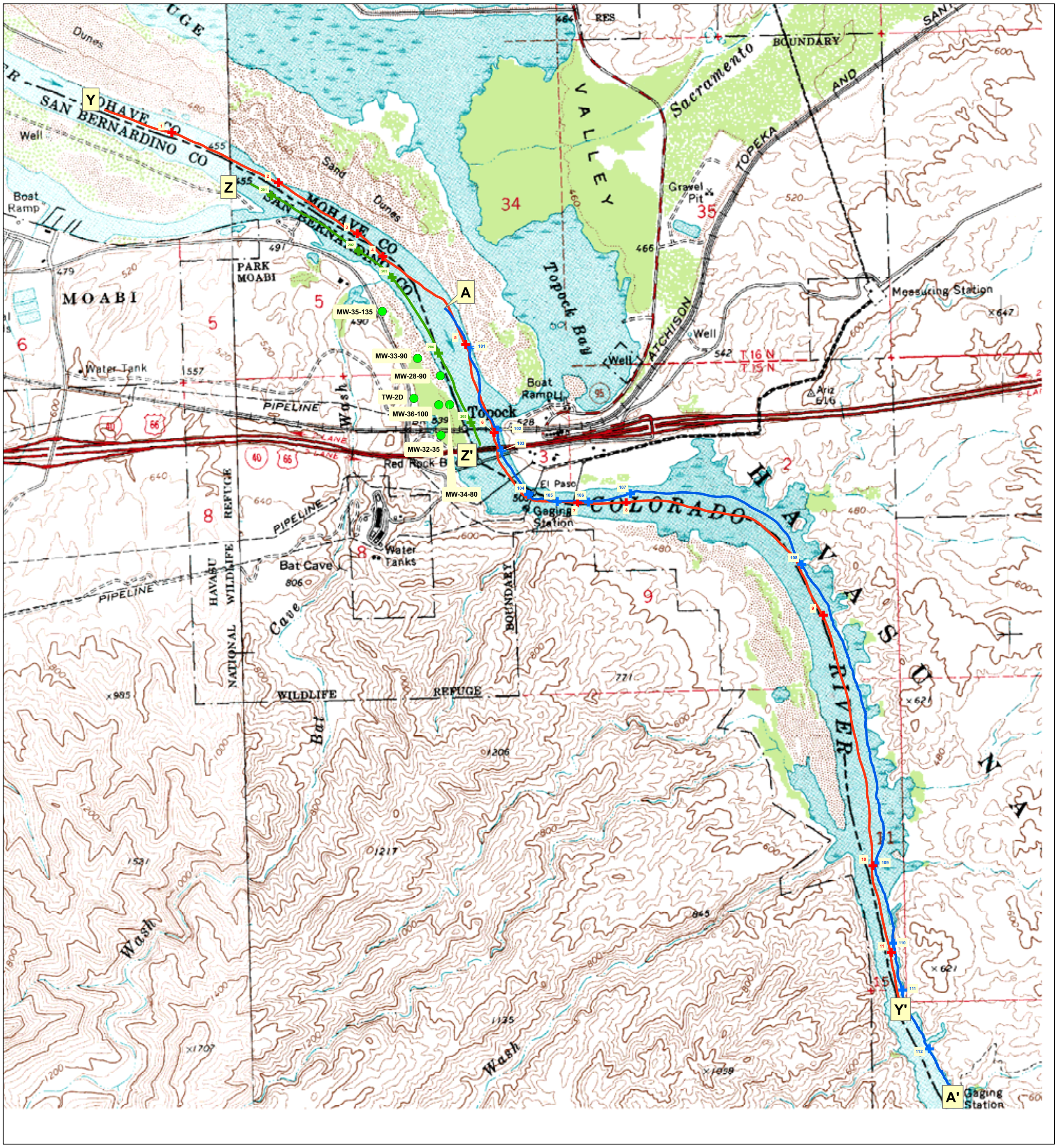
Figure 1B: Low-Frequency Boomer Seismic Survey

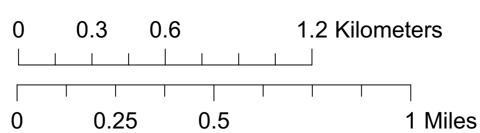


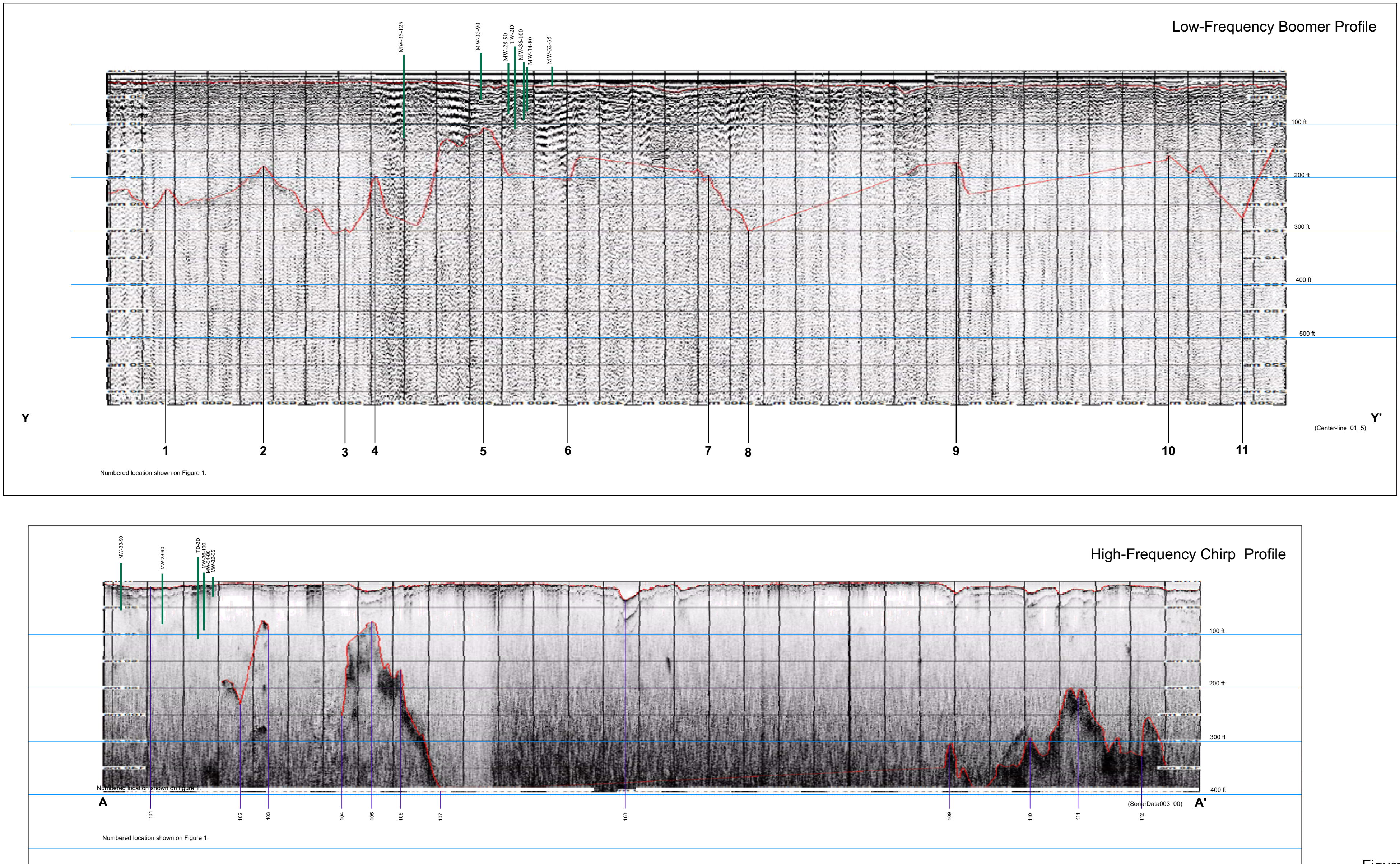
0 0.375 0.75 1.5 Kilometers

0 0.25 0.5 1 Miles

Figure 1C: Profile A-A', Y-Y', Z-Z'



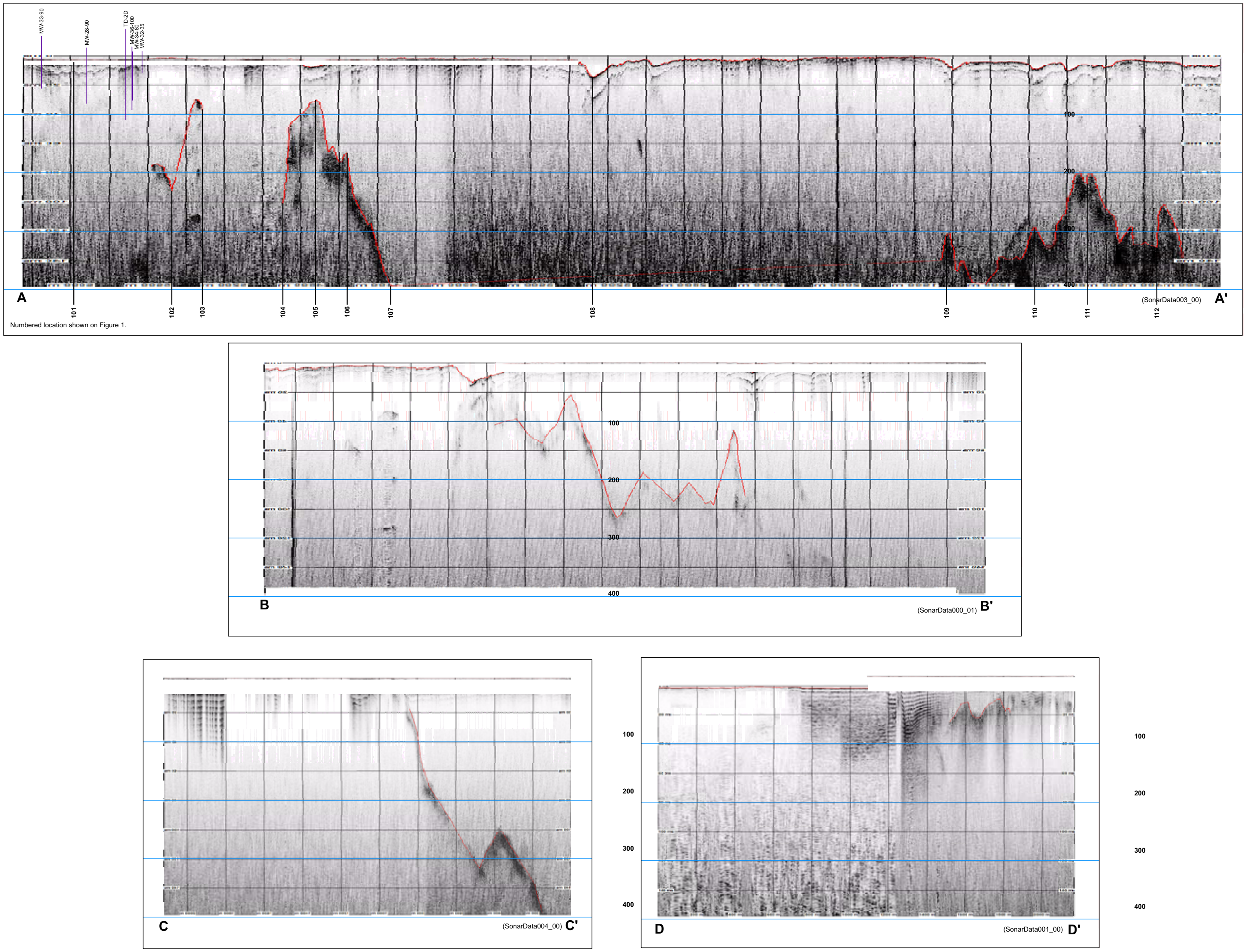


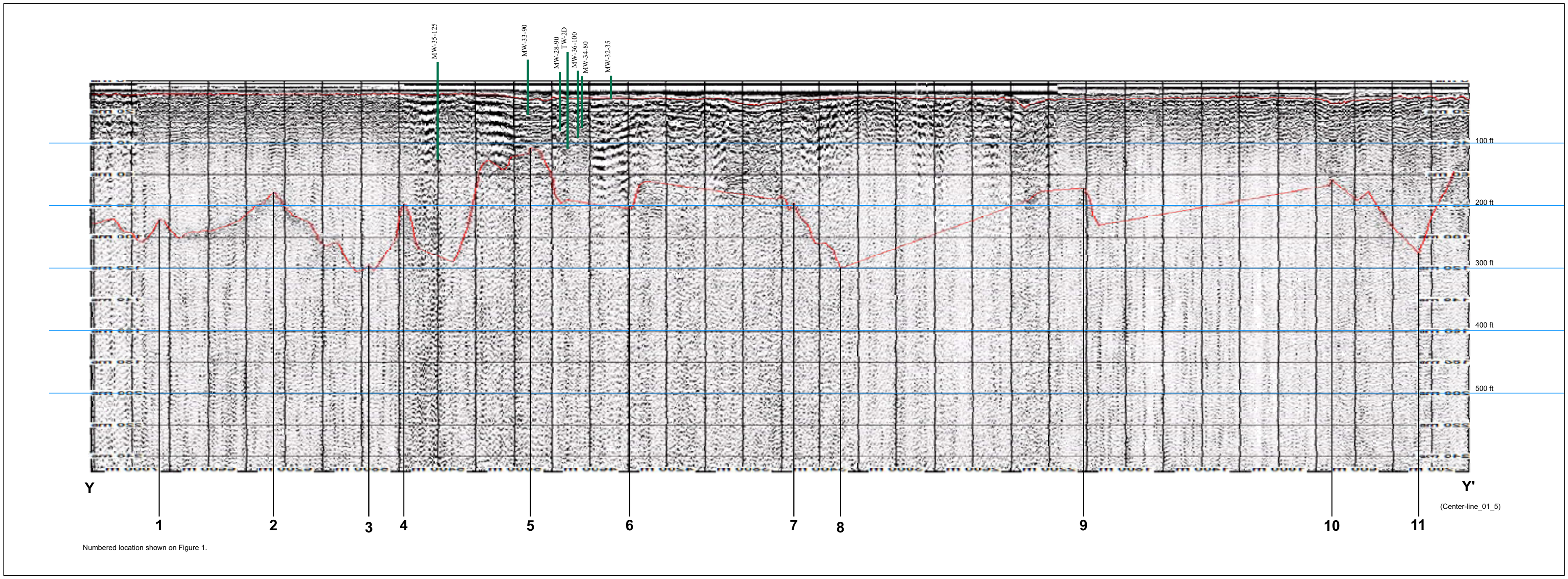


Low-Frequency Boomer Profile
MW-35-125
MW-33-90
MW-28-90
TW-2D
MW-36-100
MW-34-80
MW-32-35
100 ft
200 ft
300 ft
400 ft
500 ft
Y
Y'
(Center-line_01_5)
1
2
3
4
5
6
7
8
9
10
11
Numbered location shown on Figure 1.
High-Frequency Chirp Profile
MW-33-90
MW-28-90
TD-2D
MW-36-100
MW-34-80
MW-32-35
100 ft
200 ft
300 ft
400 ft
A
A'
(SonarData003_00)
101
102
103
104
105
106
107
108
109
110
111
112
Numbered location shown on Figure 1.

Figure 2

Figure 3: High-Frequency Chirp Profiles





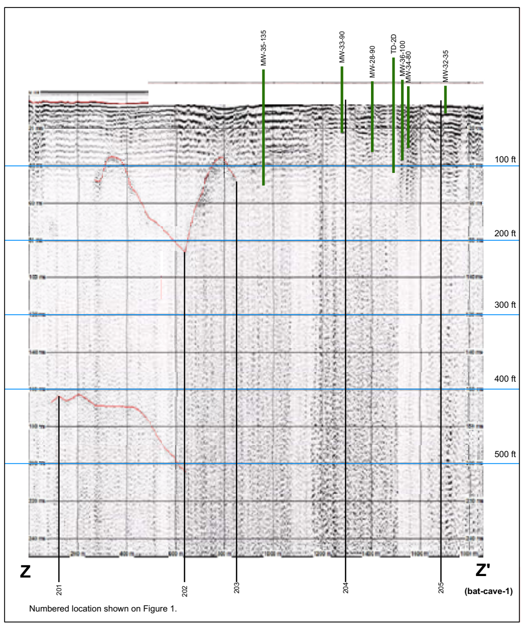


Figure 4: Low-Frequency Boomer Profiles

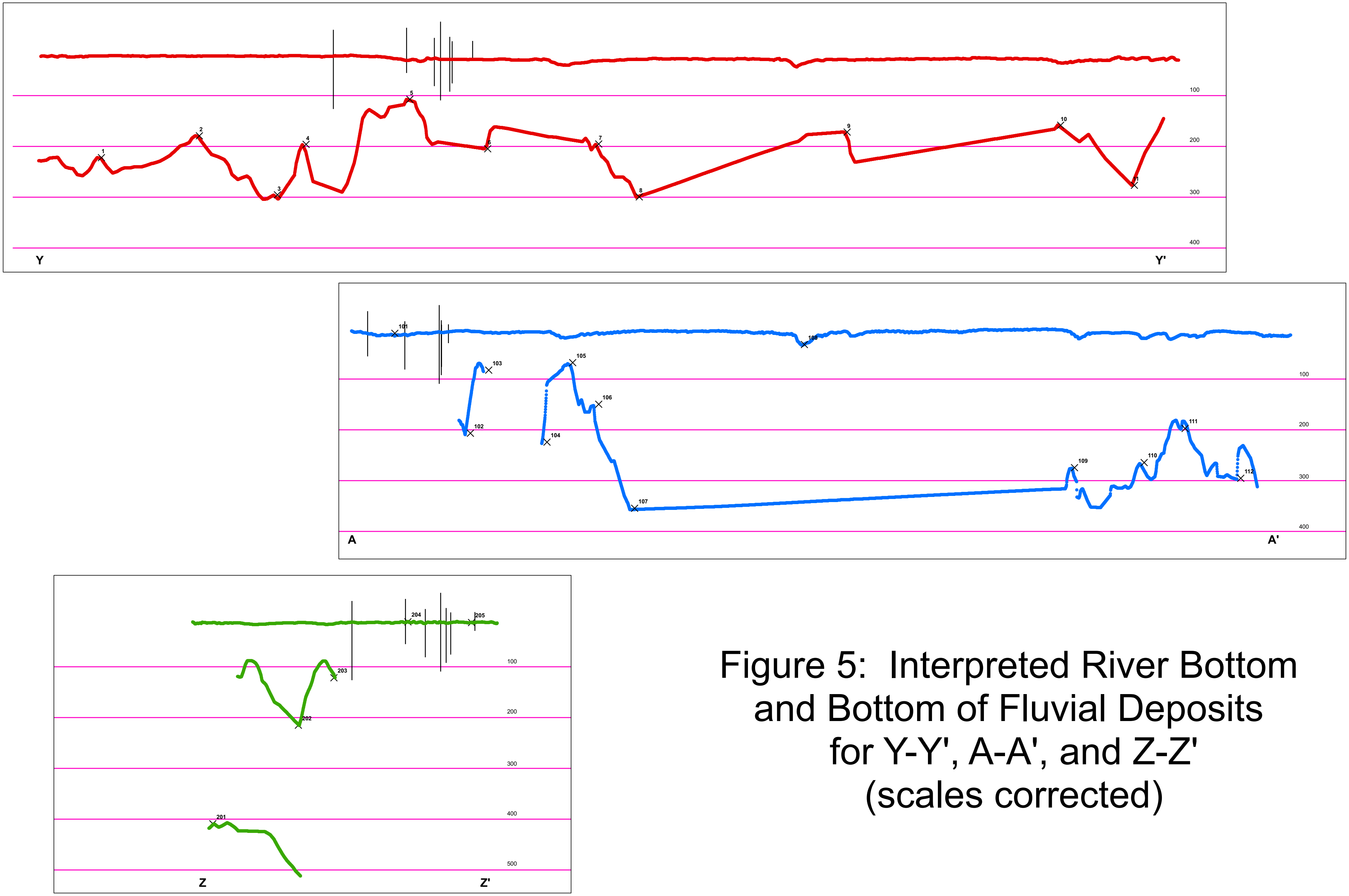


Figure 5: Interpreted River Bottom and Bottom of Fluvial Deposits for Y-Y', A-A', and Z-Z' (scales corrected)

Appendix D
Hydraulic Testing Data

D1 Summary Information for RFI and Other Hydraulic Testing

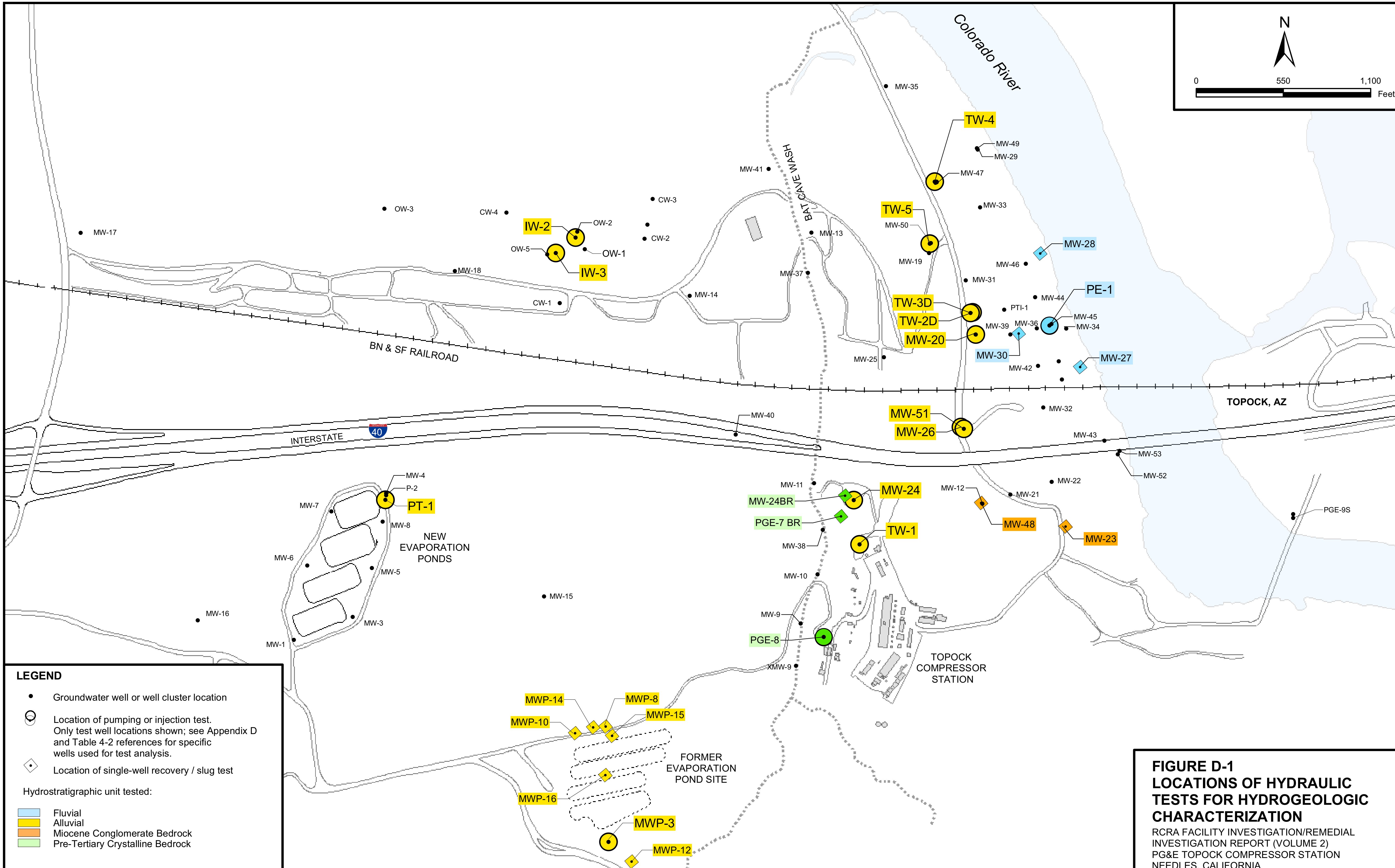


FIGURE D-1
LOCATIONS OF HYDRAULIC TESTS FOR HYDROGEOLOGIC CHARACTERIZATION
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2007\RFI\RFI_LOC_HYDTESTS_FIG4-4.MXD RFI_LOC_HYDTESTS_FIG4-4 2/6/2008 16:17:29

TABLE 4-3
Summary of Hydraulic Tests for Hydrogeologic Characterization
RCRA Facility Investigation/Remedial Investigation Report (Volume 2)
PG&E Topock Compressor Station

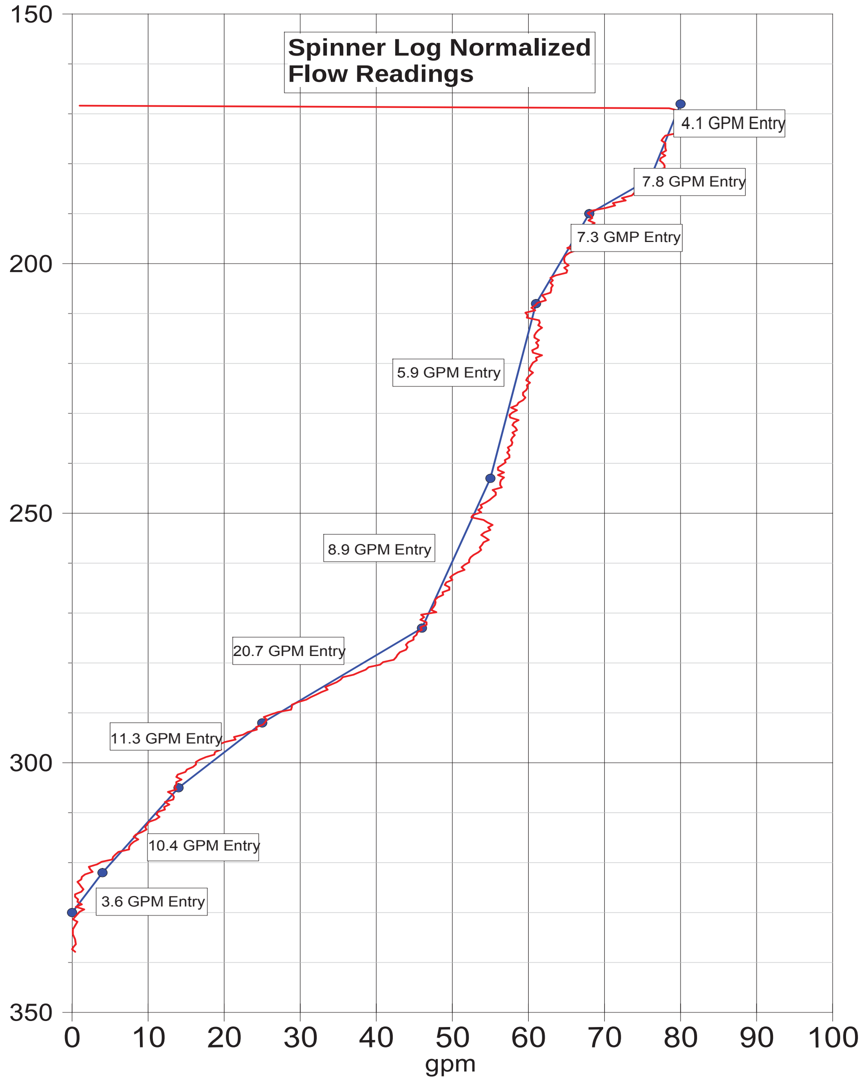
Wells Tested	Well Type	HSU / Aquifer Tested	Hydraulic Tests	Test Date	Reference
Pre-RFI Hydraulic Testing					
PT-1	test well (New Ponds)	Toa - alluvial	Constant Rate Test	14-Jan-87	PG&E-TES, 1995
MWP-3	monitoring well (Old Ponds)	Toa - alluvial	Constant Rate Test	2-Aug-92	PG&E-TES, 1995
MWP-8, -9, -10, -12	monitoring well (Old Ponds)	Toa - alluvial	Recovery (Slug) Test	2-Aug-92	PG&E-TES, 1995
MWP-14, -15, -16	monitoring well (Old Ponds)	Toa - alluvial	Recovery (Slug) Test	2-Aug-92	PG&E-TES, 1995
RFI - 2002 Hydraulic Testing					
MW-20-100	monitoring well	Toa - alluvial	Constant Rate Test	29-Jan-02	E&E, 2002
MW-20-130	monitoring well	Toa - alluvial	Constant Rate Test	30-Jan-02	E&E, 2002
MW-24B	monitoring well	Toa - alluvial	Constant Rate Test	31-Jan-02	E&E, 2002
MW-23	monitoring well	Tmc - bedrock	Recovery (Slug-out) Test	31-Jan-02	E&E, 2002
MW-24BR	monitoring well	pTbr - bedrock	Recovery (Slug-out) Test	29-Jan-02	E&E, 2002
MW-27	monitoring well	Qr3 - fluvial	Recovery (Slug-in) Test	30-Jan-02	E&E, 2002
MW-28-25	monitoring well	Qr3 - fluvial	Recovery (Slug-in) Test	1-Feb-02	E&E, 2002
MW-30-30	monitoring well	Qr3 - fluvial	Recovery (Slug-in) Test	1-Feb-02	E&E, 2002
IM Investigation Testing					
TW-1	test well	Toa - alluvial	Step Test	21-Nov-03	CH2M HILL, 2003e
			Spinner Test Velocity Log	15-Dec-03	CH2M HILL, 2003e
TW-2S	extraction well	Toa - alluvial	Constant Rate Test	30-Apr-04	CH2M HILL, 2005a
TW-2D	extraction well	Toa - alluvial	Constant Rate Test	5-May-04	CH2M HILL, 2005a
TW-2S & TW-2D	extraction well	Toa - alluvial	Constant Rate Test	9-May-04	CH2M HILL, 2005a
TW-3D	extraction well	Toa - alluvial	Step Test	17-Nov-05	CH2M HILL, 2005u
			Constant Rate Test	19-Dec-05	CH2M HILL, 2005u
PE-1	extraction well	Qr1 - fluvial	Step Test	5-Mar-05	CH2M HILL, 2005v
TW-4	test well	Toa - alluvial	Constant Rate Test	13-Jun-06	CH2M HILL, 2006o
TW-5	test well	Toa - alluvial	Step Test	6-May-06	CH2M HILL, 2006o
			Constant Rate Test	11-May-06	CH2M HILL, 2006o
MW-26	monitoring well	Toa - alluvial	Constant Rate Extraction Test	12-May-06	CH2M HILL, 2006o
MW-51	monitoring well	Toa - alluvial	Constant Rate Extraction Test	12-May-06	CH2M HILL, 2006o
IM Injection Area Testing					
IW-2	injection well	Toa - alluvial	Constant Rate Extraction Test	6-Jan-05	CH2M HILL, 2005w
			Constant Rate Injection Test #1	8-Jan-05	CH2M HILL, 2005w
			Constant Rate Injection Test #2	9-Jan-05	CH2M HILL, 2005w
			Step Test	22-Dec-05	CH2M HILL, 2005w
			Spinner Test Velocity Log	22-Dec-05	CH2M HILL, 2005w
IW-3	injection well	Toa - alluvial	Constant Rate Extraction Test	14-Jan-05	CH2M HILL, 2005w
			Constant Rate Injection Test	20-Jan-05	CH2M HILL, 2005w
			Step Test	14-Jan-05	CH2M HILL, 2005w
			Spinner Test Velocity Log	12-Jan-05	CH2M HILL, 2005w
Bedrock Hydraulic Testing					
PGE-8	former injection well	pTbr - bedrock	Constant Rate Extraction Test	11-Aug-07	CH2M HILL, 2008i
			Constant Rate Injection Test	19-Aug-07	CH2M HILL, 2008i
PGE-7BR	test well	pTbr - bedrock	Recovery (Slug-out) Test	14-Nov-07	CH2M HILL, 2008i
MW-48	monitoring well	Tmc - bedrock	Recovery (Slug-out) Test	4-Oct-07	CH2M HILL, 2008i

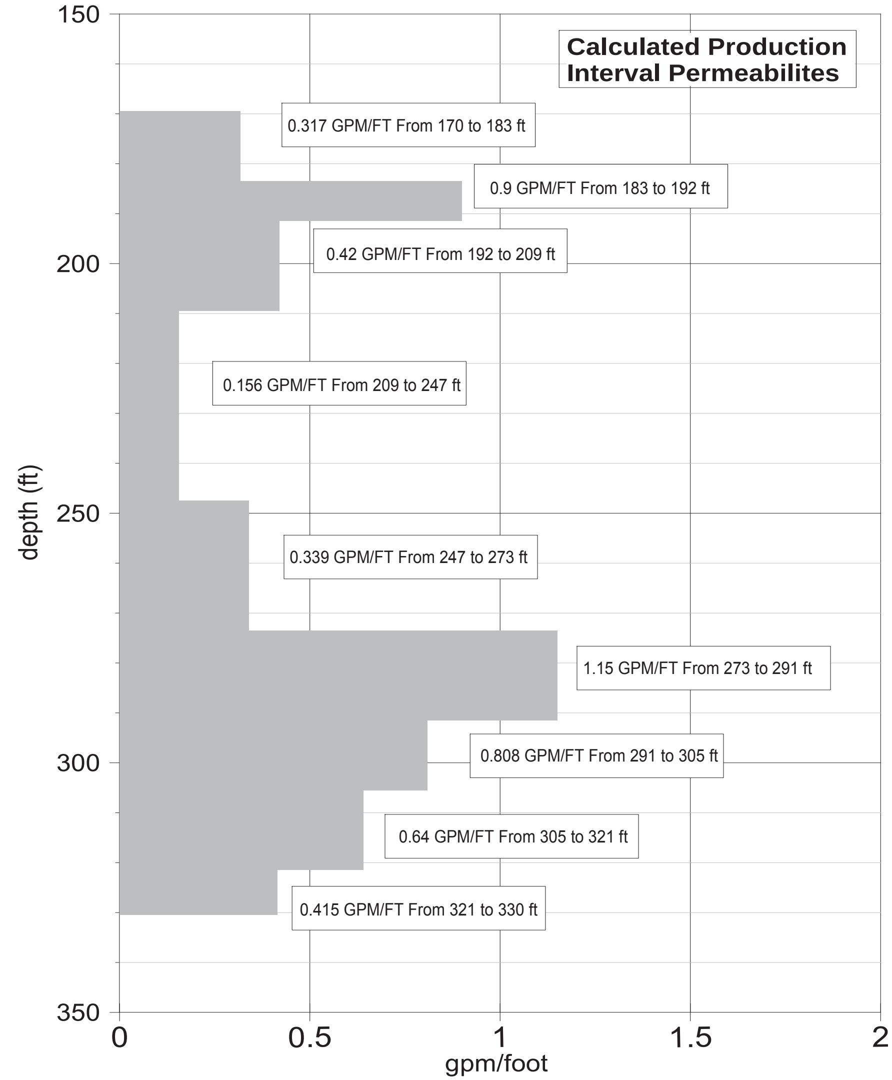
Notes:

1. Aquifer types and site hydrostratigraphic units (HSUs) are defined in Table 3-1
2. Test plots and documentation for the hydraulic tests listed are included in Appendix D

D2 Spinner Velocity Logging

(Provided only on CD ROM)

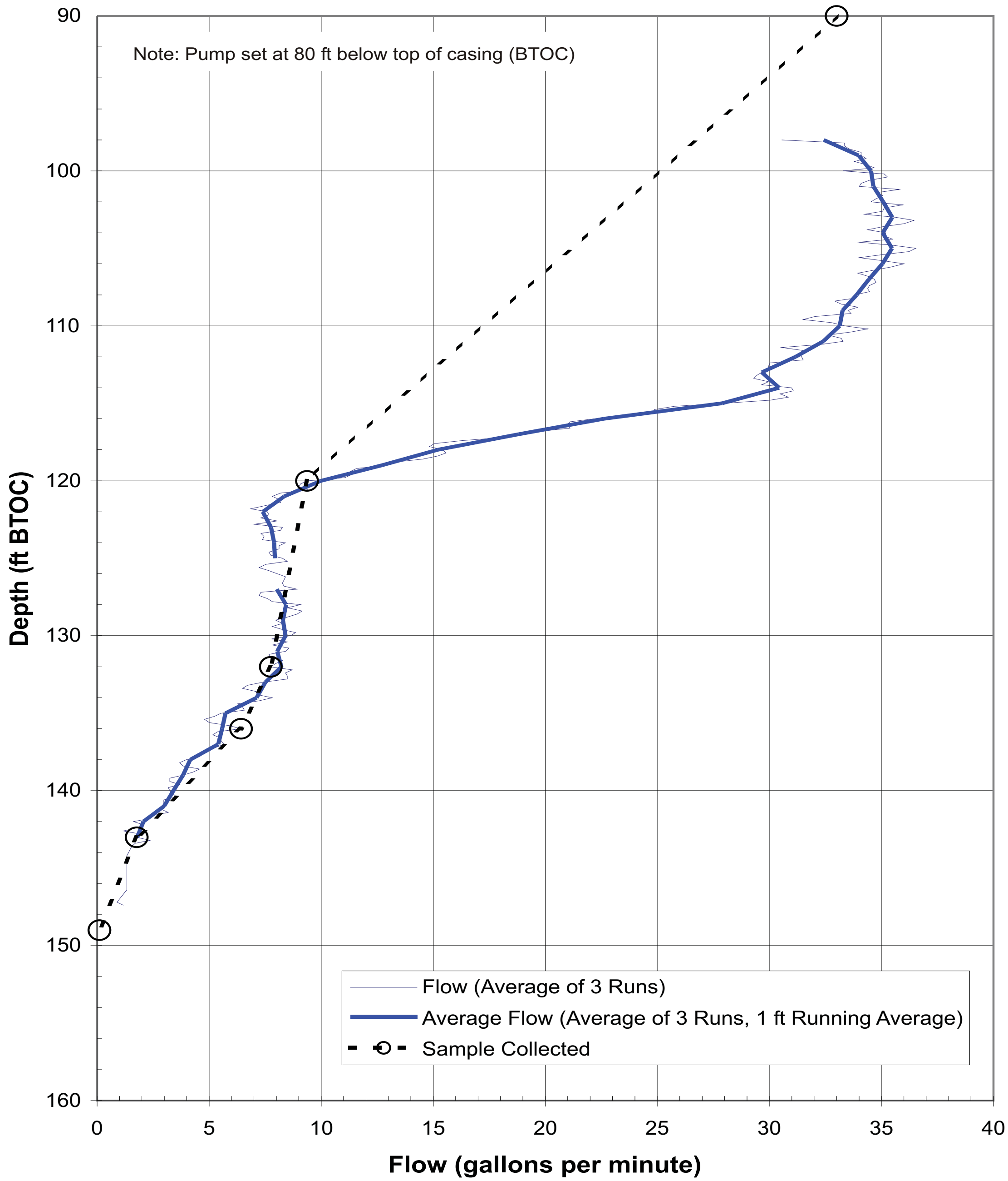




Notes:
Spinner test conducted at IW-2 on 12/22/2004 at 80 gpm.
Log and Production Evaluation provided by Walenco Inc.

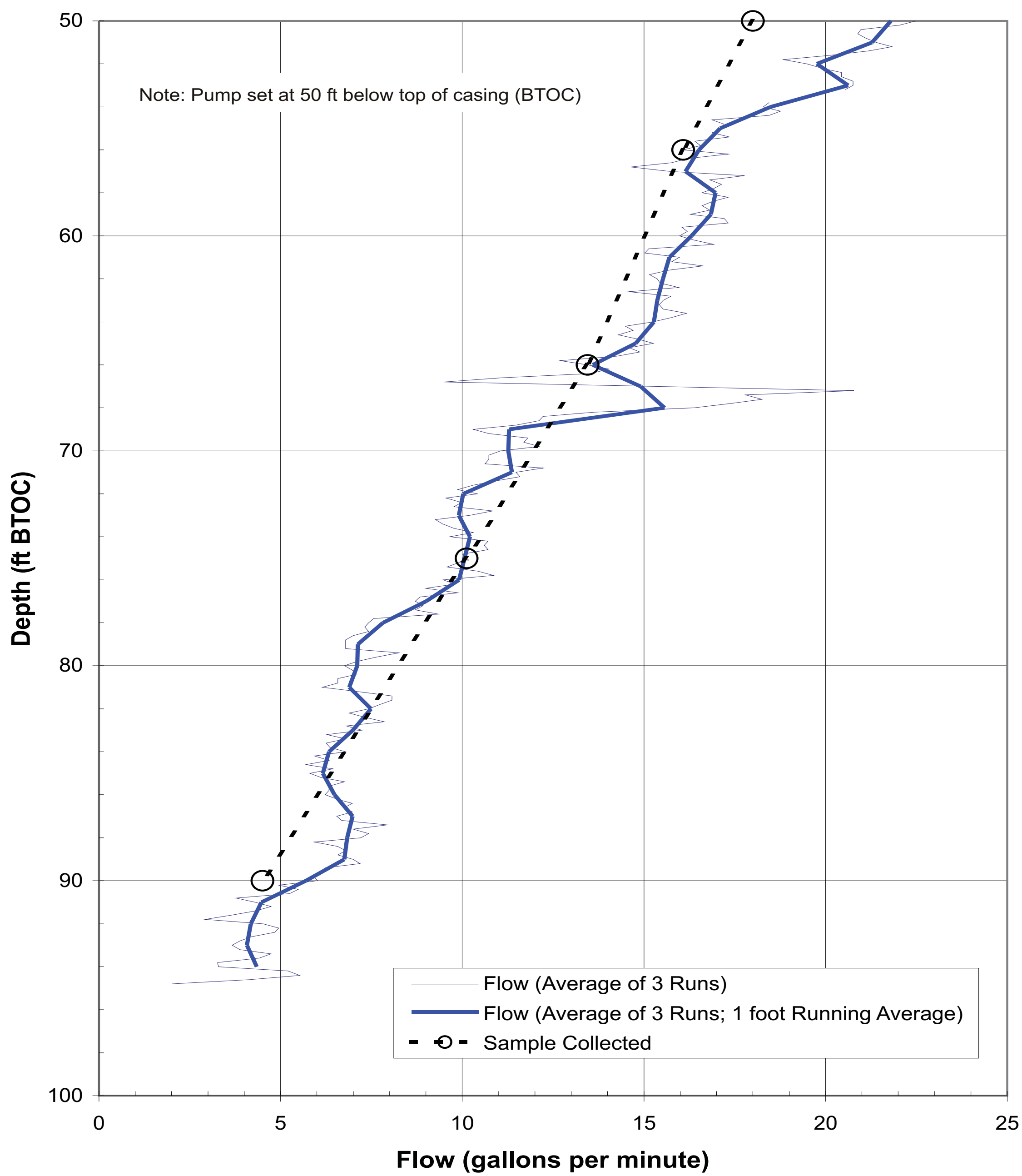
APPENDIX D-2A
IW-2 SPINNER TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D-2B
TW-2D SPINNER FLOW
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT
(VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

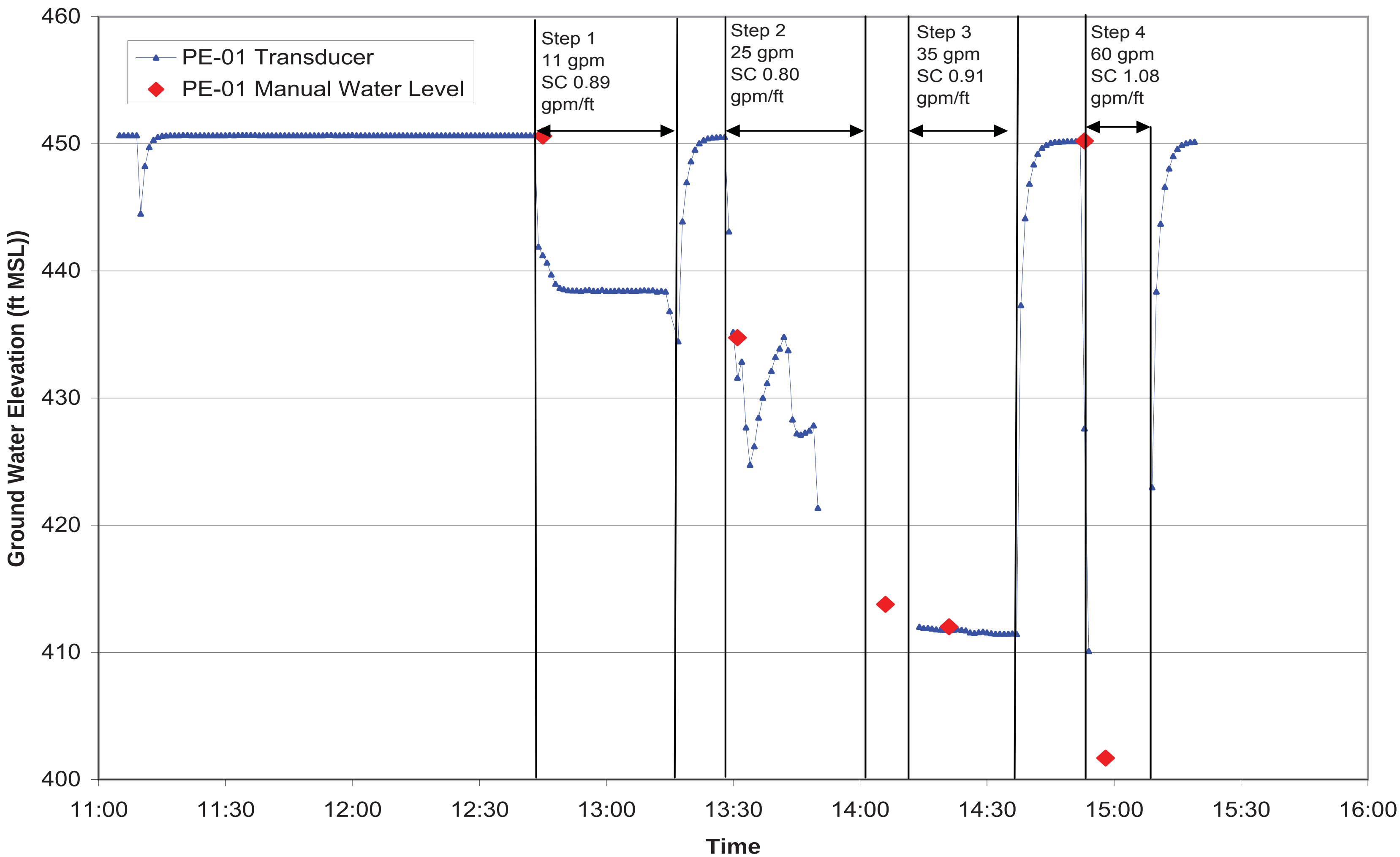
CH2MHILL



APPENDIX D-2C
TW-2S SPINNER FLOW
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT
(VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

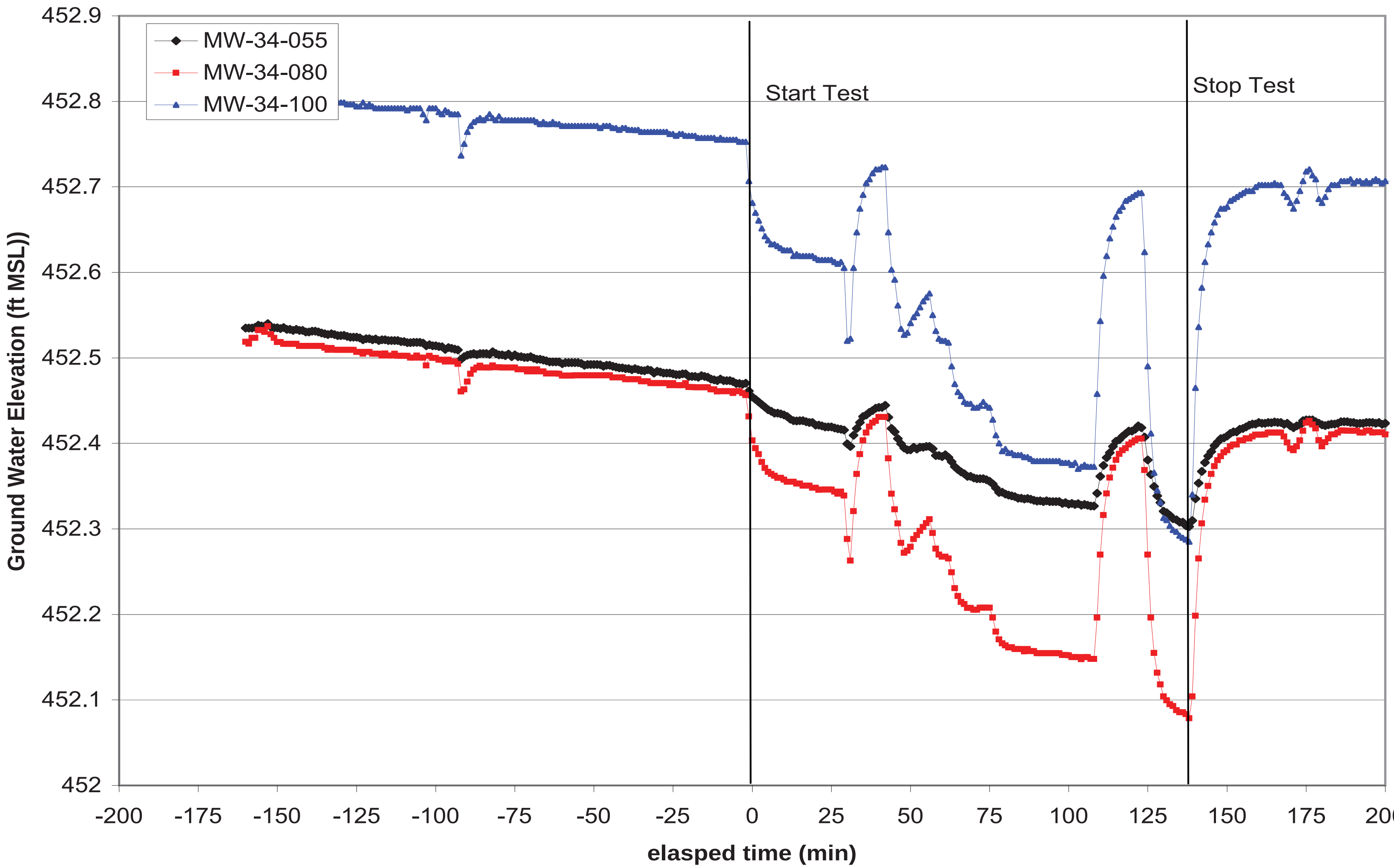
D3 Drawdown Step Tests

(Provided only on CD ROM)



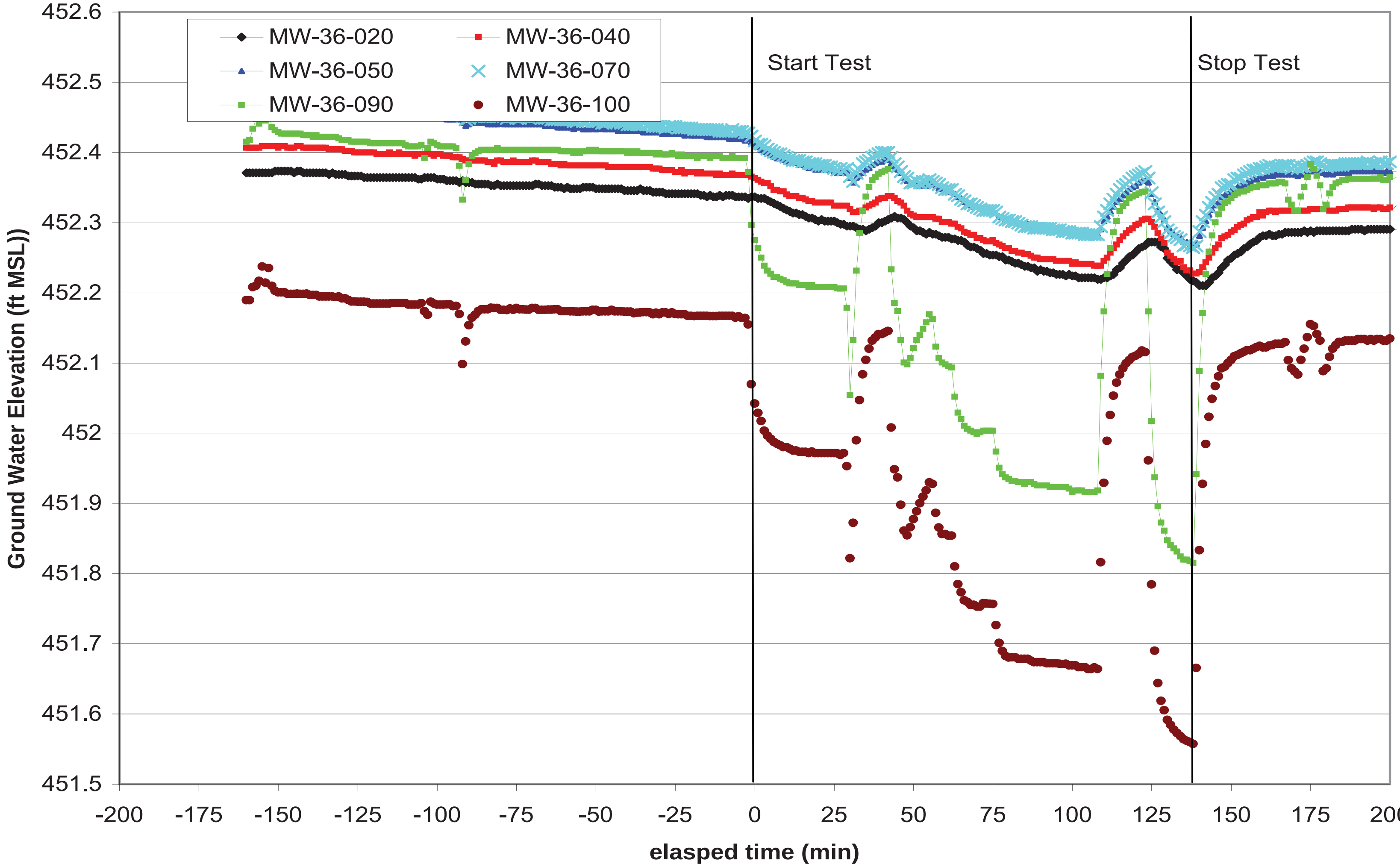
APPENDIX D-3A
DRAWDOWN IN PE-1 EXTRACTION WELL
DURING MARCH 5, 2005 STEP TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D-3B
DRAWDOWN IN MW-34 CLUSTER DURING PE-1 EXTRACTION WELL STEP TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

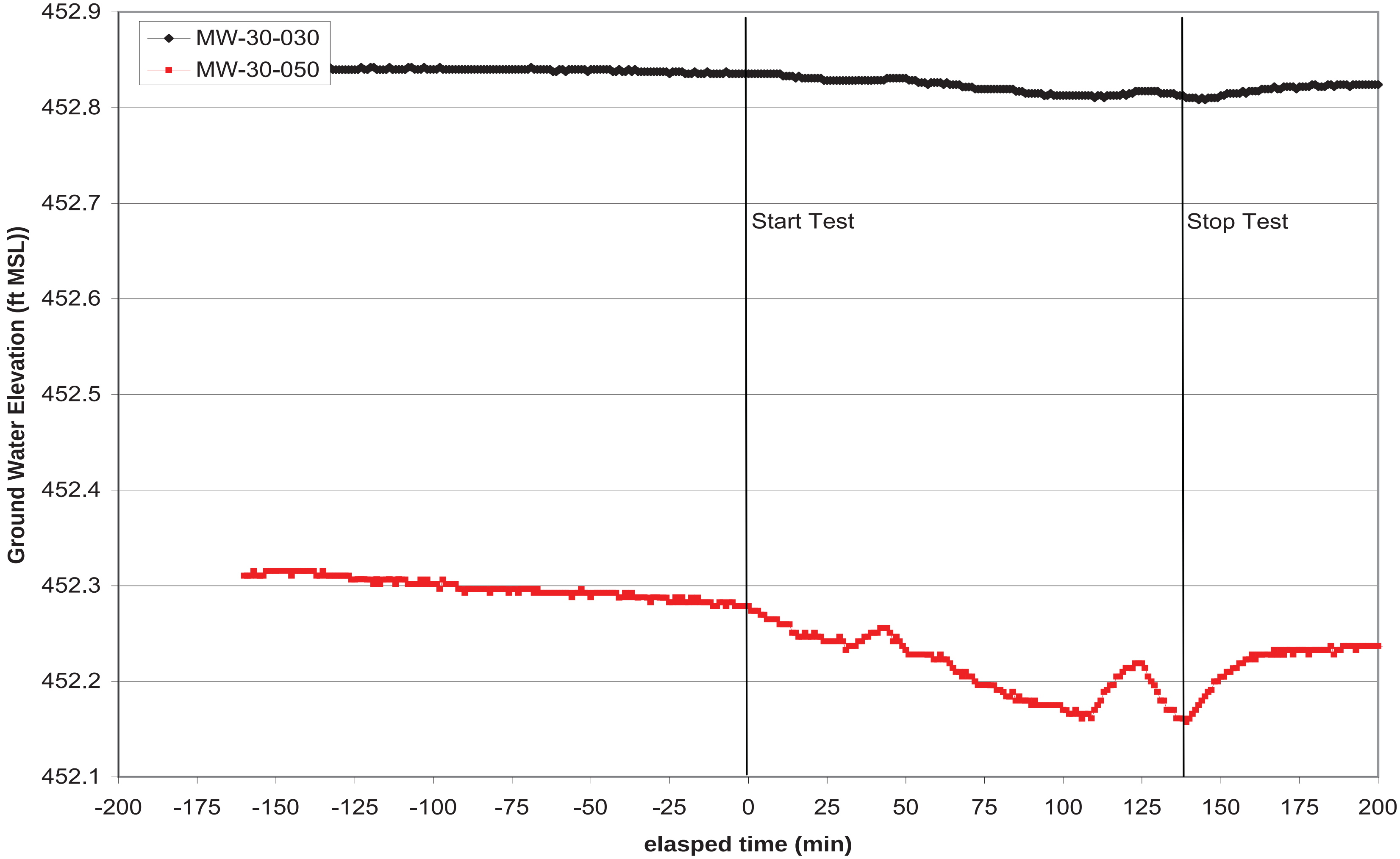


APPENDIX D-3C
DRAWDOWN IN MW-36 CLUSTER DURING PE-1 EXTRACTION WELL STEP TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

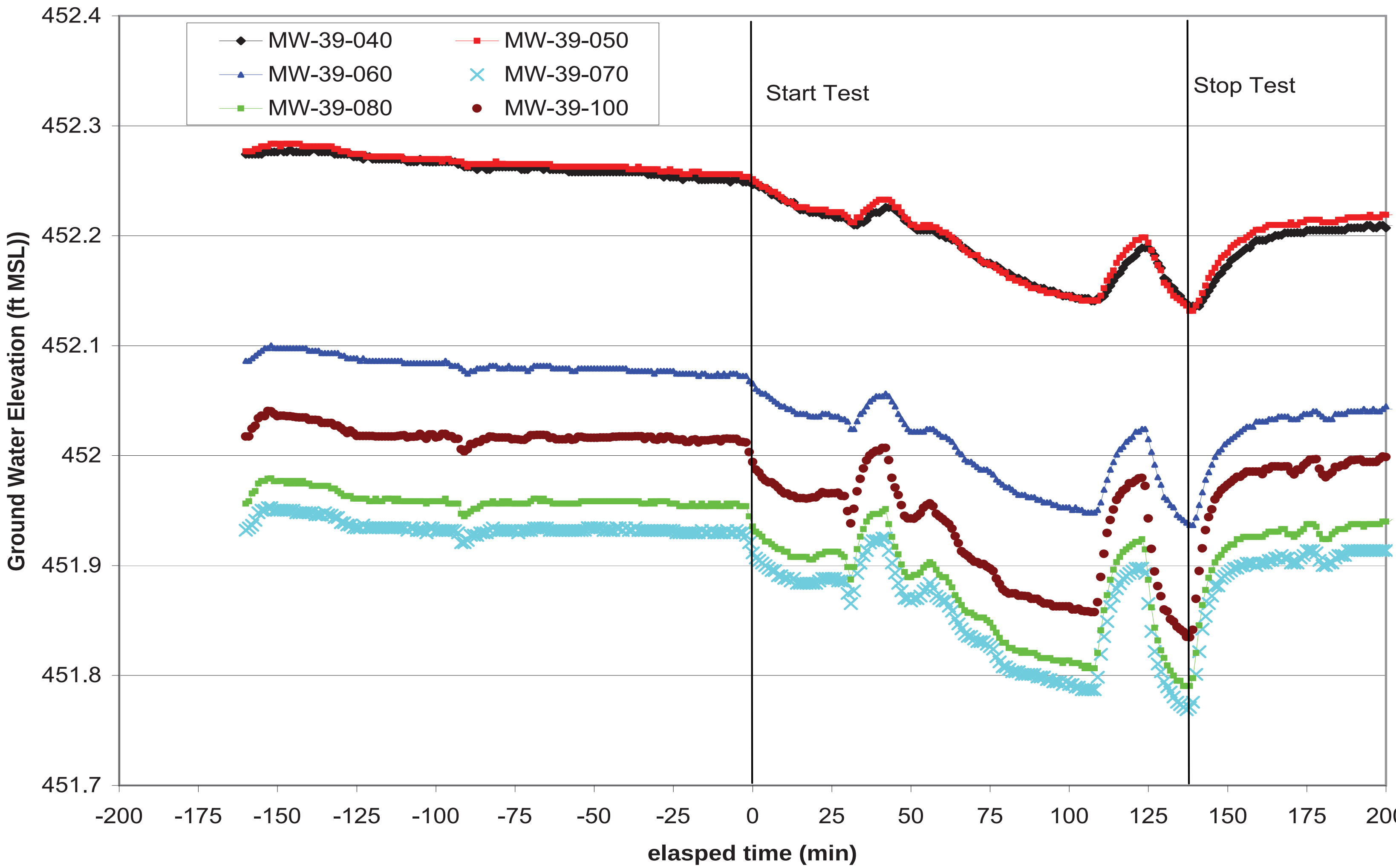
ES102007005BAO_Appendix_D_figures.indd_022808_lho



APPENDIX D-3D
DRAWDOWN IN MW-30 CLUSTER DURING PE-1 EXTRACTION WELL STEP TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

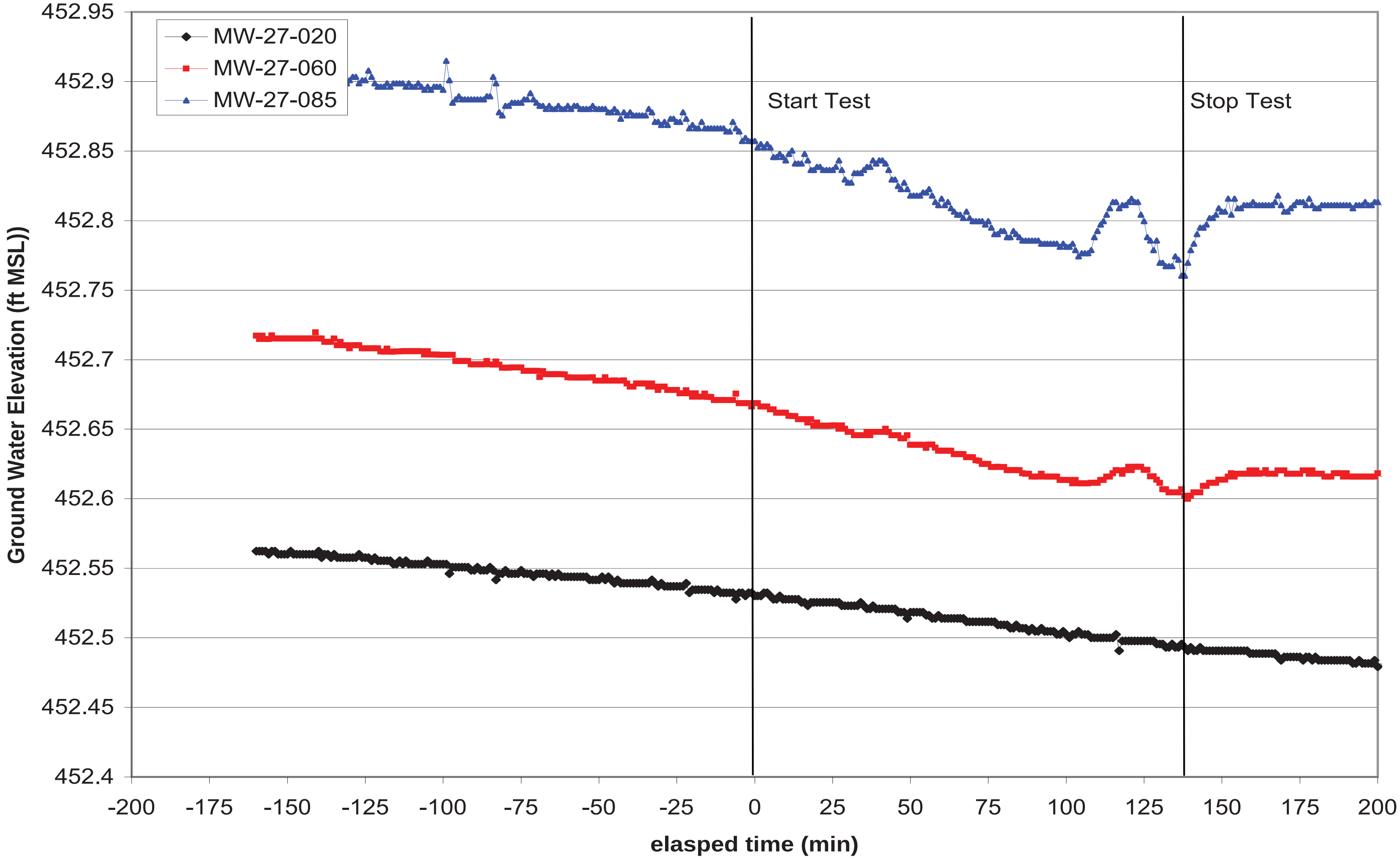


APPENDIX D-3E
DRAWDOWN IN MW-39 CLUSTER DURING PE-1 EXTRACTION WELL STEP TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

ES102007005BAO_Appendix_D_figures.indd_022808_lho



APPENDIX D-3F
DRAWDOWN IN MW-27 CLUSTER DURING PE-1 EXTRACTION WELL STEP TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

ES102007005BAO_Appendix_D_figures.indd_022808_lho

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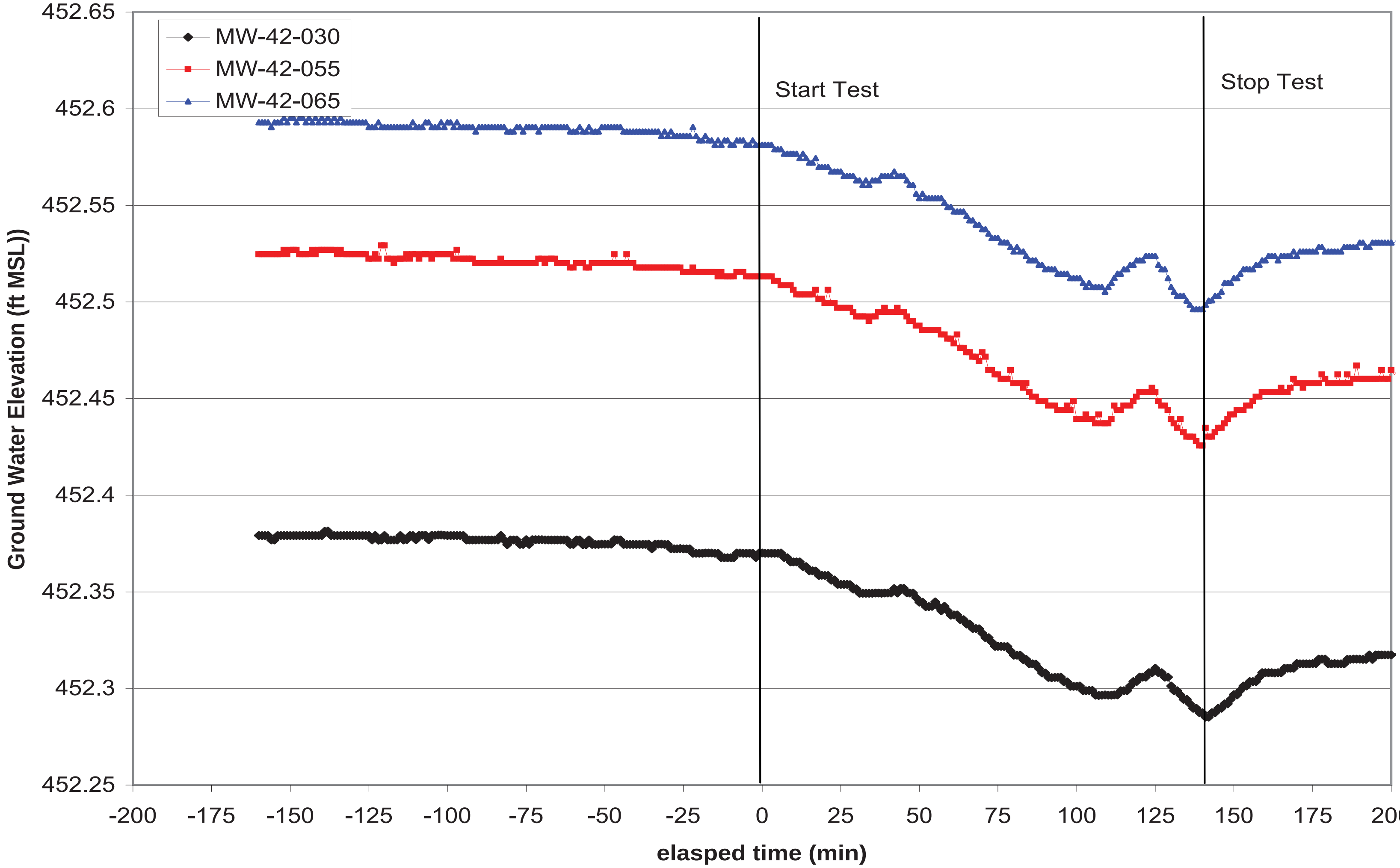
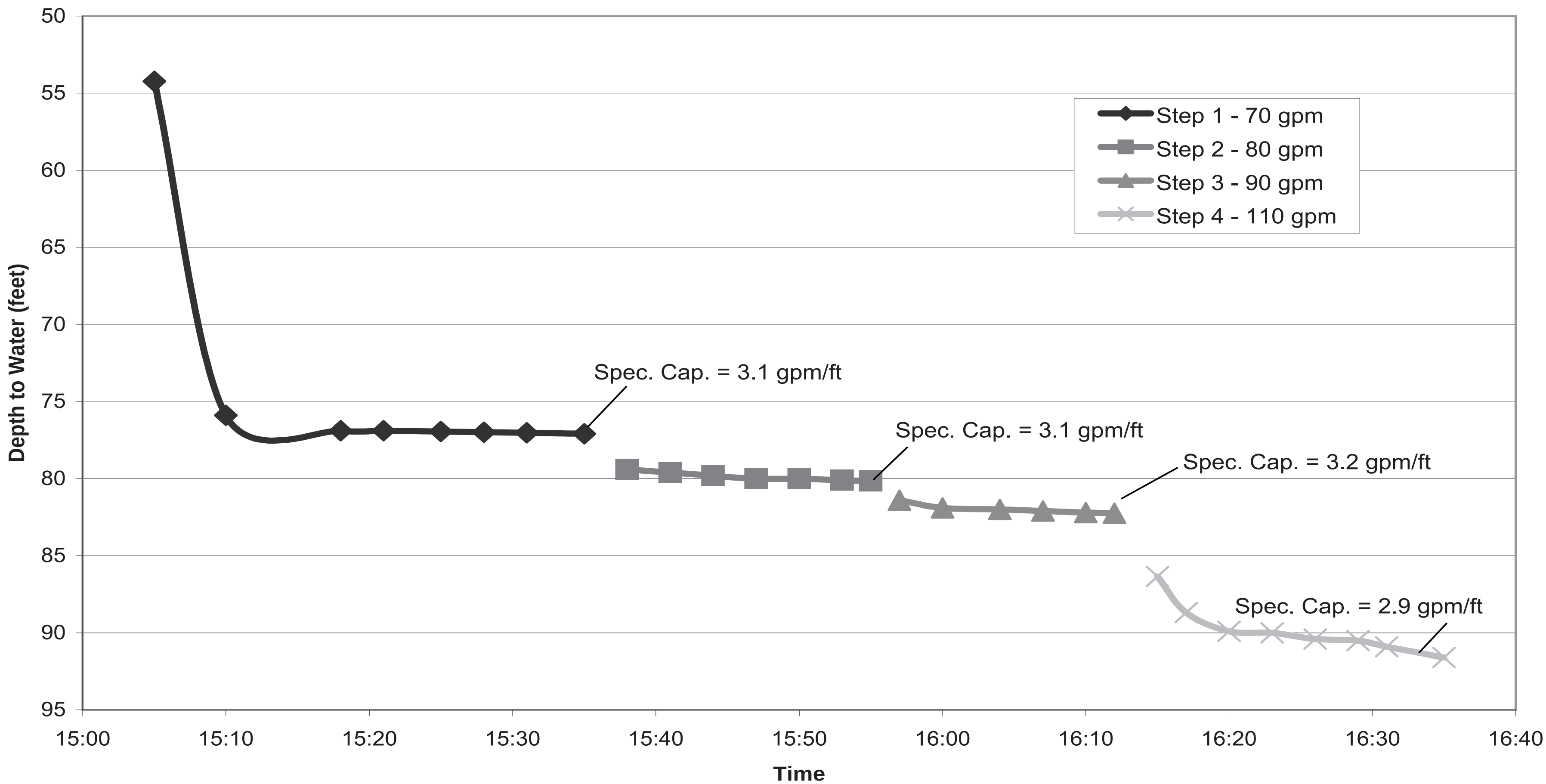


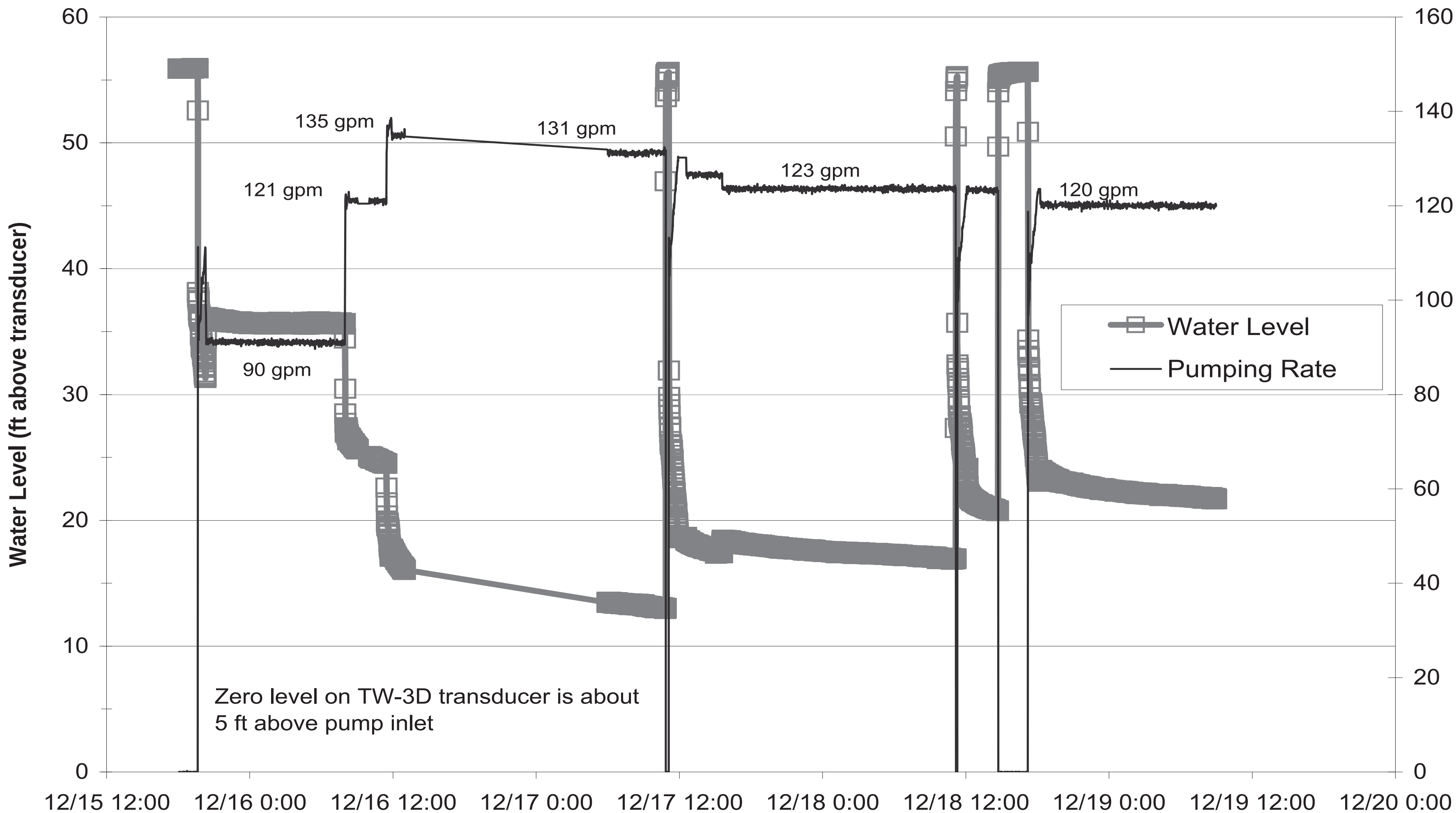
APPENDIX D-3G
DRAWDOWN IN MW-42 CLUSTER DURING PE-1 EXTRACTION WELL STEP TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



APPENDIX D-3H
EXTRACTION WELL TW-3D STEP-DRAWDOWN
NOVEMBER 17, 2005

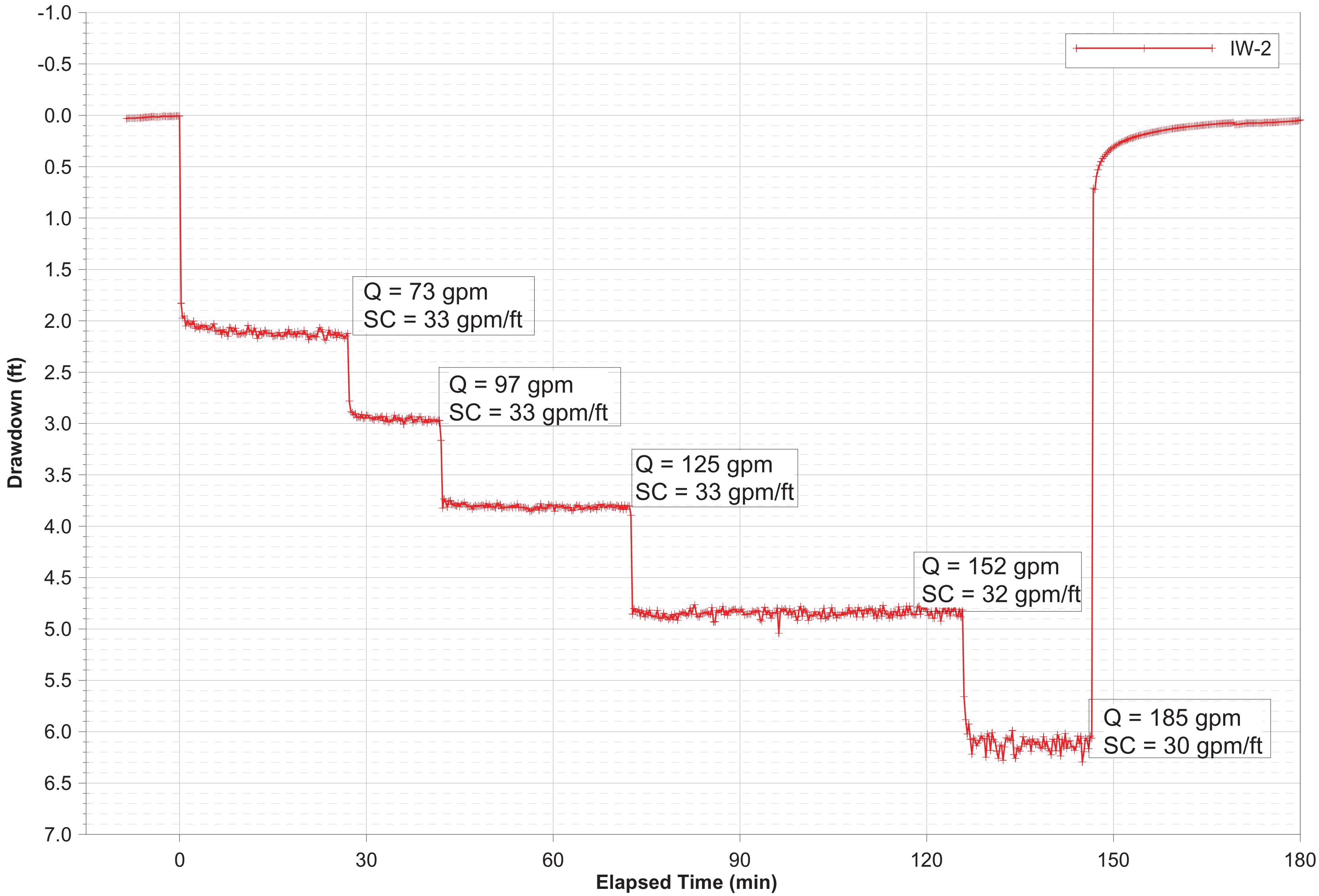
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D-3I
PUMPING RATE AND WATER LEVEL IN TW-3D DURING SHORT TERM TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

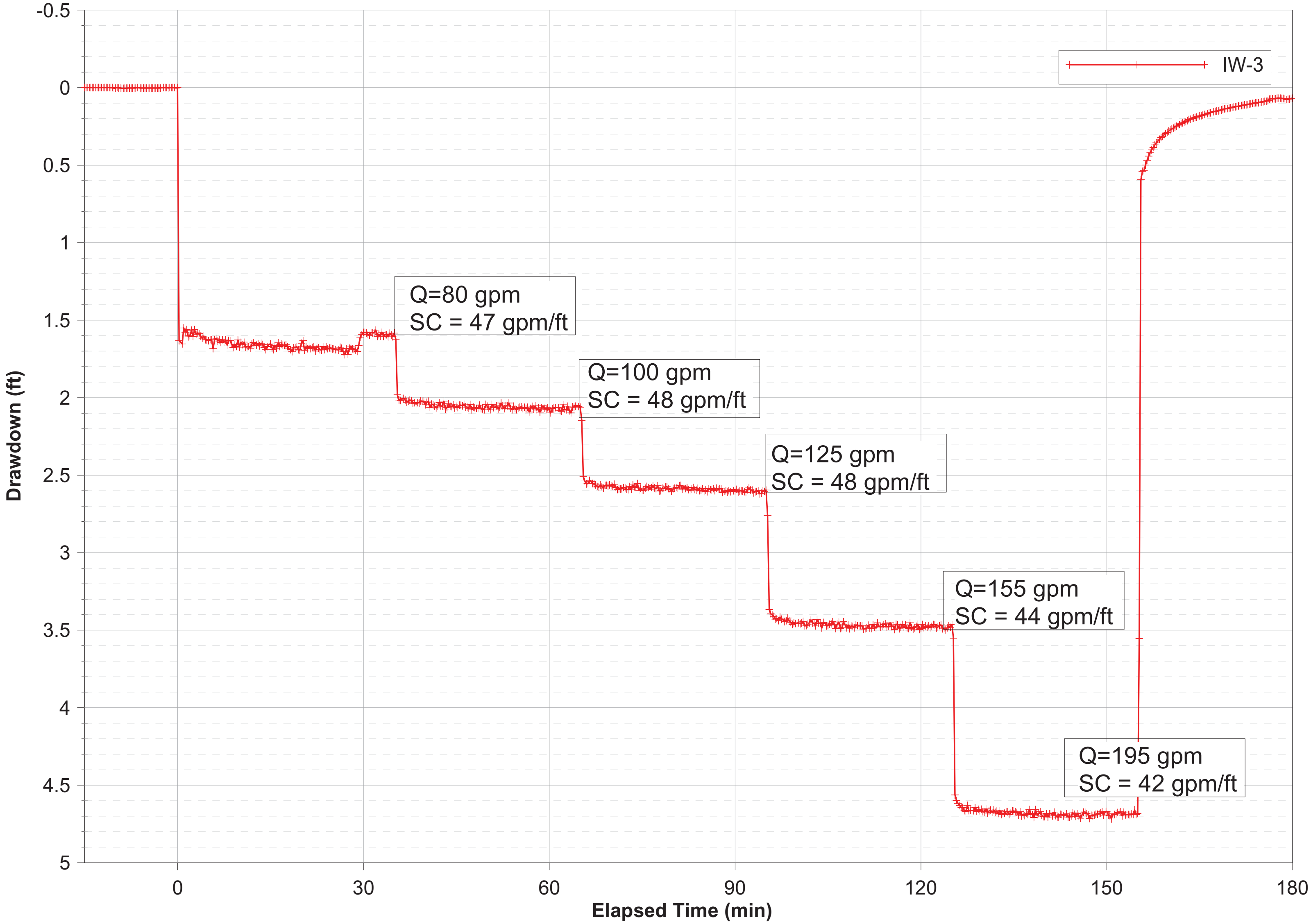
CH2MHILL



Notes:
Step test conducted at IW-2 on 12/22/2005.

APPENDIX D-3J
IW-2 STEP TEST DRAWDOWN AT IW-2
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

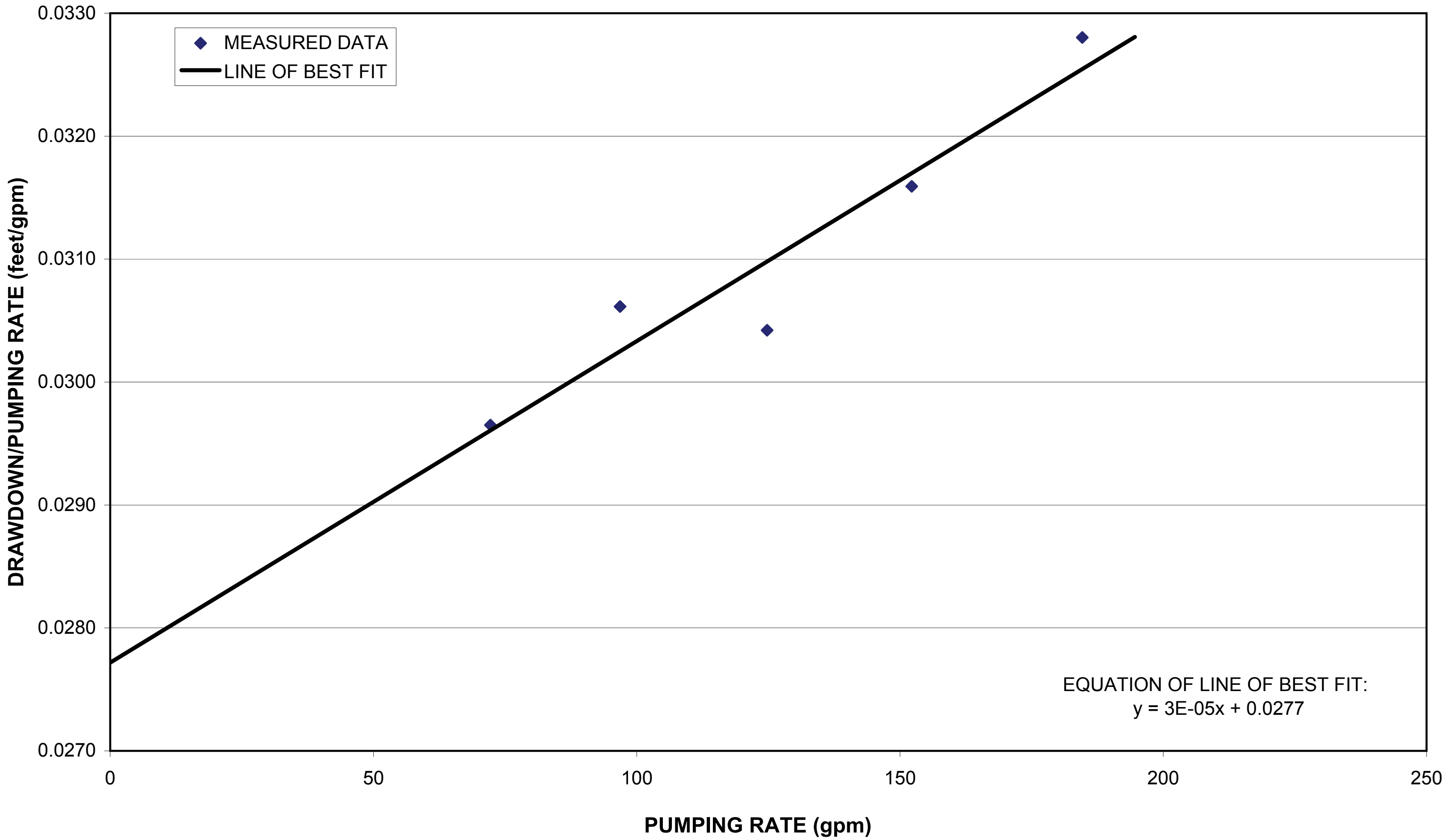
CH2MHILL



Notes:
Step test conducted at IW-3 on 1/14/2005.

APPENDIX D-3K
IW-3 STEP TEST DRAWDOWN AT IW-3
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

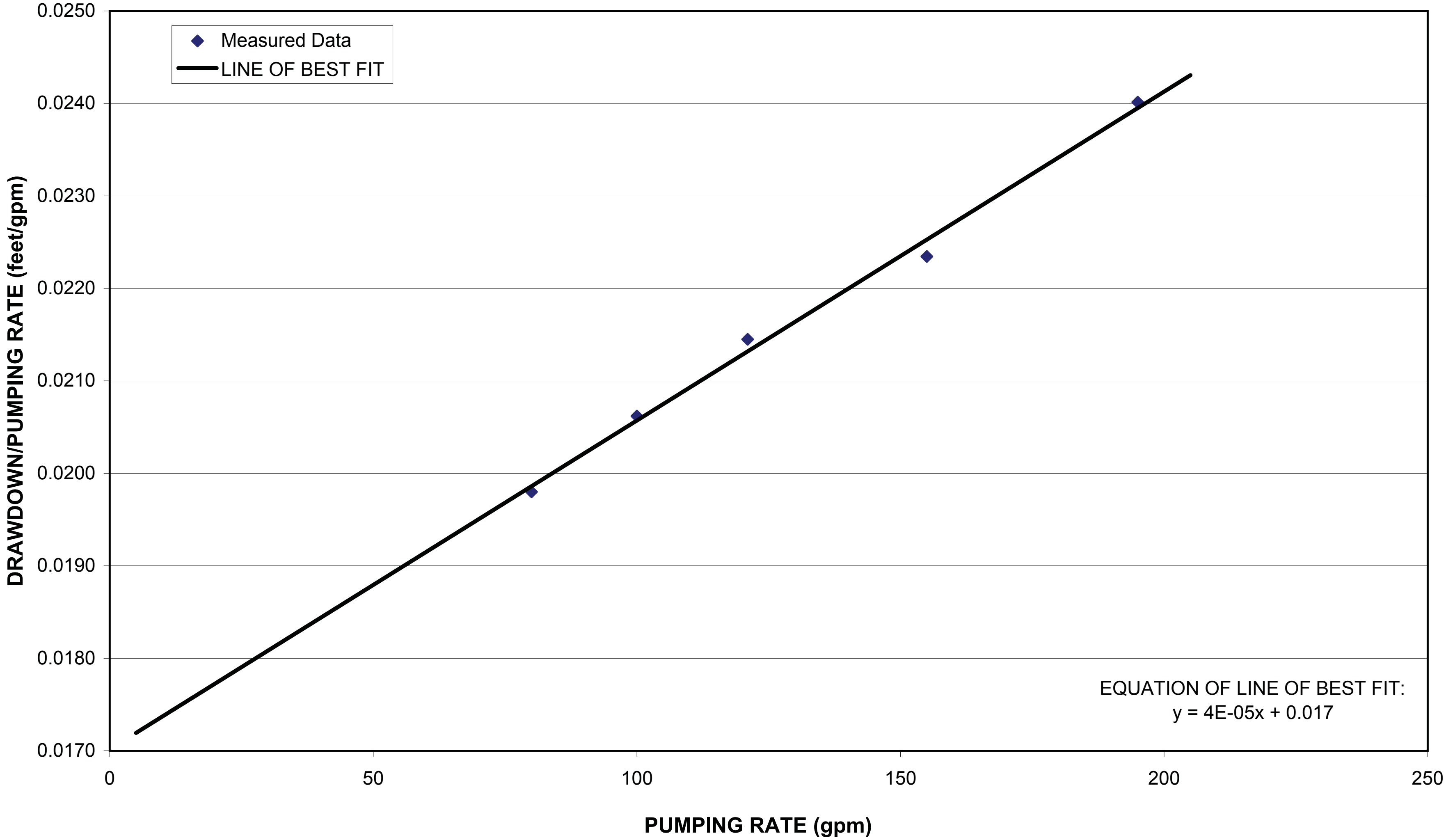
CH2MHILL



APPENDIX D-3L
HANTUSH-BIERSHENK PLOT OF IW-2 STEP TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

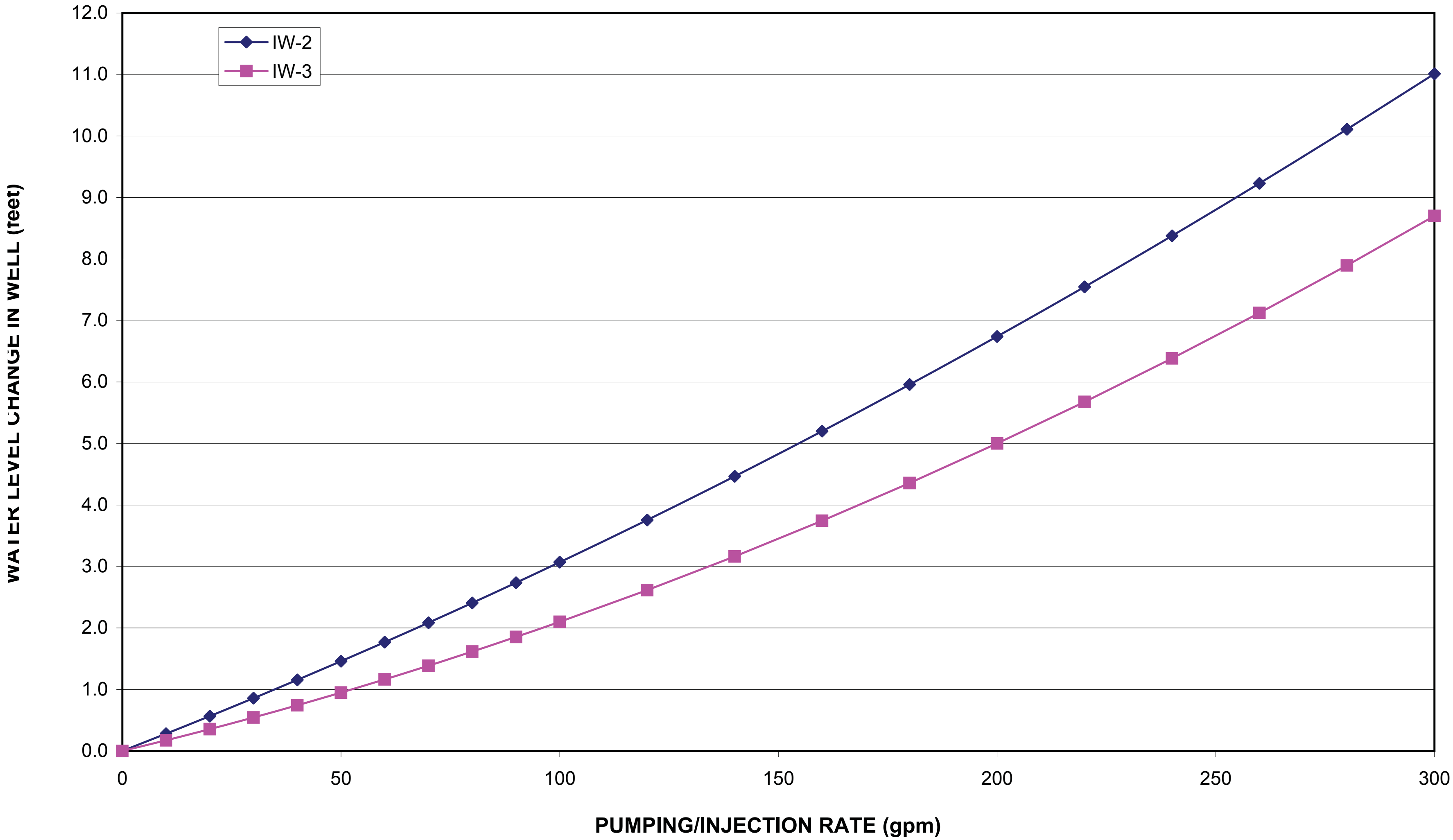
CH2MHILL



APPENDIX D-3M
HANTUSH-BIERSHENK PLOT OF IW-3 STEP TEST

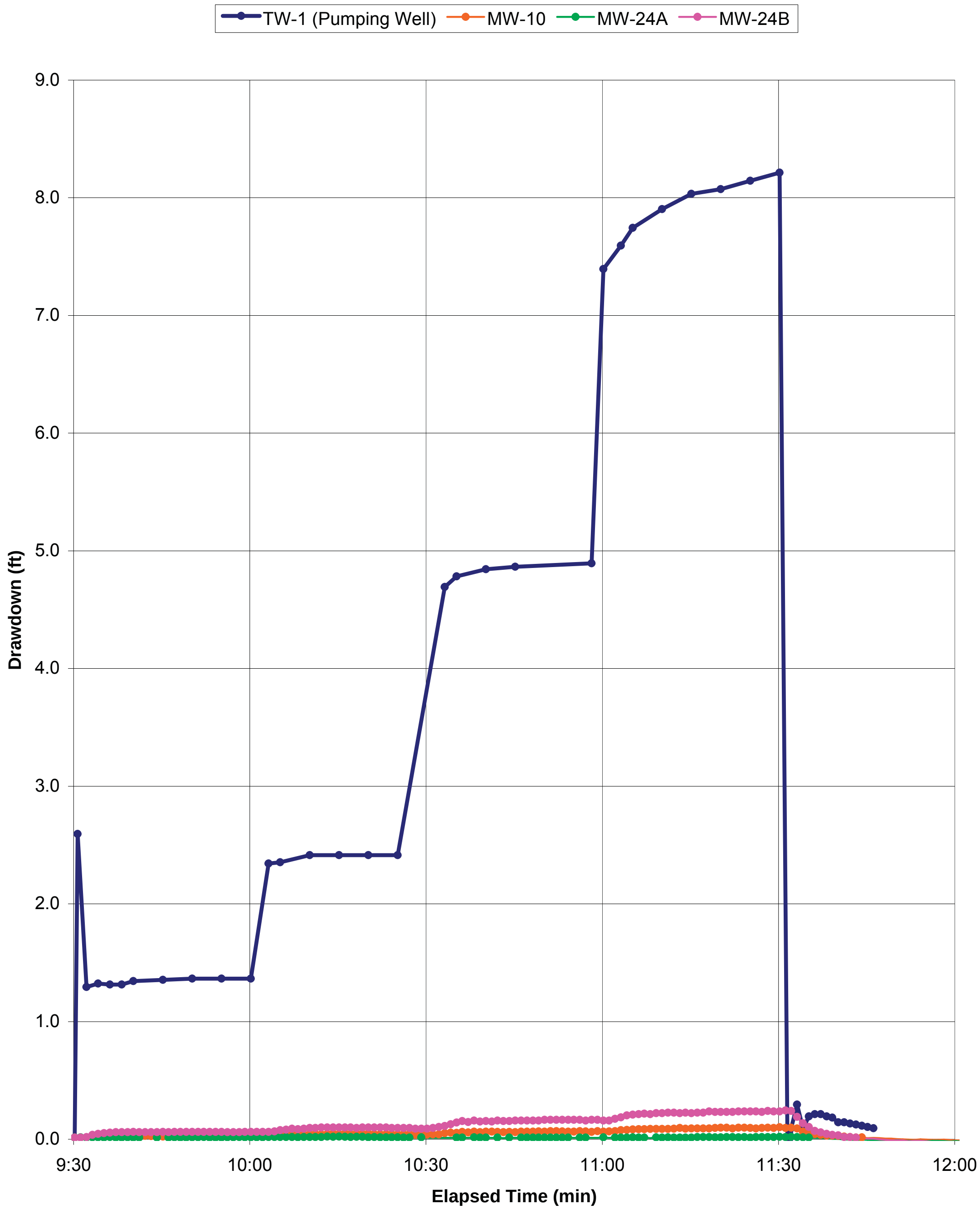
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



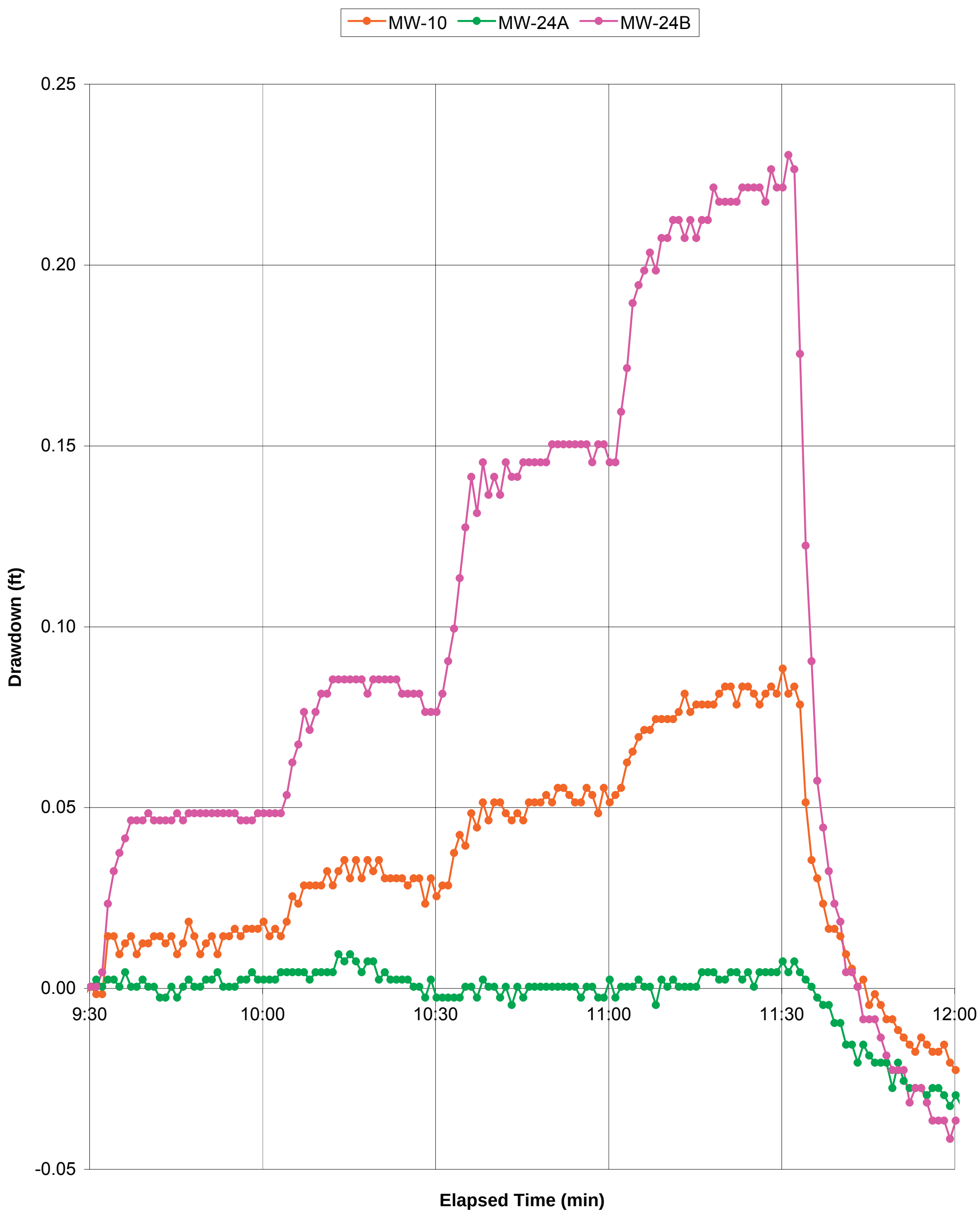
APPENDIX D-3N
PREDICTED WATER LEVEL CHANGE WITH CHANGE IN PUMPING/INJECTION RATE BASED ON BIERSHENK ANALYSIS OF STEP TEST DATA

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D-3O
TW-1 STEP TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

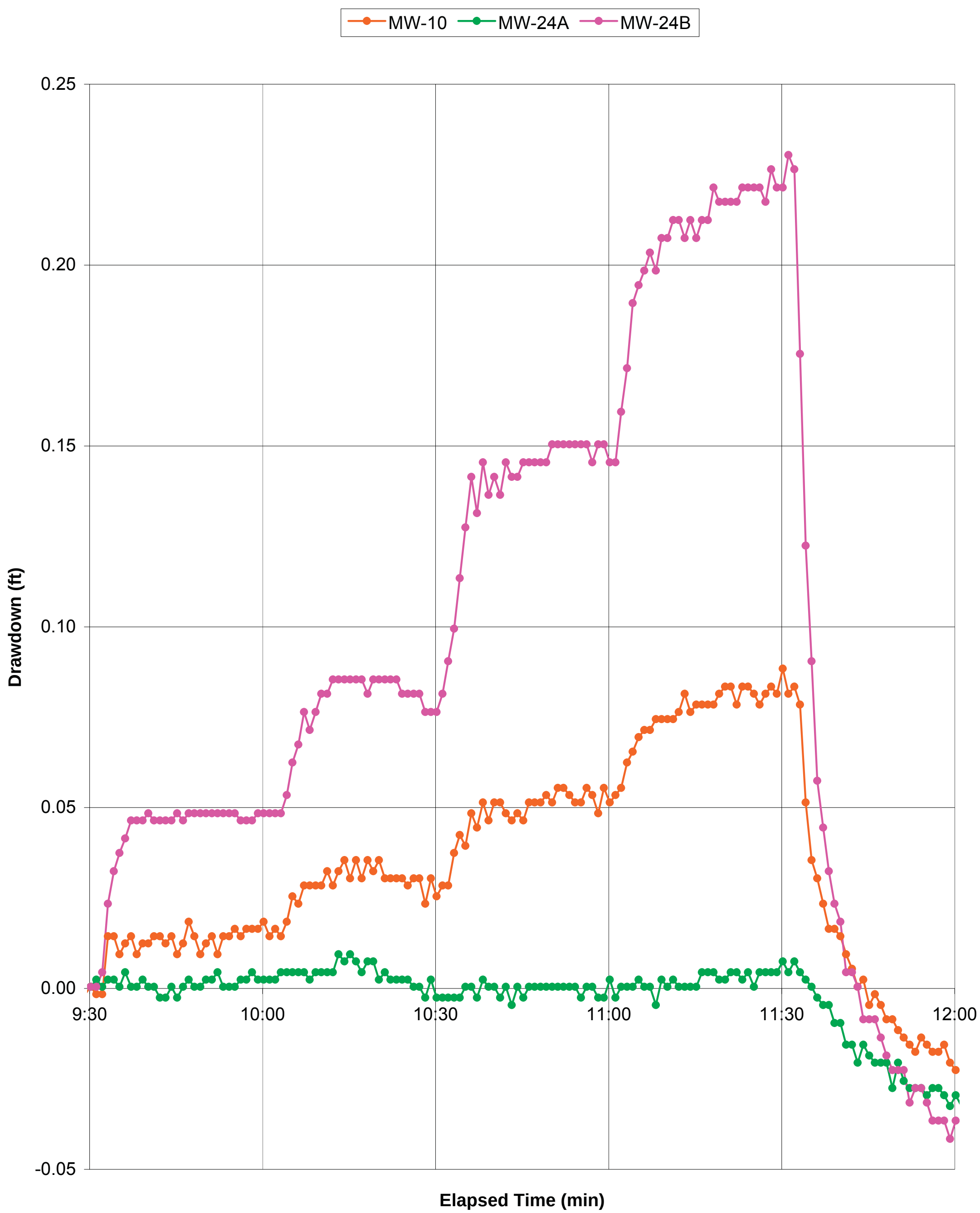
CH2MHILL



APPENDIX D-3P
TW-1 STEP TEST 2
MONITORING WELLS ONLY

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



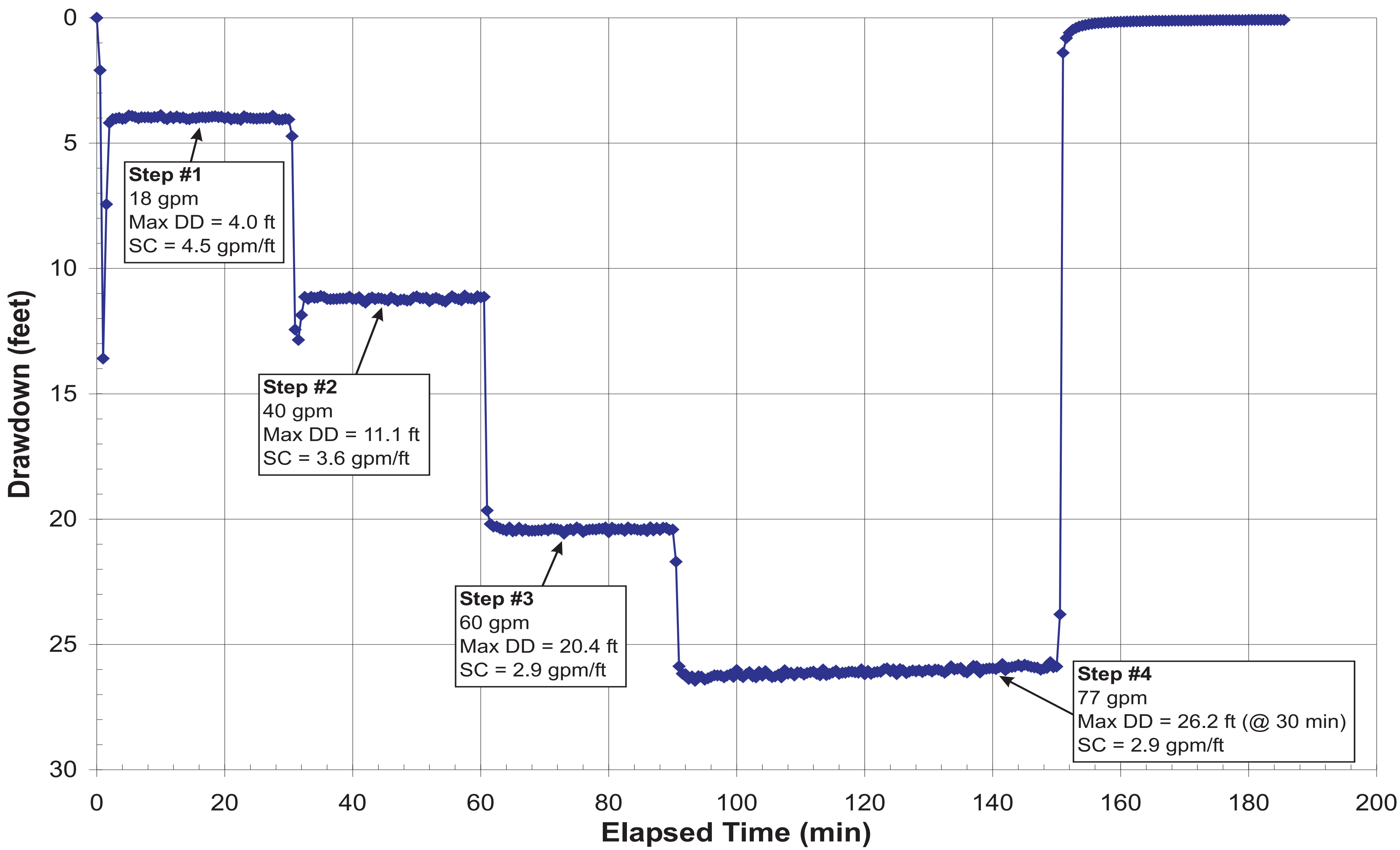
APPENDIX D-3P
TW-1 STEP TEST 2
MONITORING WELLS ONLY

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

D4 Pumping and Recovery Tests

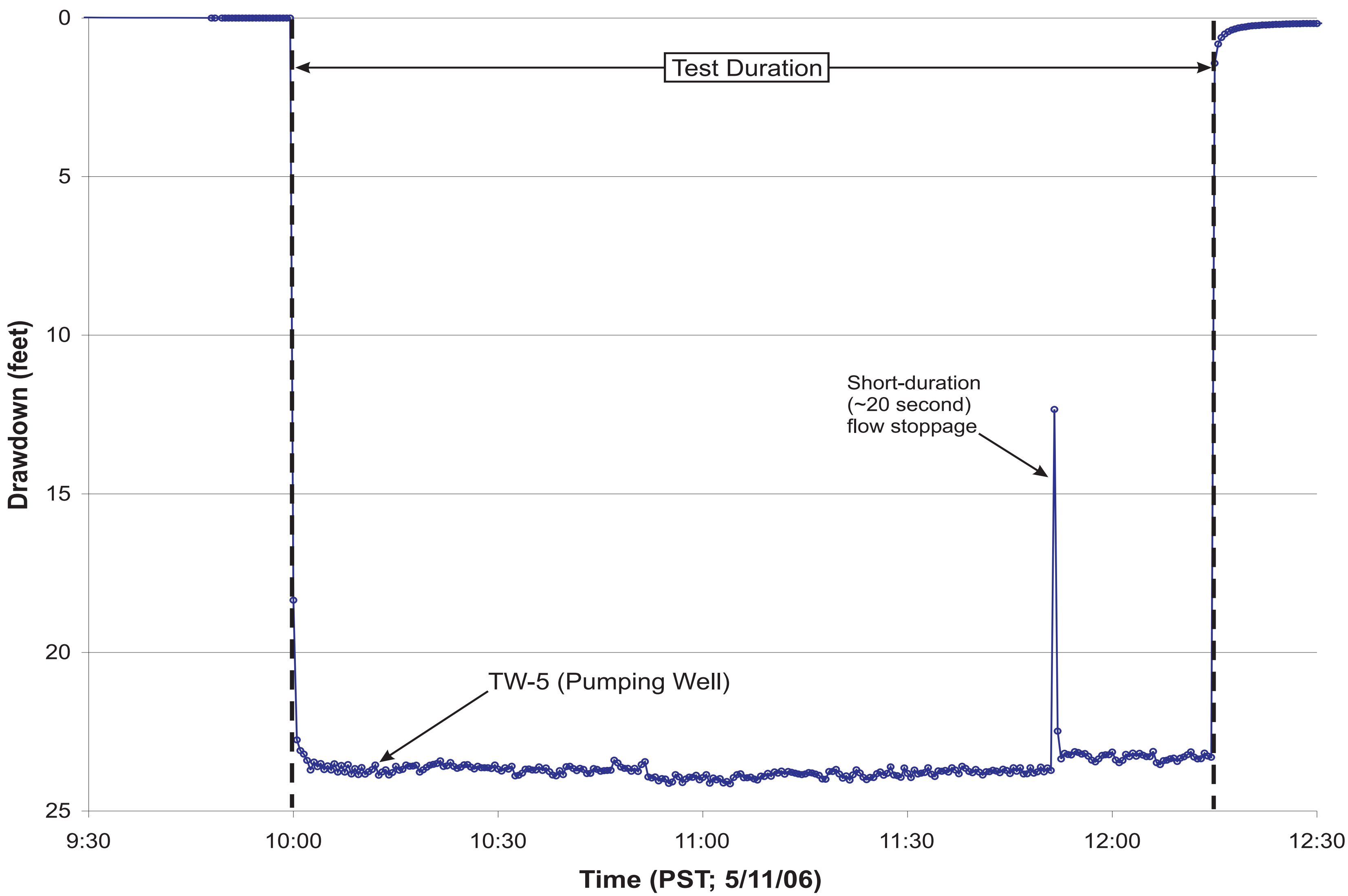
(Provided only on CD ROM)



Notes:
Test was conducted on 05/10/2006 at 12:30:00 PM.
Each step of the is 30 minutes except the last step, which was extended to 60 minutes.

APPENDIX D-4A
TW-5 STEP DRAWDOWN TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

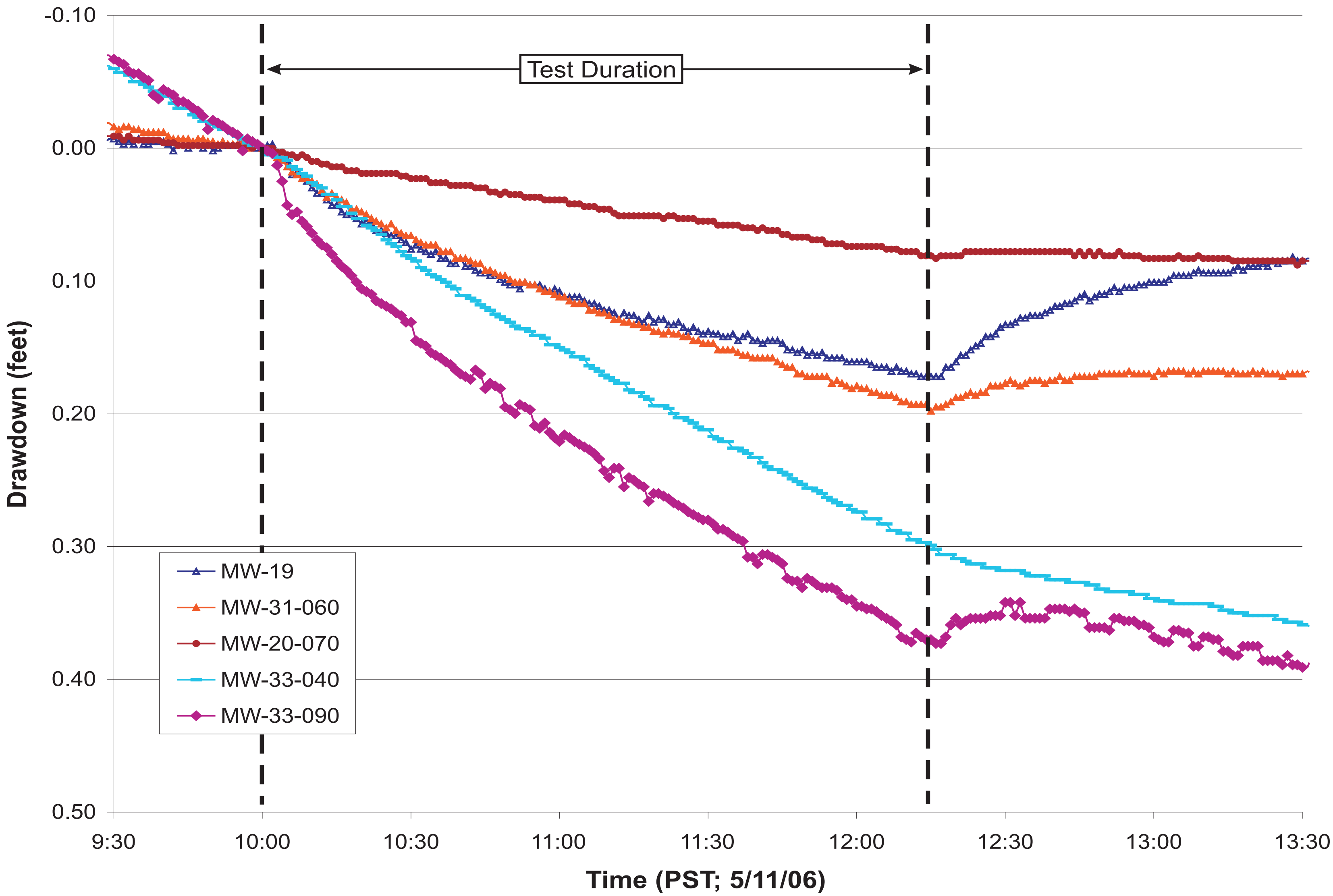
CH2MHILL



Notes:
Pumping well is TW-5; test began at 5/11/06 at 10:00 AM, PST.
Pumping rate = 70.1 gallons/minute; test duration = 135 minutes.

APPENDIX D-4B
TW-5 CONSTANT RATE TEST - DRAWDOWN AT PUMPING WELL
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

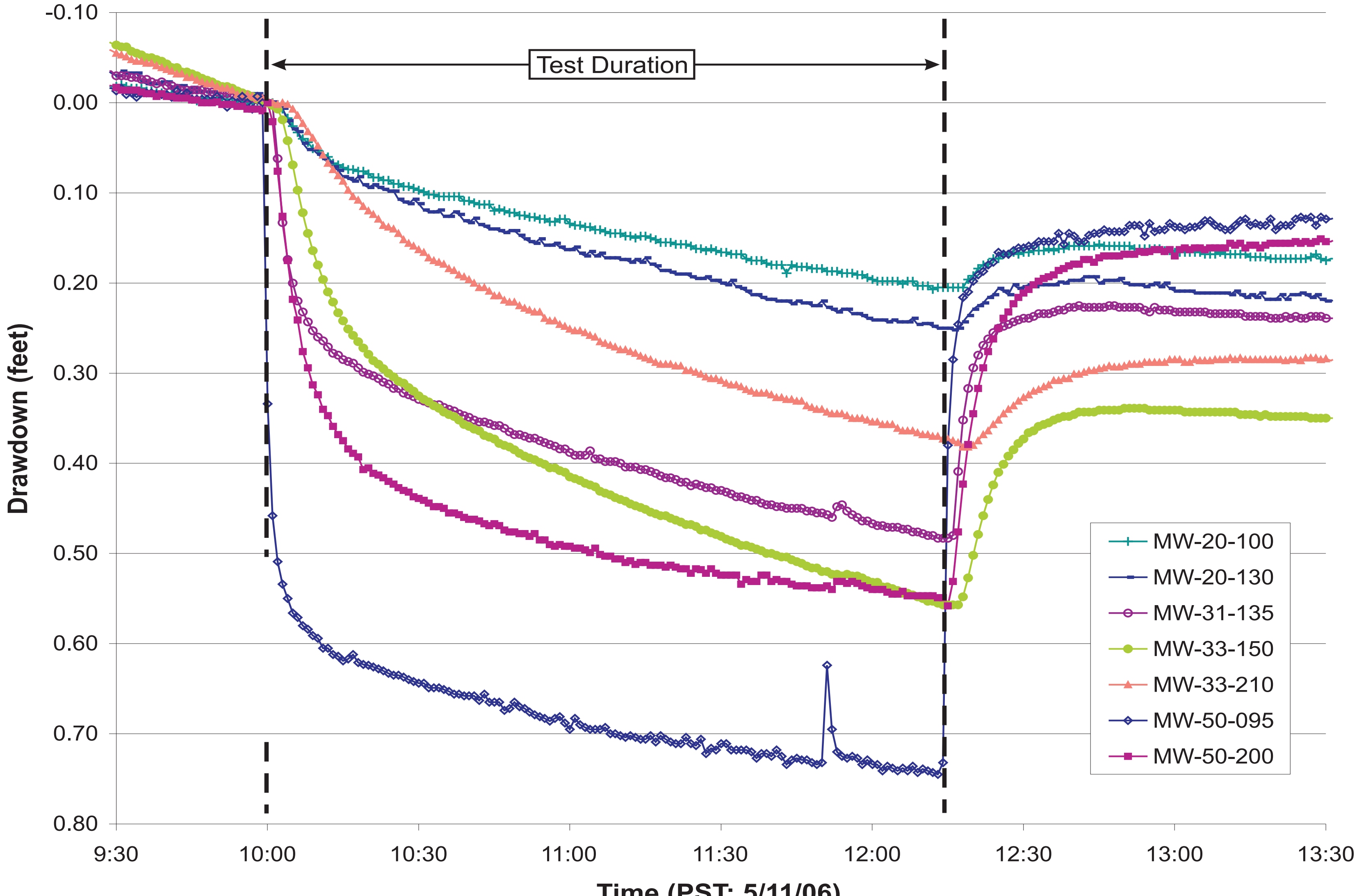
CH2MHILL



Notes:
Pumping well is TW-5; test began at 5/11/06 at 10:00 PST.
Pumping rate = 70.1 gallons/minute; test duration = 135 minutes.

APPENDIX D-4C
TW-5 CONSTANT RATE TEST - DRAWDOWN
SELECT SHALLOW OBSERVATION WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

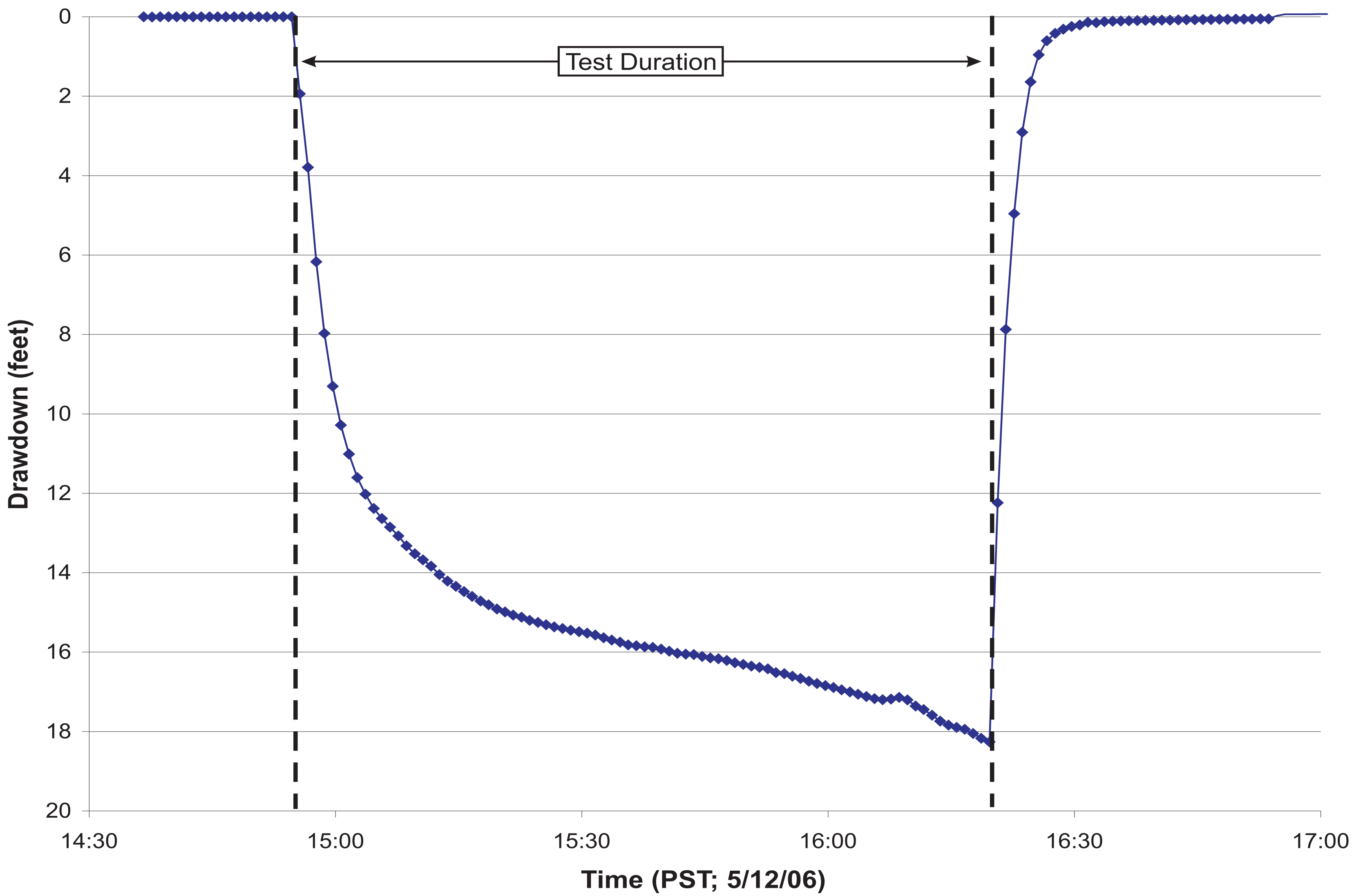


Notes:
Pumping well is TW-5; test began at 5/11/06 at 10:00 PST.
Pumping rate = 70.1 gallons/minute; test duration = 135 minutes.

APPENDIX D-4D
TW-5 CONSTANT RATE TEST - DRAWDOWN
SELECT DEEPER OBSERVATION WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

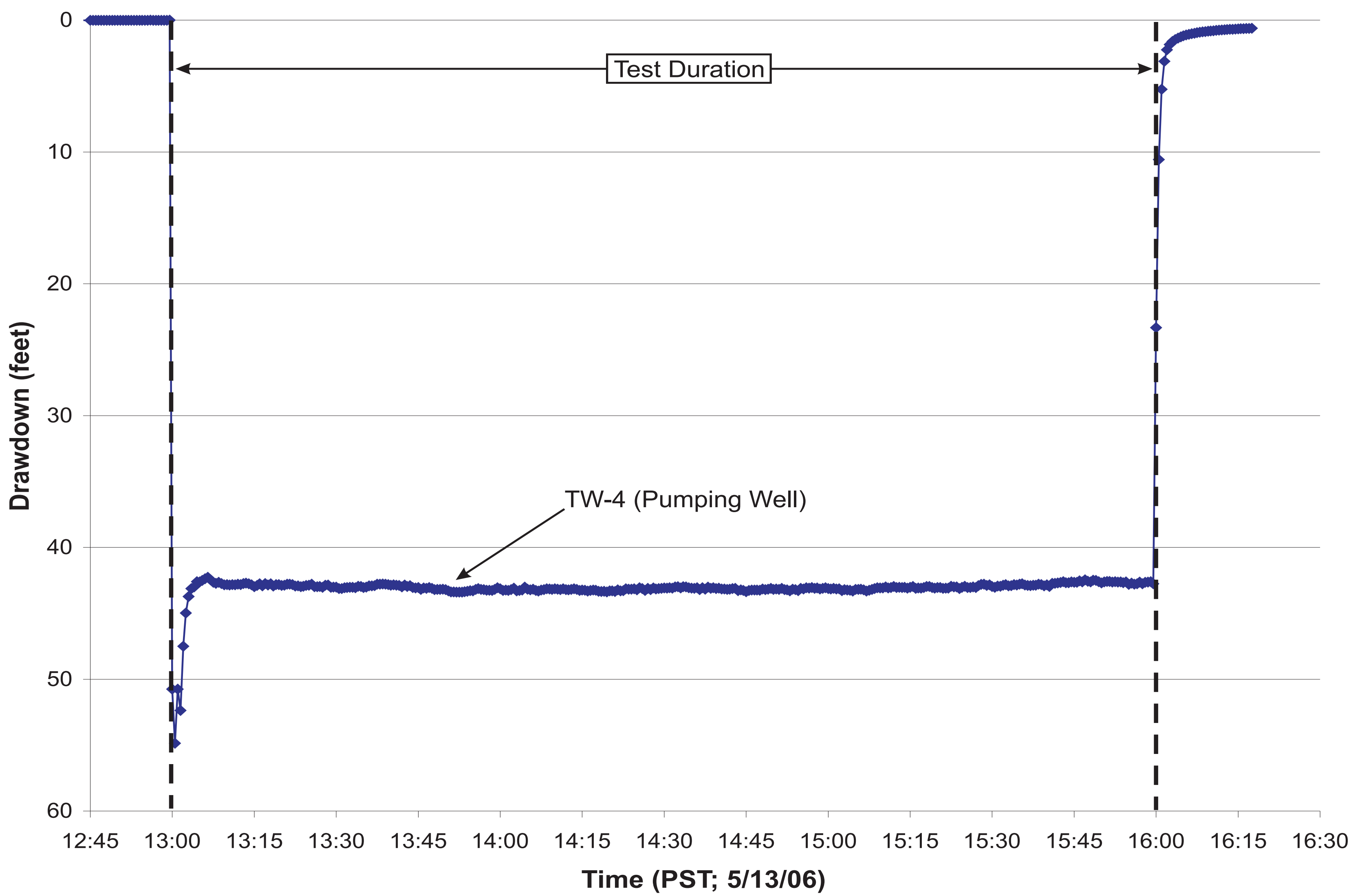
CH2MHILL



Notes:
Pumping well is MW-26; test began at 5/12/06 at 13:55 PST.
Pumping rate = 4.8 gallons/minute; test duration = 85 minutes.

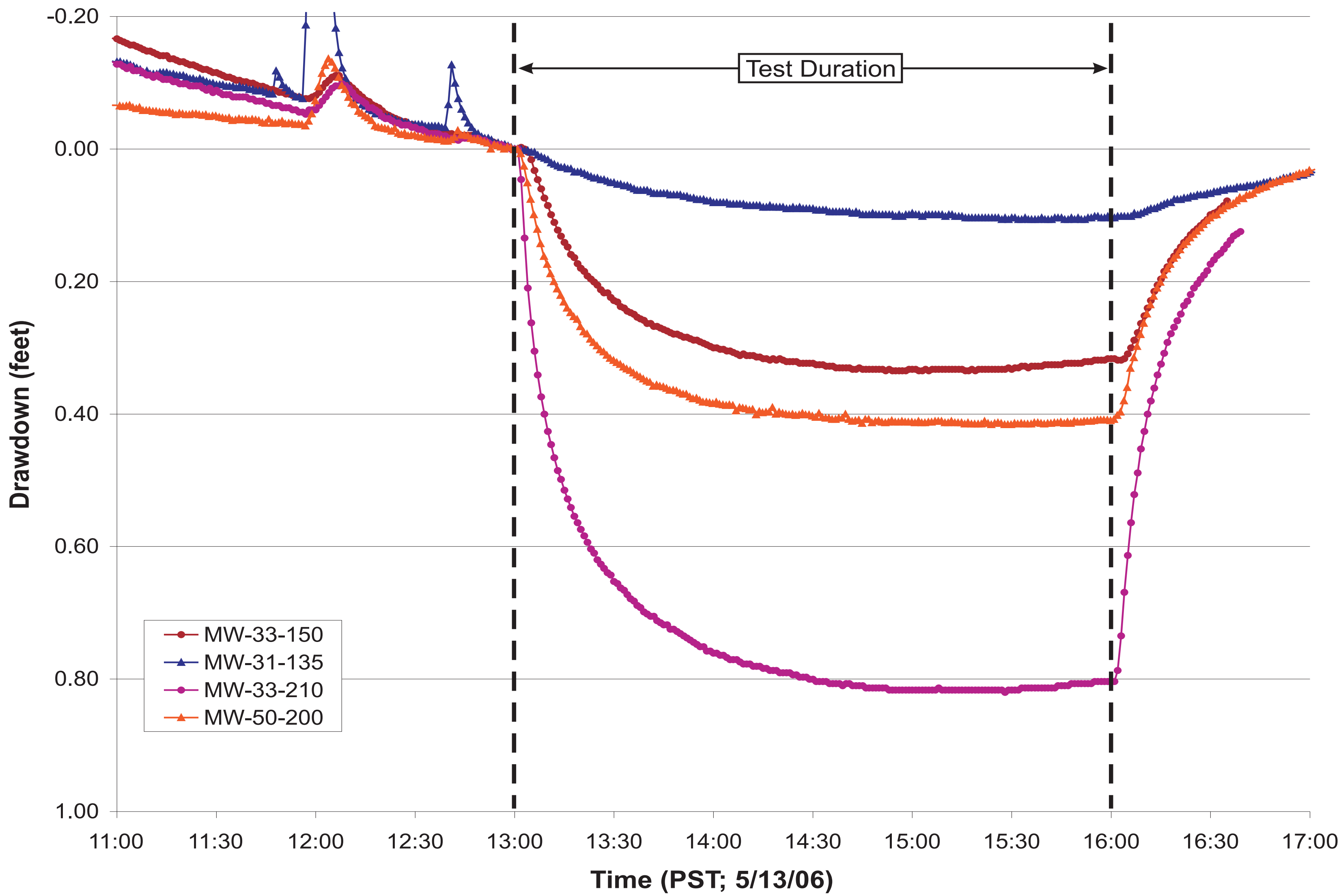
APPENDIX D-4E
MW-26 CONSTANT RATE TEST - DRAWDOWN AT PUMPING WELL
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Notes:
Pumping well is TW-4; test began at 5/13/06 at 13:00.
Pumping rate = 28 gallons/minute; test duration = 180 minutes.

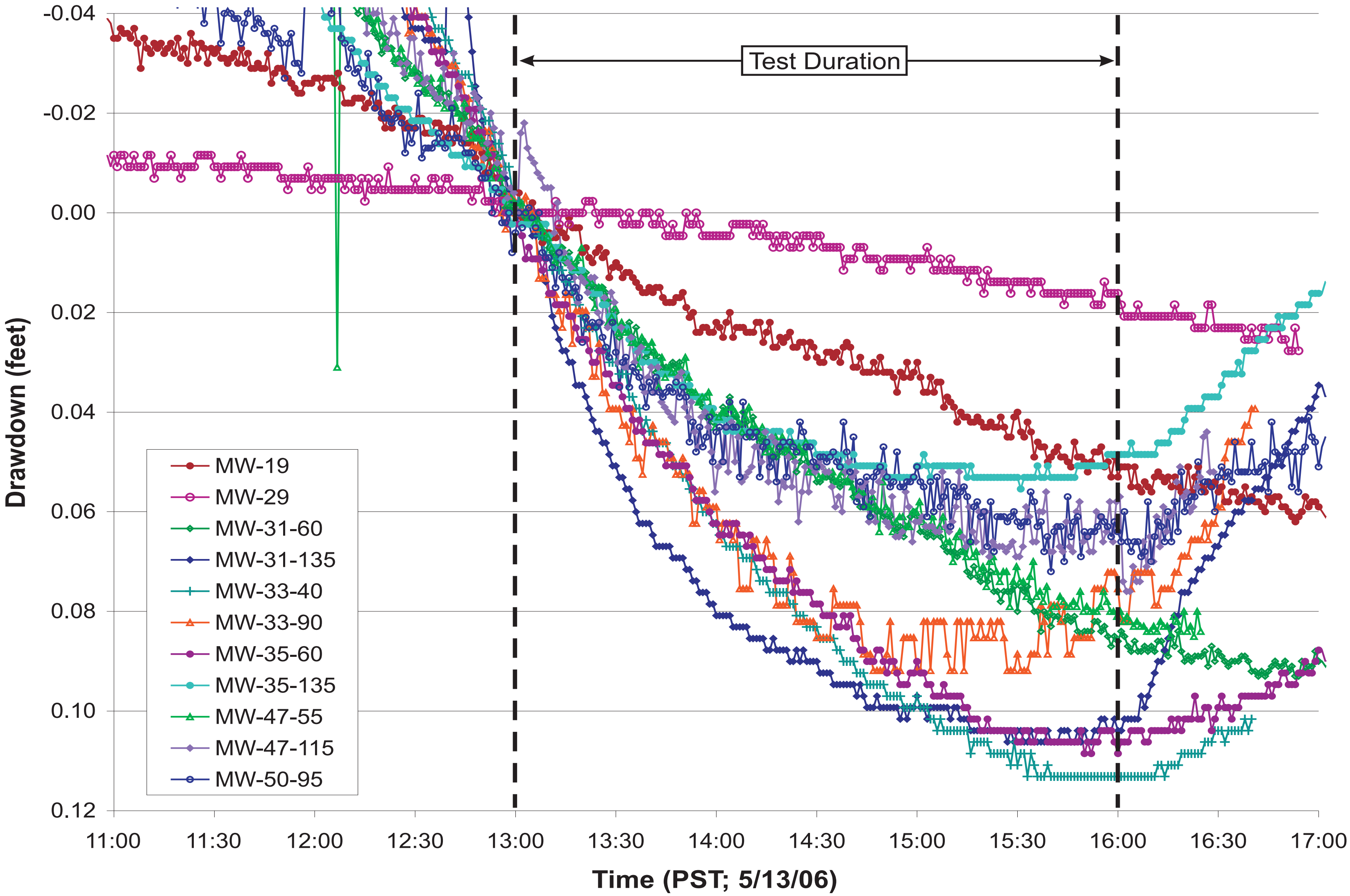
APPENDIX D-4F
TW-4 CONSTANT RATE TEST - DRAWDOWN AT PUMPING WELL
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
Pumping well is TW-4; test began at 5/13/06 at 13:00.
Pumping rate = 28 gallons/minute; test duration = 180 minutes.

APPENDIX D-4G
TW-4 CONSTANT RATE TEST - DRAWDOWN AT SELECT OBSERVATION WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

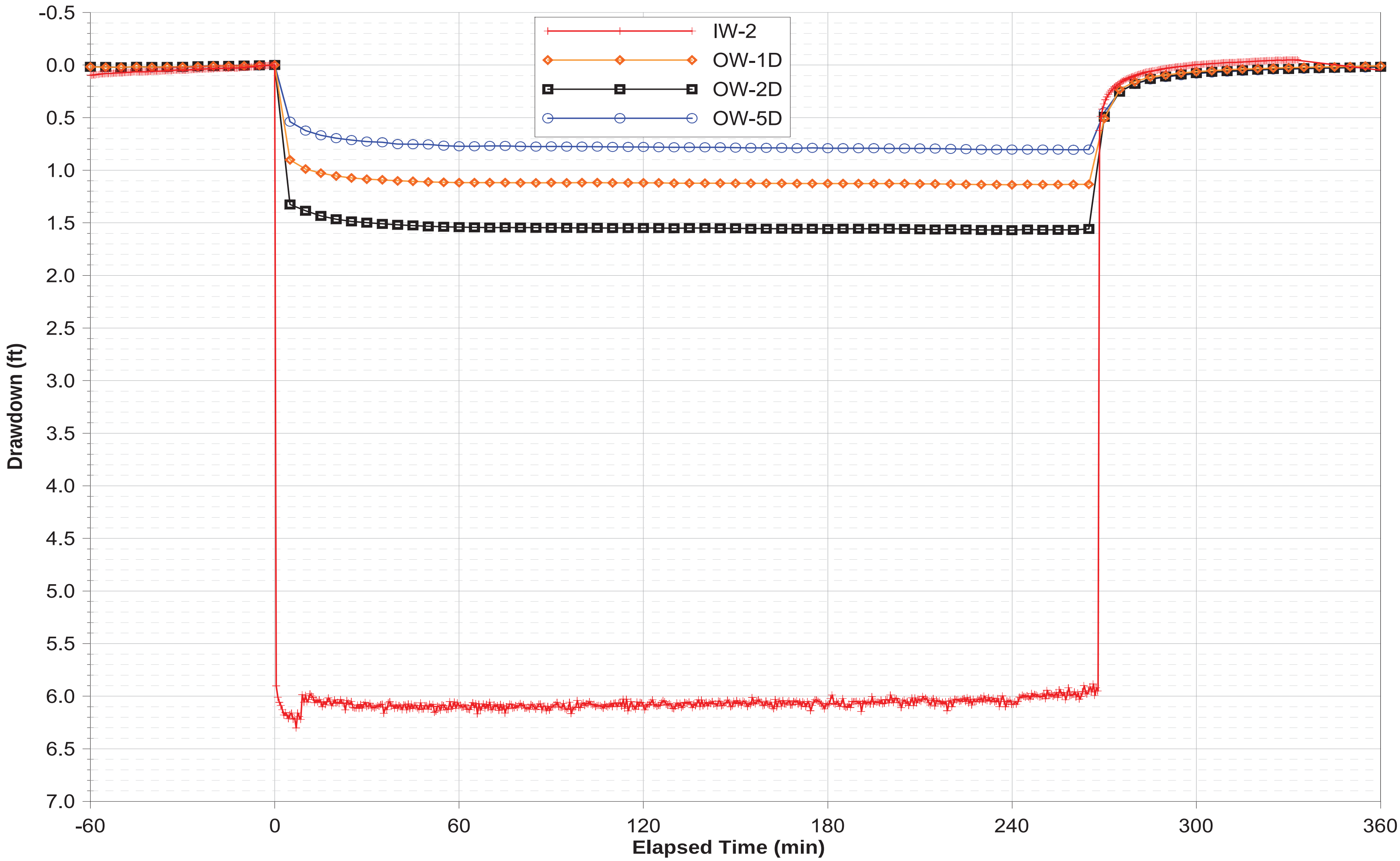


Notes:
Pumping well is TW-4; test began at 5/13/06 at 13:00.
Pumping rate = 28 gallons/minute; test duration = 180 minutes.

APPENDIX D-4H
TW-4 CONSTANT RATE TEST - DRAWDOWN AT SELECT OBSERVATION WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

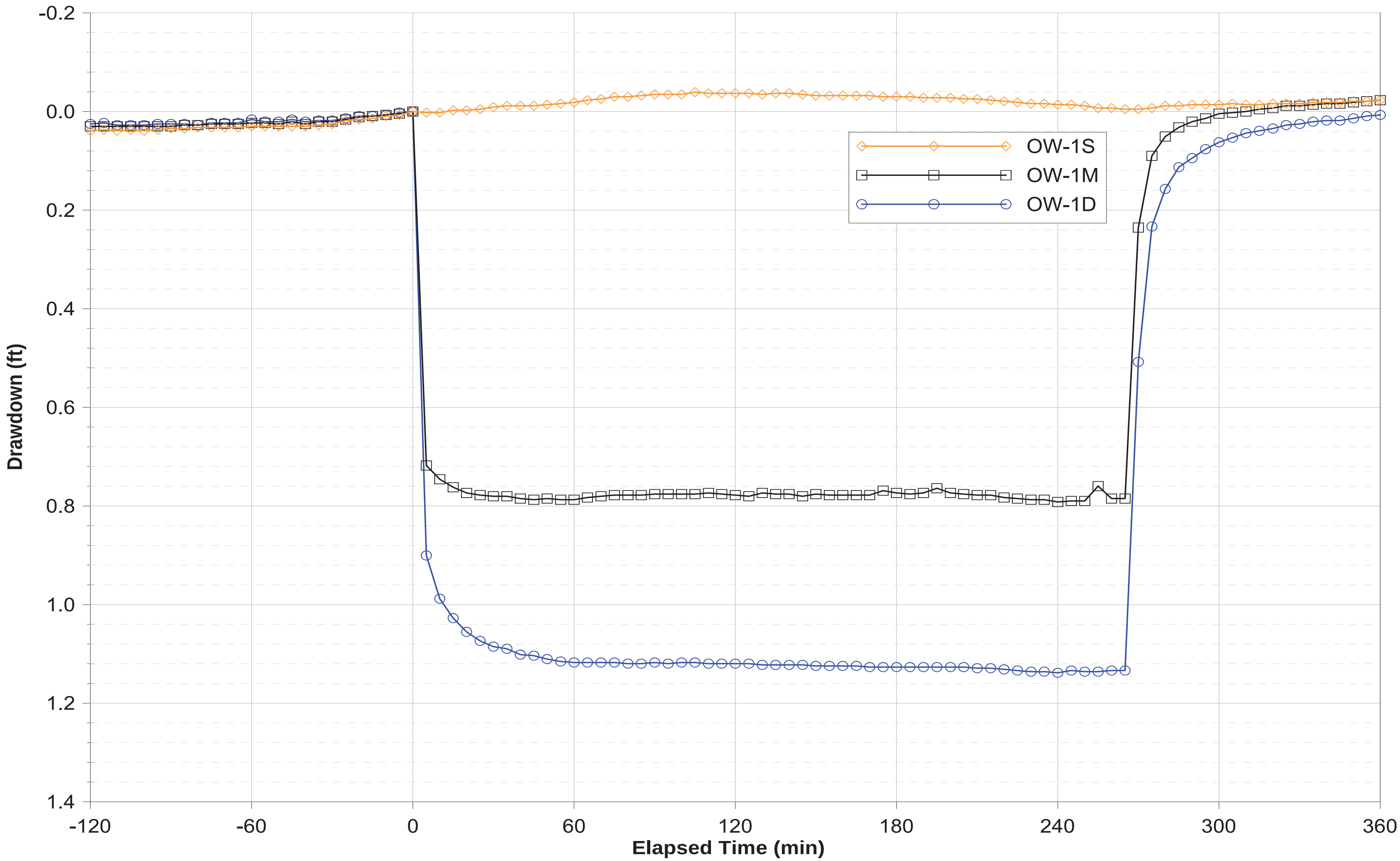


Notes:
Pumping conducted from IW-2 at 188 gpm starting on 1/06/2005 10:45AM.

APPENDIX D-4I
IW-4 EXTRACTION TEST - DRAWDOWN AT IW-2 AND DEEP MONITORING WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

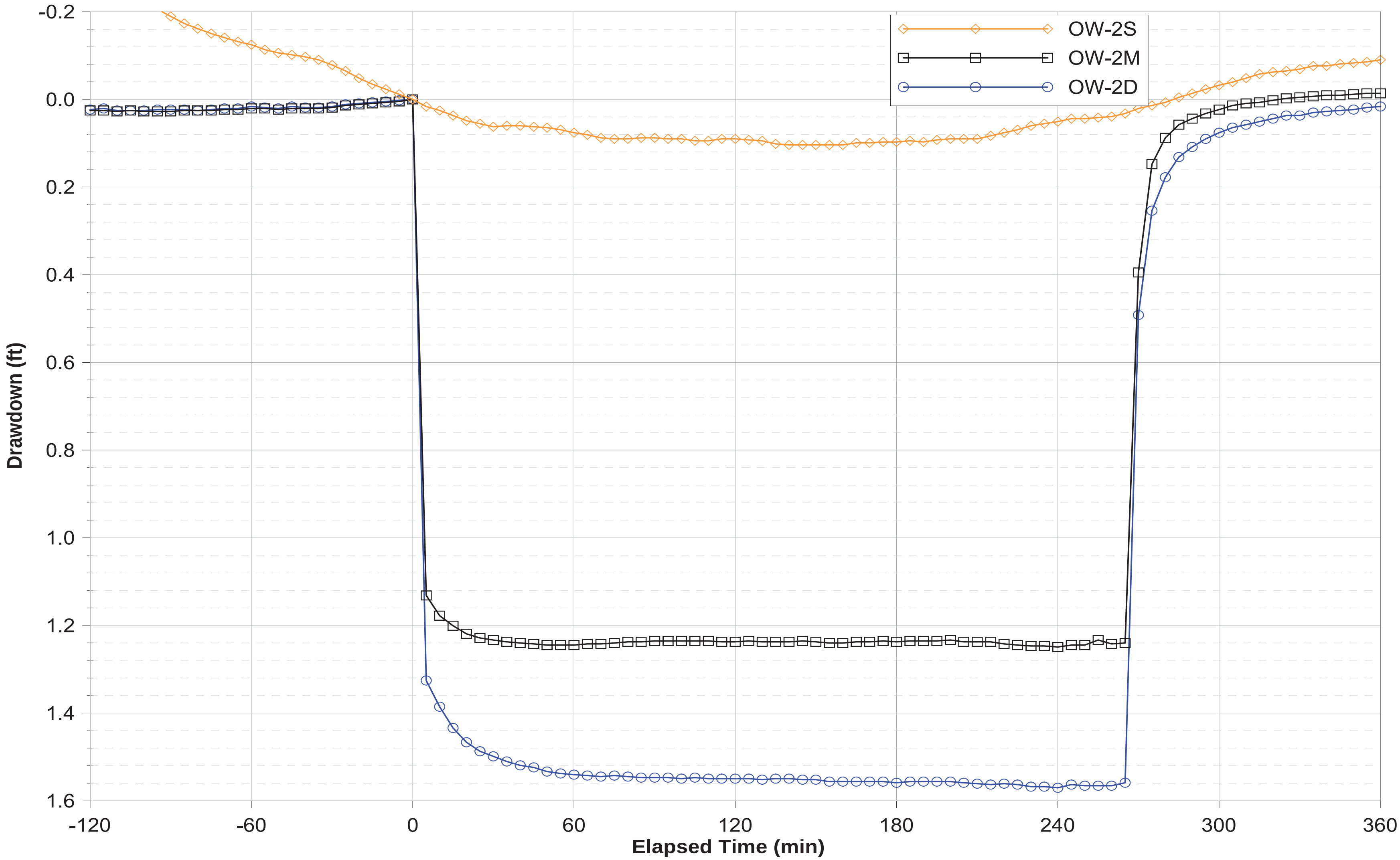


Notes:
Pumping conducted from IW-2 at 188 gpm
starting on 1/06/2005 10:45AM.

APPENDIX D-4J
IW-2 EXTRACTION TEST - DRAWDOWN AT OW-1 MONITORING WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

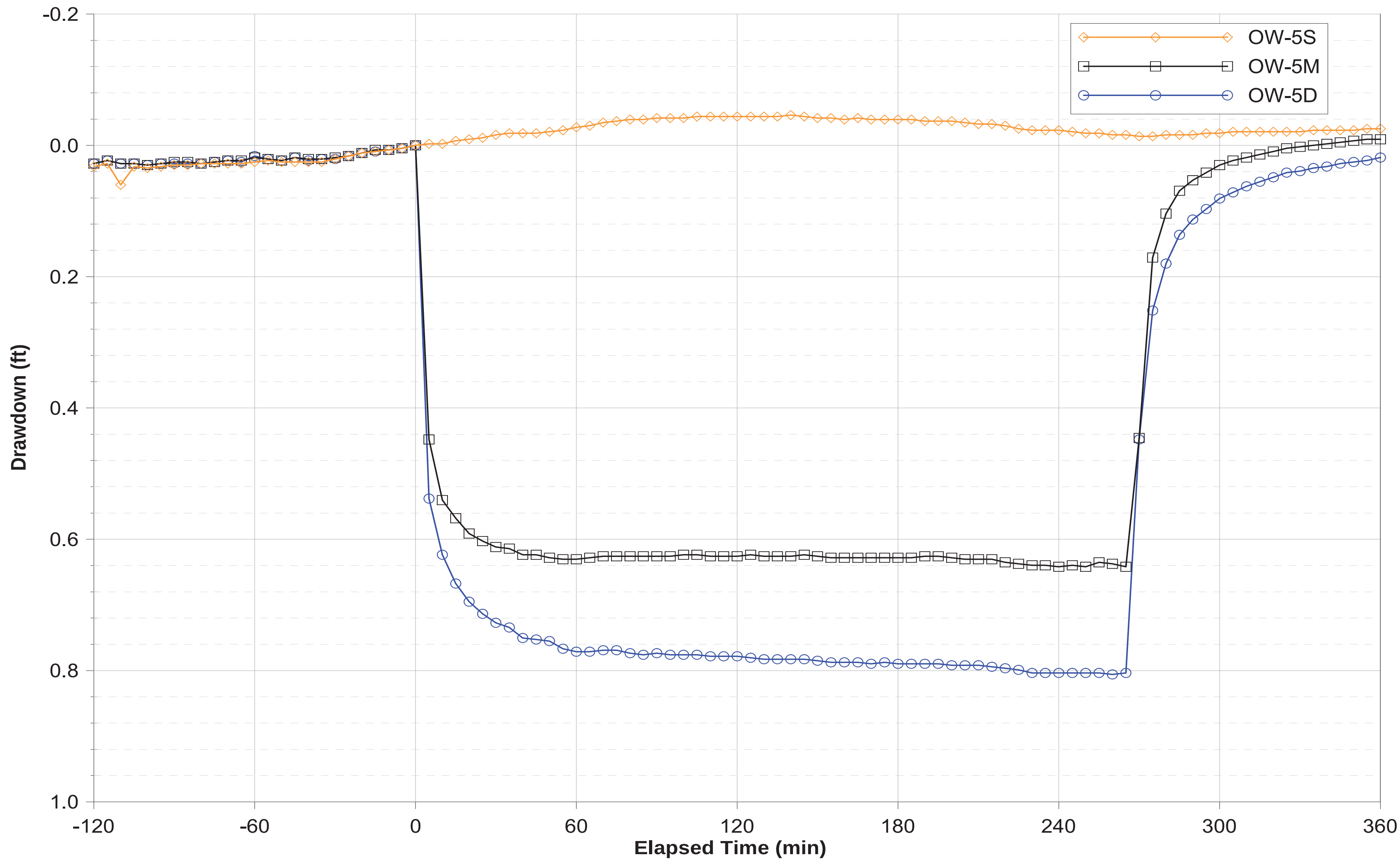
CH2MHILL



Notes:
Pumping conducted from IW-2 at 188 gpm
starting on 1/06/2005 10:45AM.

APPENDIX D-4K
IW-2 EXTRACTION TEST - DRAWDOWN AT OW-2 MONITORING WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

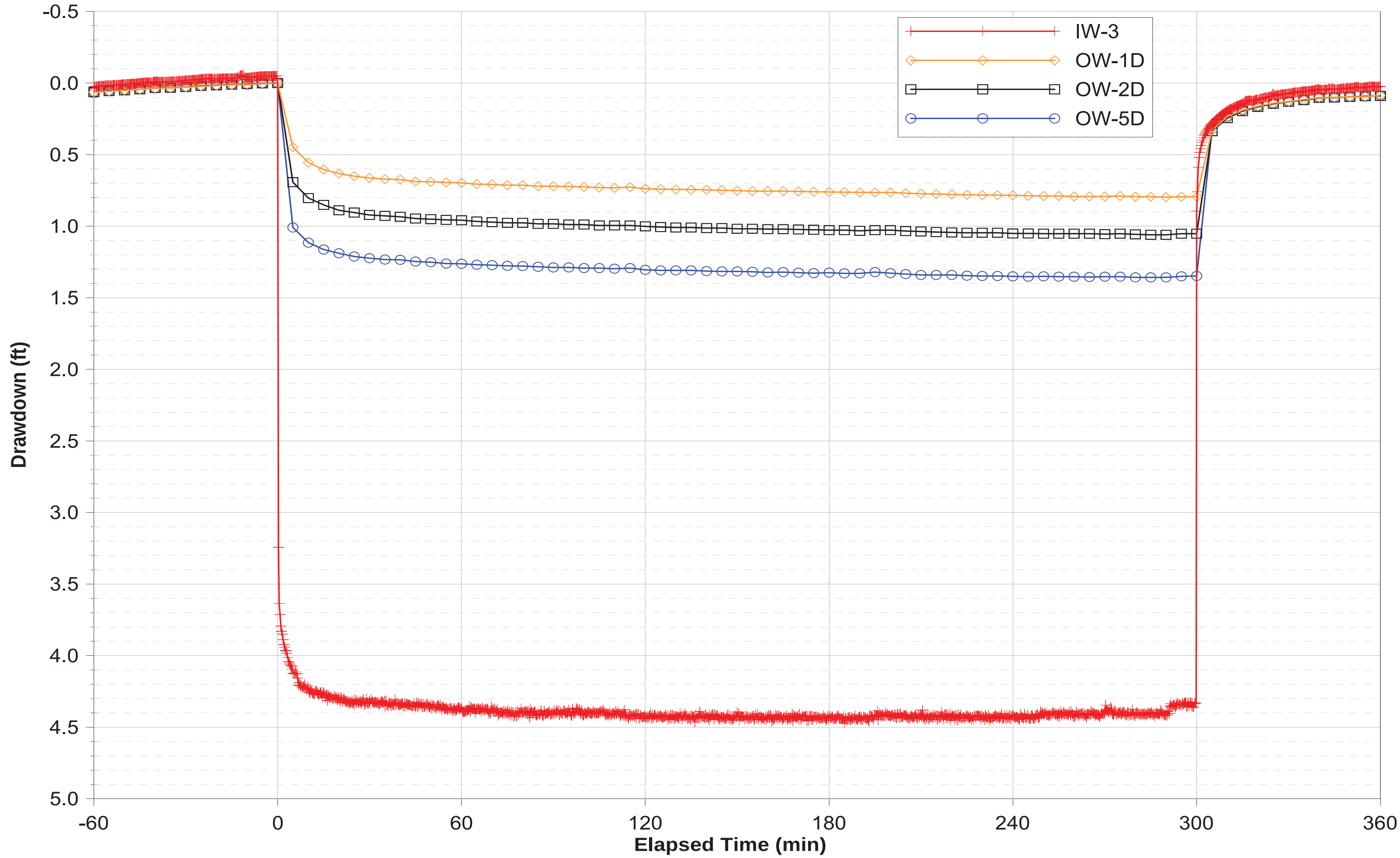
CH2MHILL



Notes:
Pumping conducted from IW-2 at 188 gpm
starting on 1/06/2005 10:45AM.

APPENDIX D-4L
IW-2 EXTRACTION TEST - DRAWDOWN AT OW-5 MONITORING WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

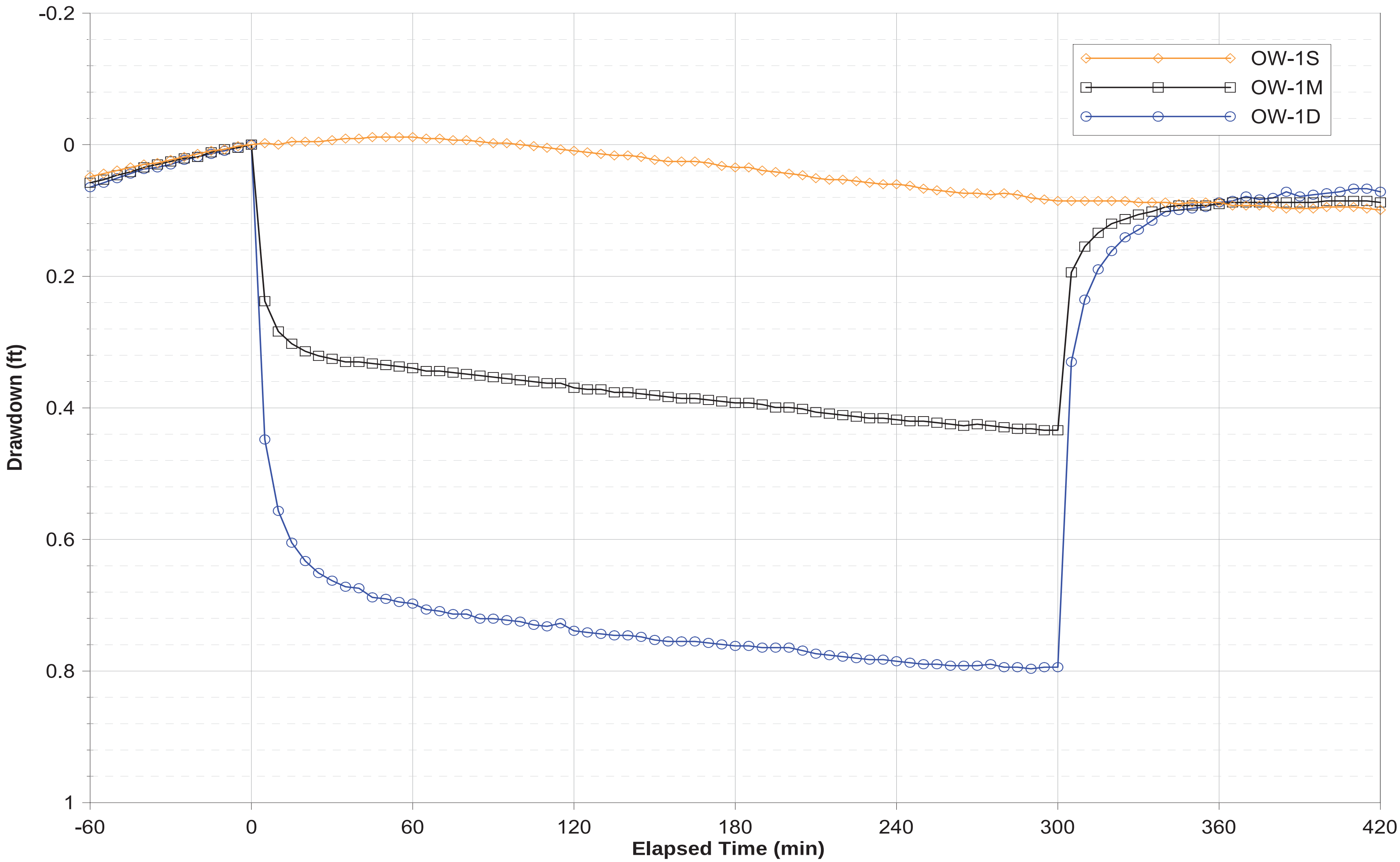


Notes: Extraction from IW-3 at 183 gpm starting on 1/14/2005 12:15 PM.

APPENDIX D-4M
IW-3 EXTRACTION TEST - DRAWDOWN AT IW-3 AND DEEP MONITORING WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

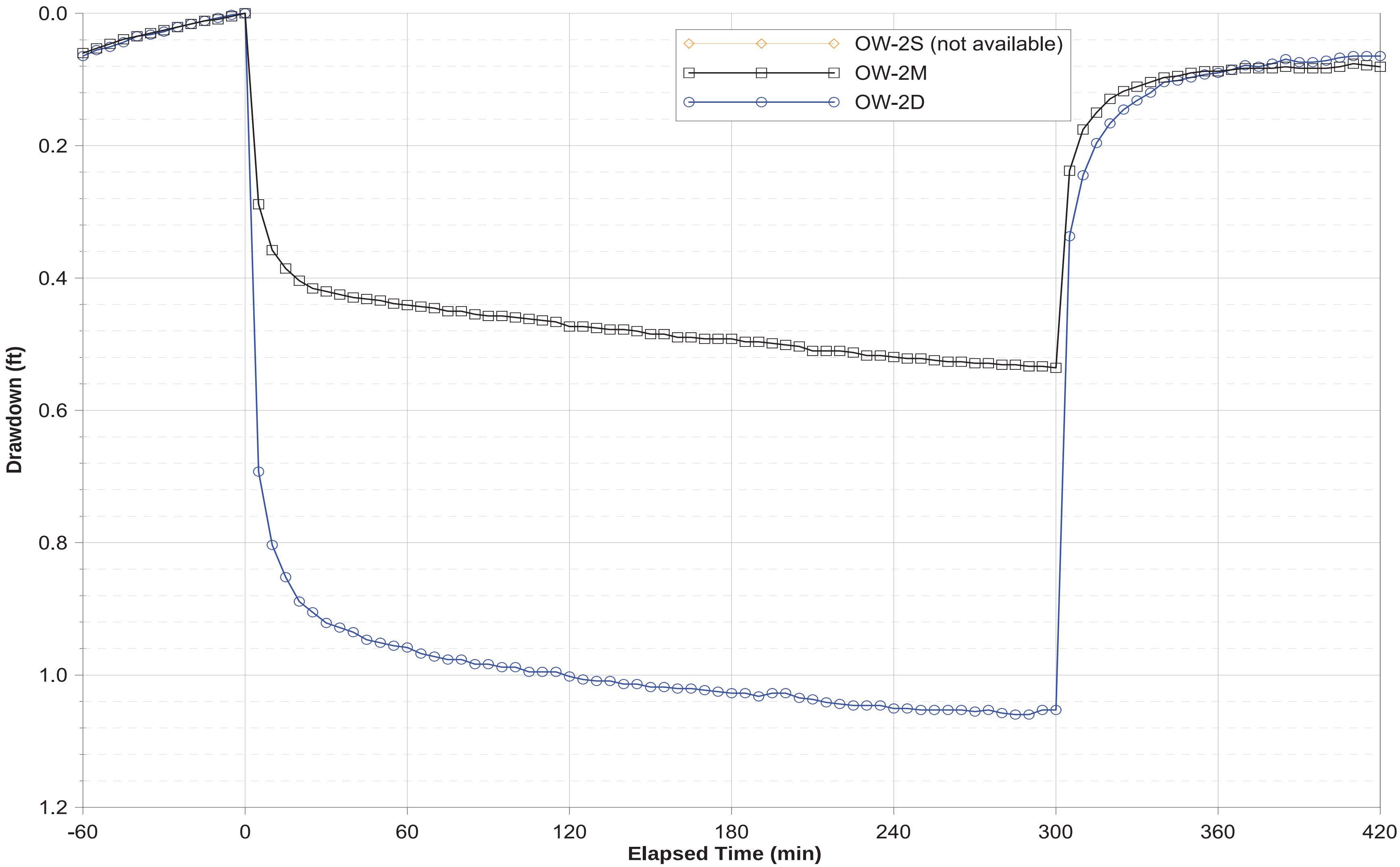


Notes: Extraction from IW-3 at 183 gpm
starting on 1/14/2005 12:15 PM.

APPENDIX D-4N
IW-3 EXTRACTION TEST - DRAWDOWN AT OW-1 MONITORING WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

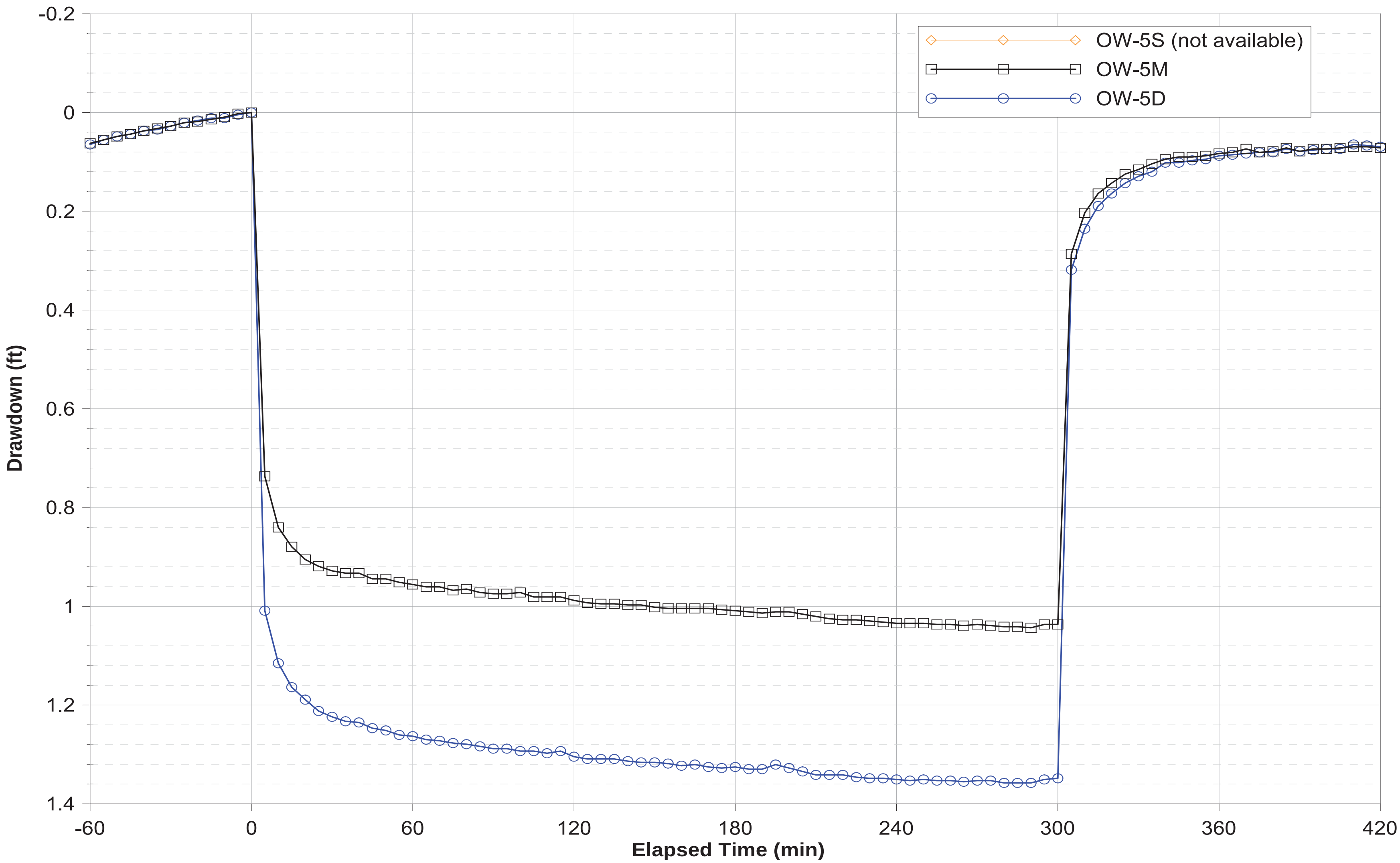
CH2MHILL



<u>Notes:</u> Extraction from IW-3 at 183 gpm
starting on 1/14/2005 12:15 PM.

APPENDIX D-4O
IW-3 EXTRACTION TEST - DRAWDOWN AT OW-2 MONITORING WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

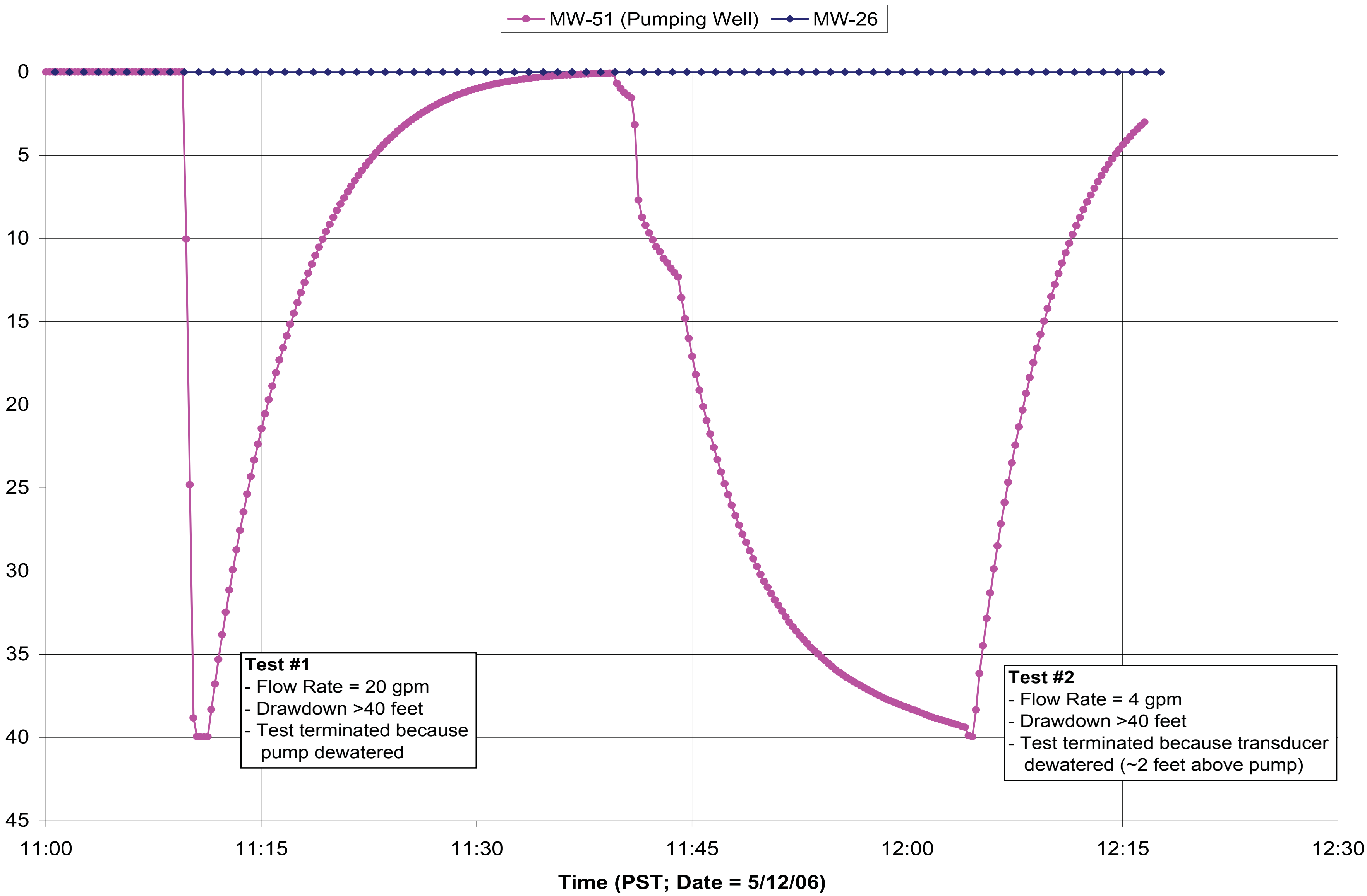


Notes: Extraction from IW-3 at 183 gpm starting on 1/14/2005 12:15 PM.

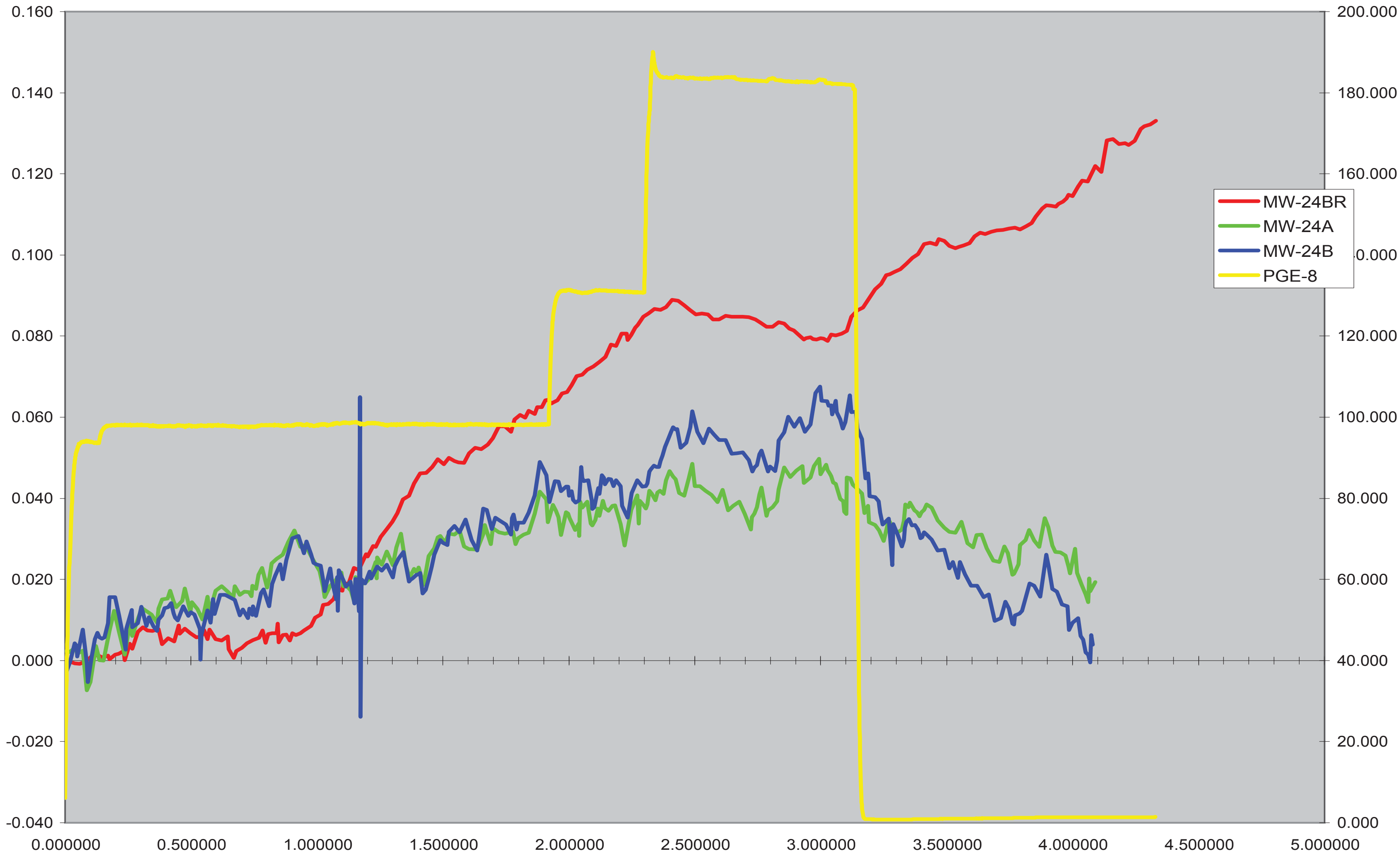
APPENDIX D-4P
IW-3 EXTRACTION TEST - DRAWDOWN AT OW-5 MONITORING WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



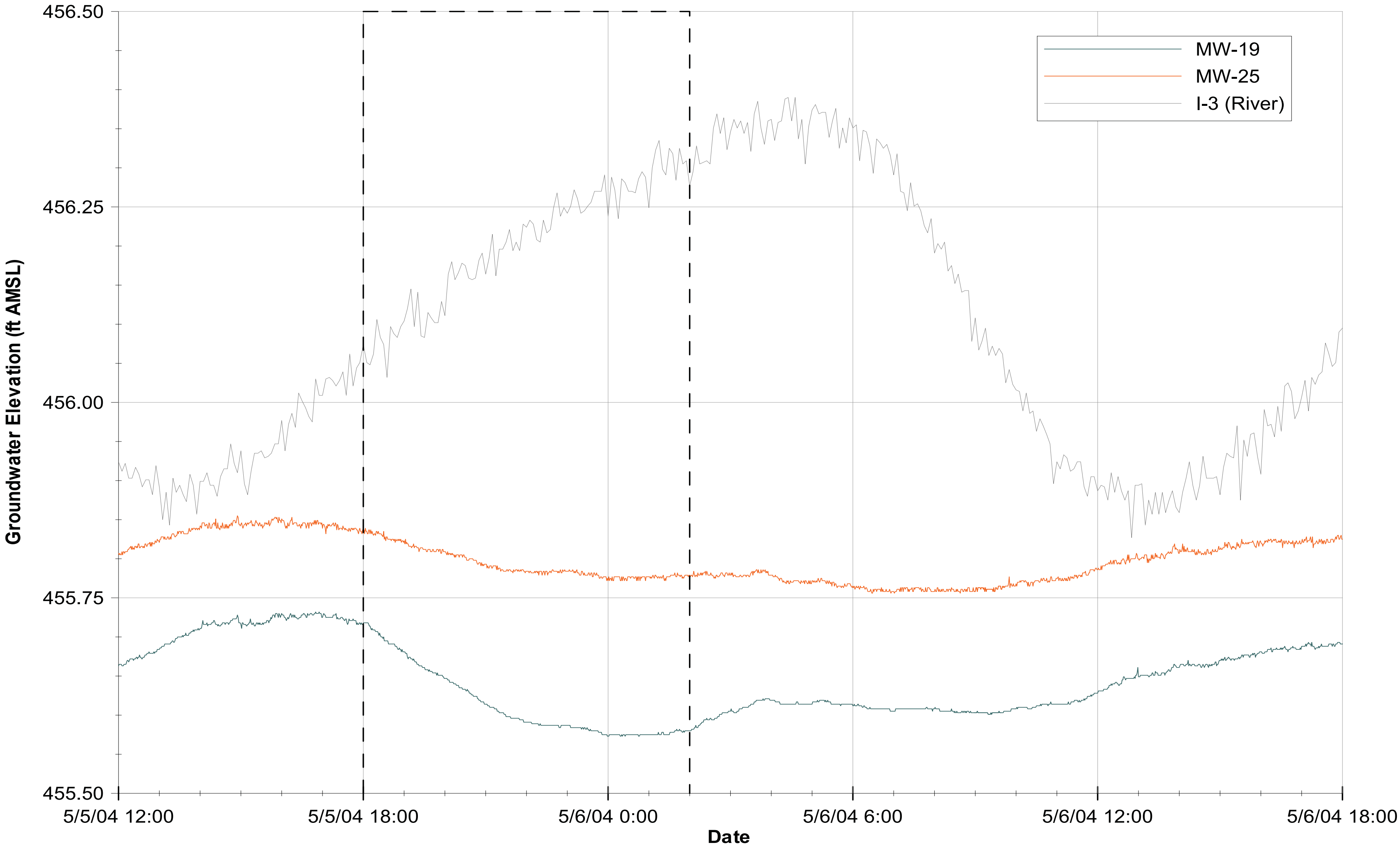
APPENDIX D-4Q
MW-51 PUMPING TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D-4R
PGE-8 TIME SERIES DRAWDOWN

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

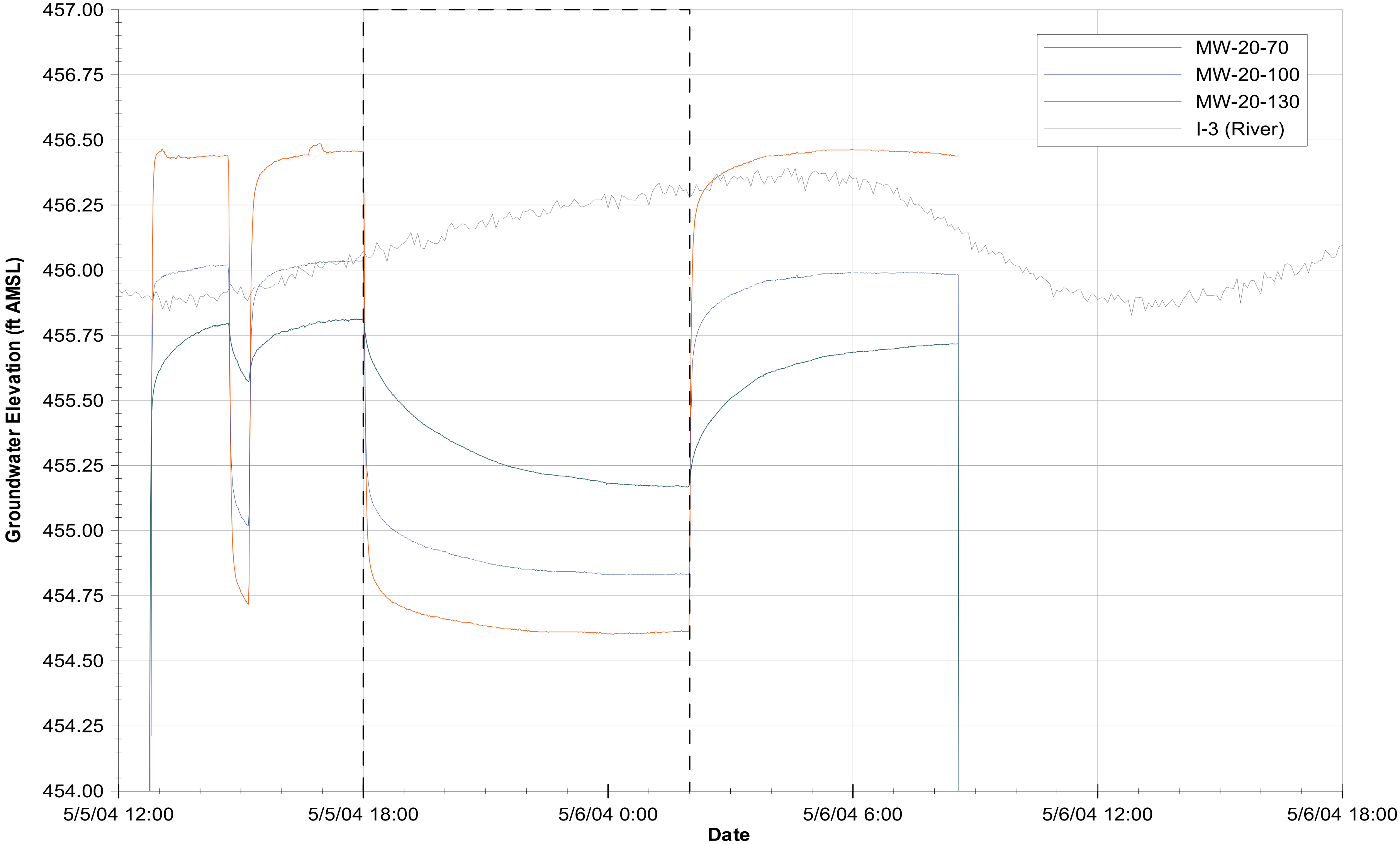
CH2MHILL



Note: Data subject to review.

APPENDIX D-4S-1
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Note: Data subject to review.

APPENDIX D-4S-2
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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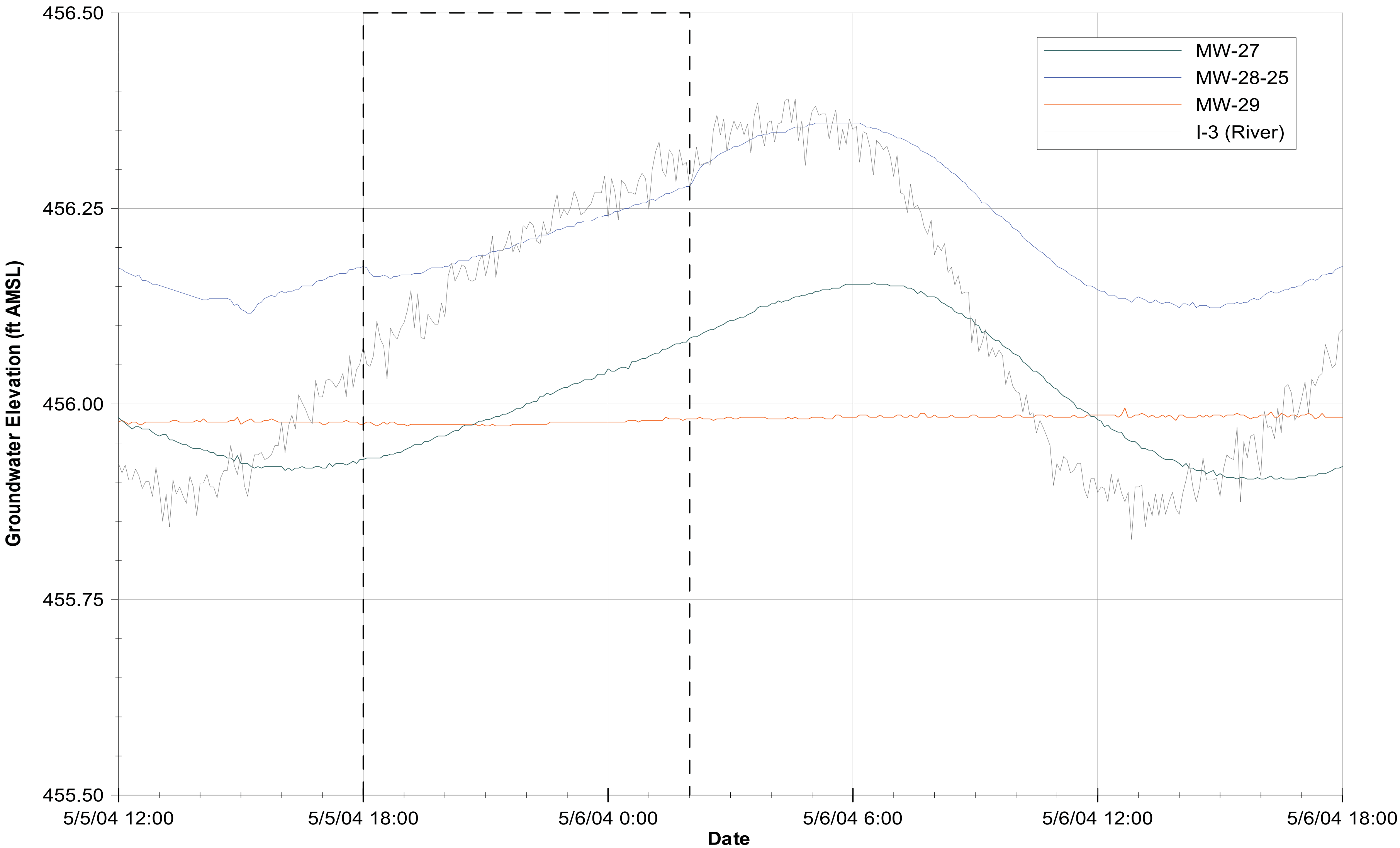

Note: Data subject to review.

APPENDIX D-4S-3
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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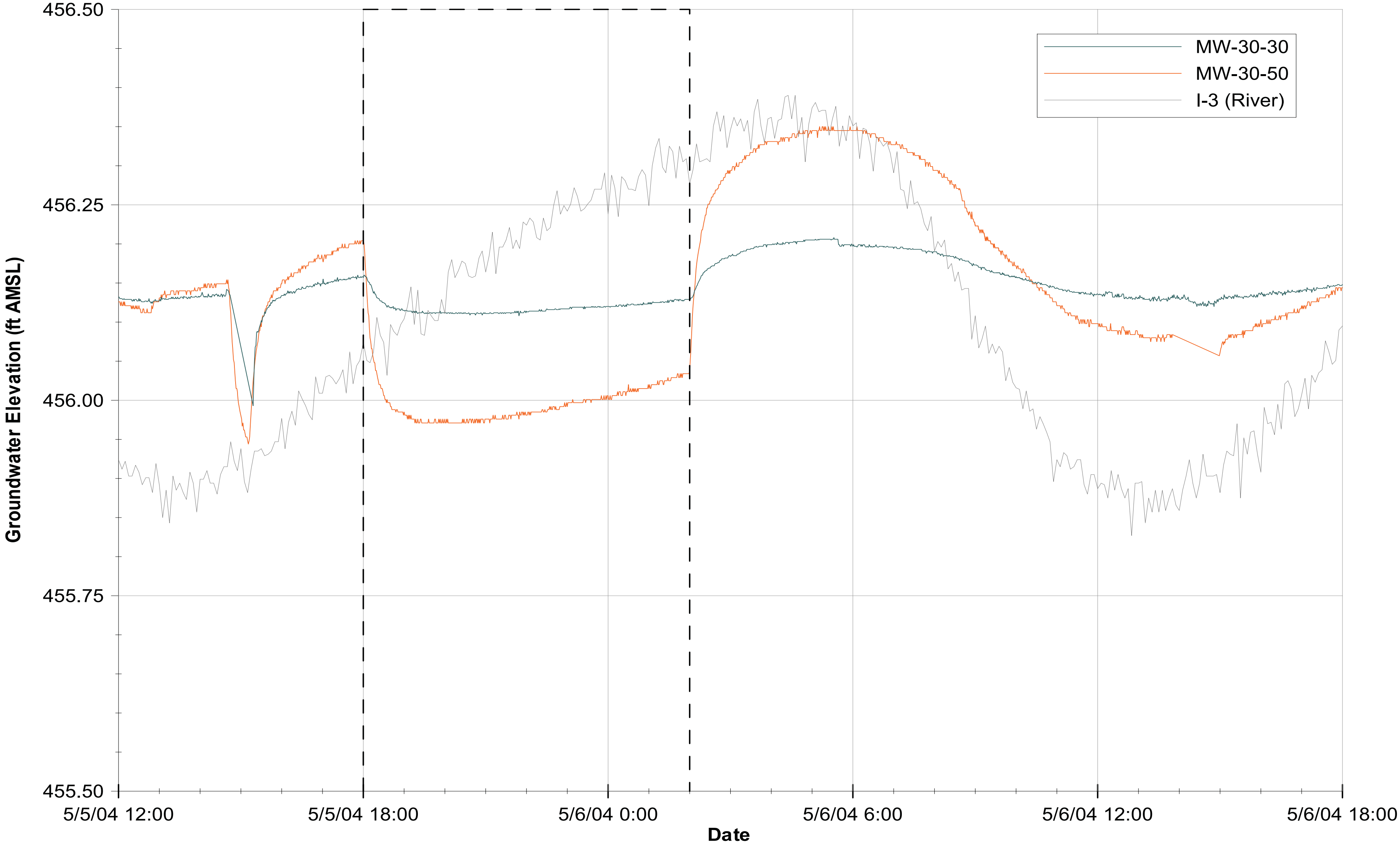

Note: Data subject to review.

APPENDIX D-4S-4
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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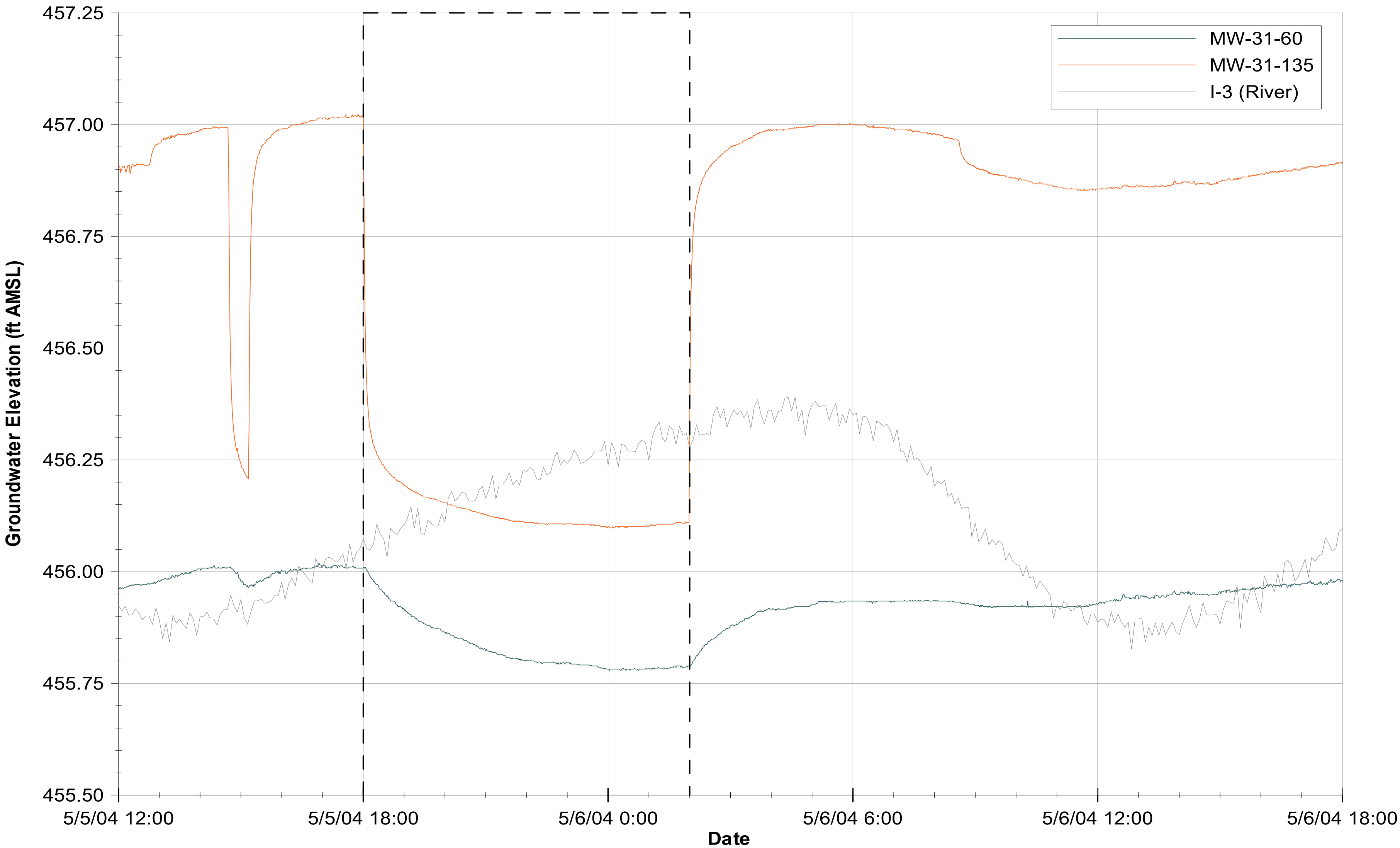

Note: Data subject to review.

APPENDIX D-4S-5
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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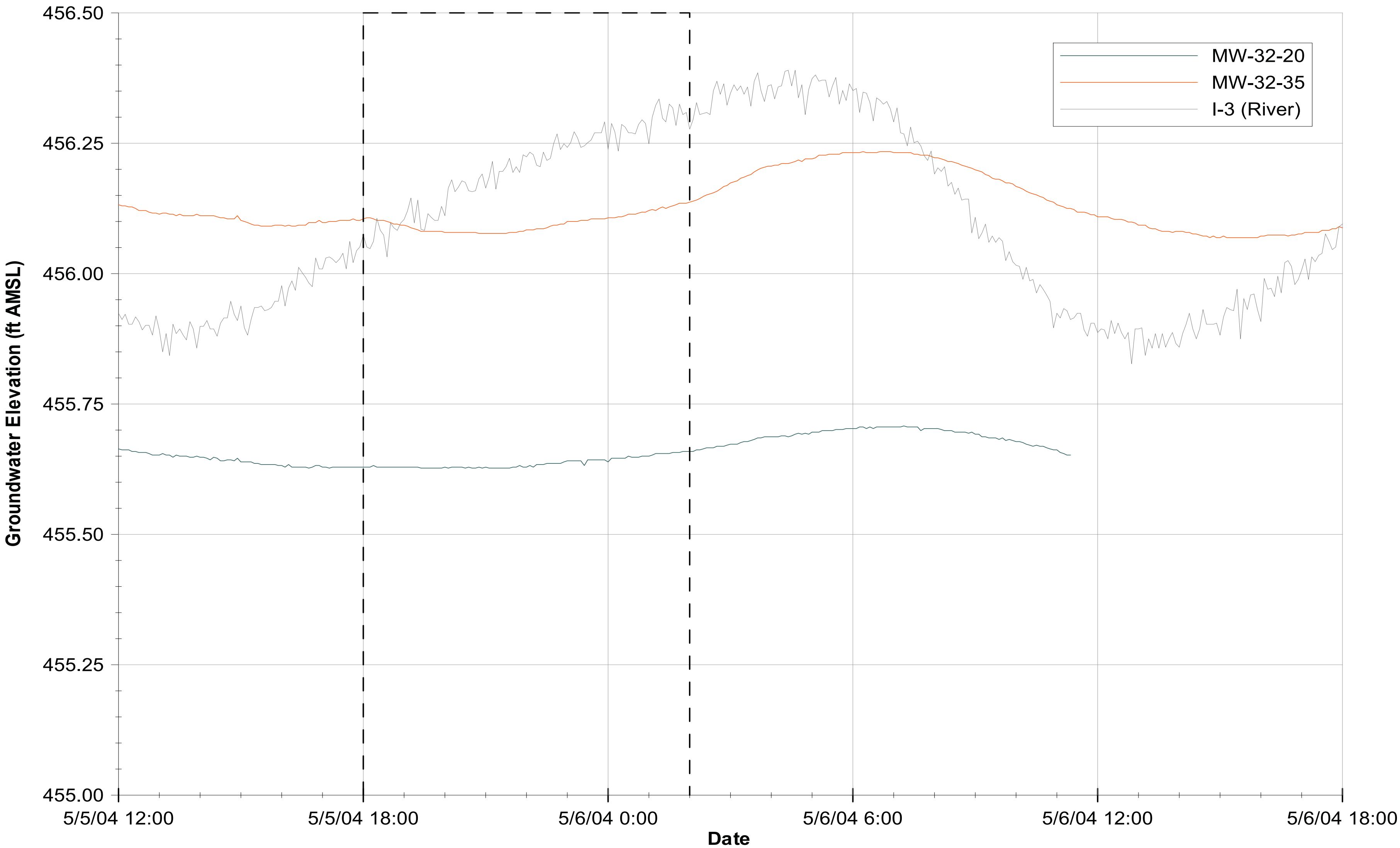

Note: Data subject to review.

APPENDIX D-4S-6
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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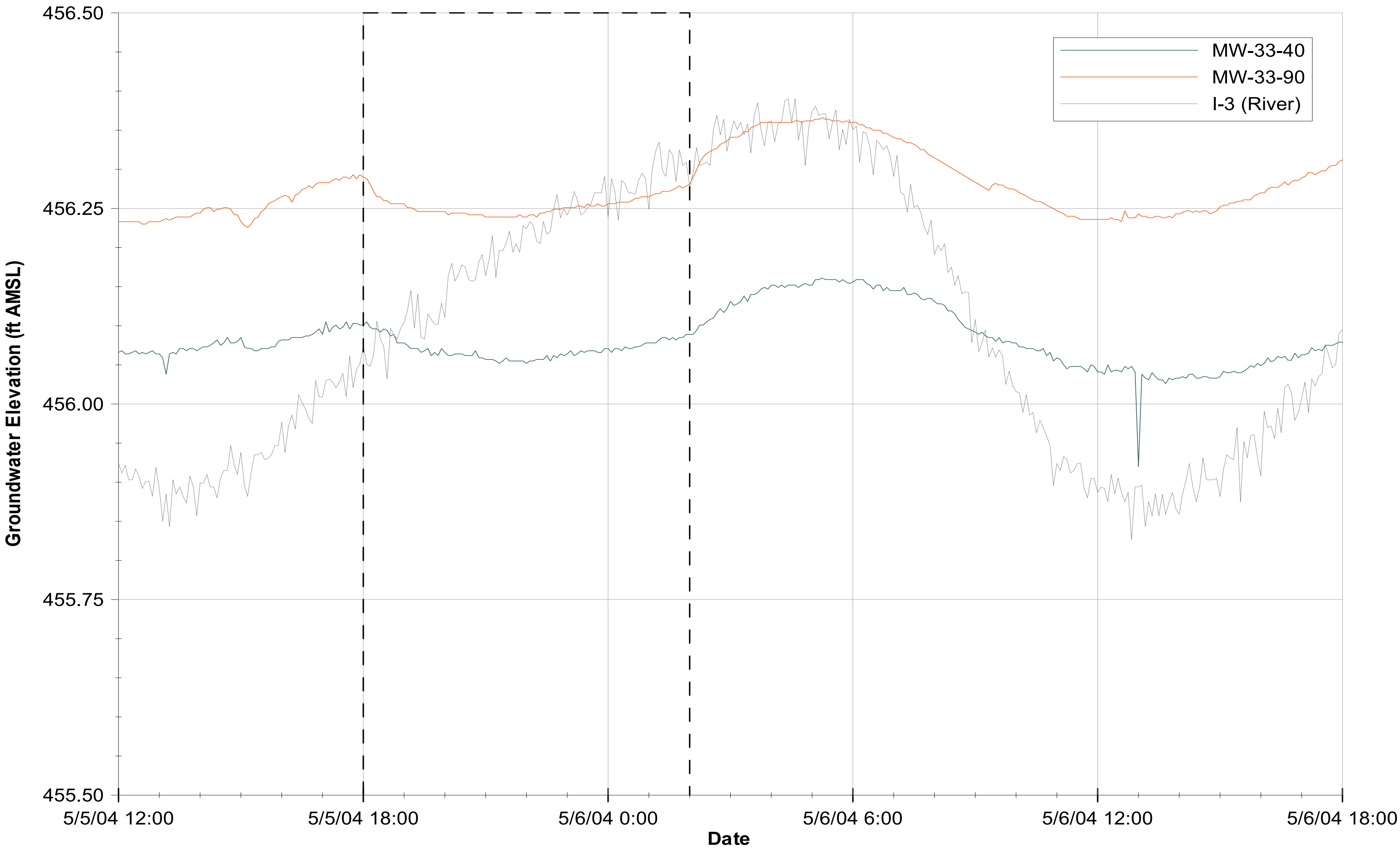

Note: Data subject to review.

APPENDIX D-4S-7
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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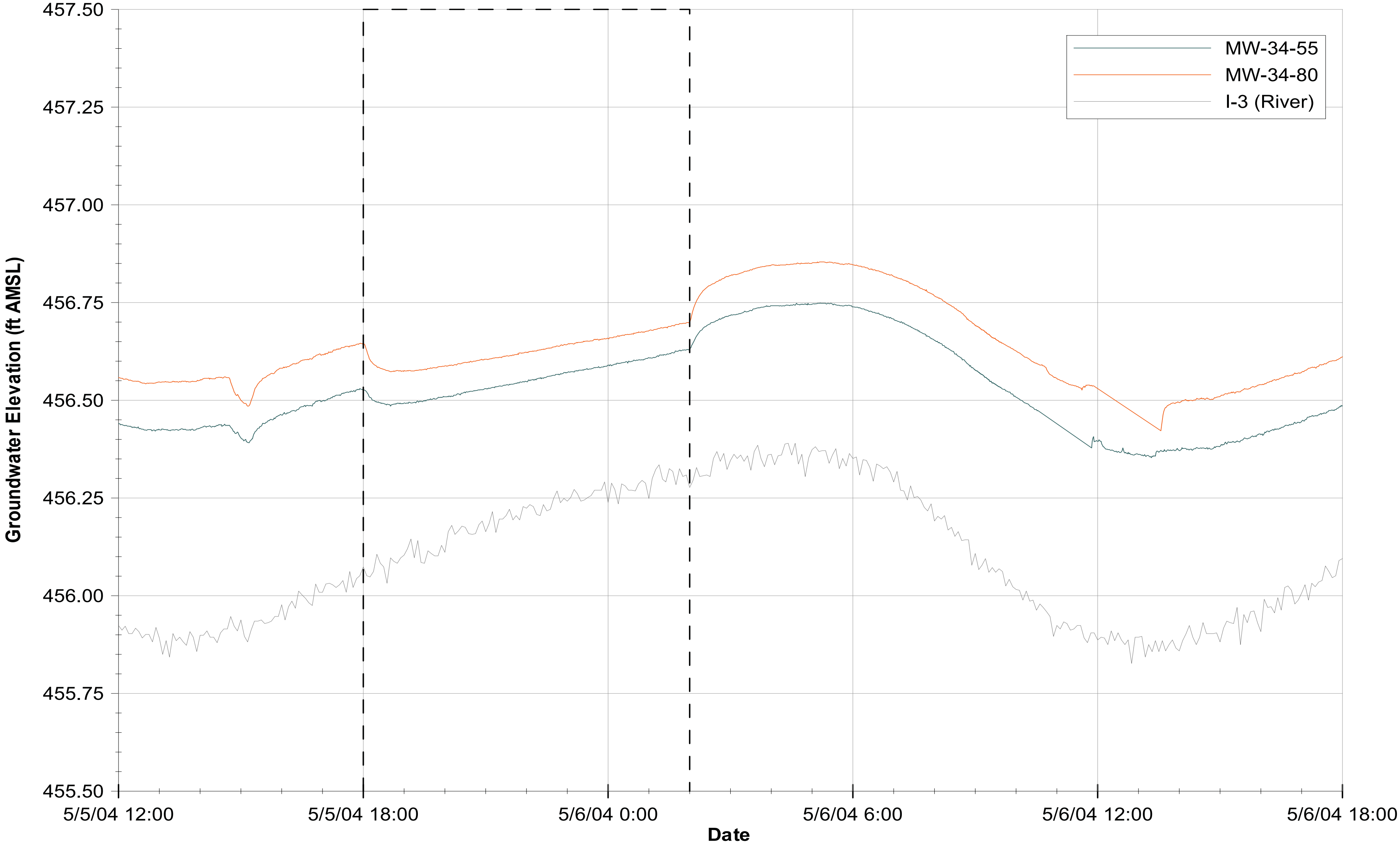

Note: Data subject to review.

APPENDIX D-4S-8
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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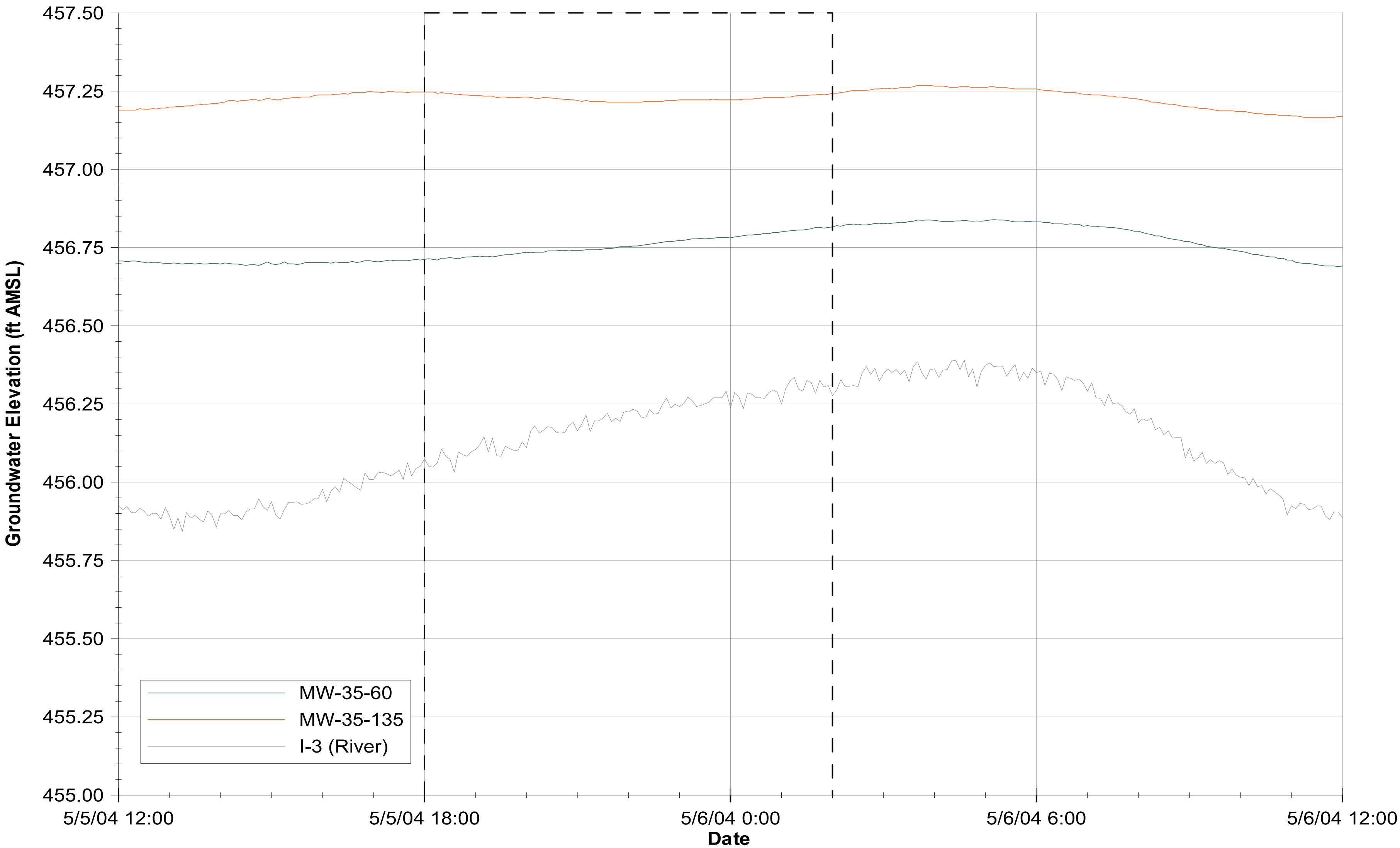

Note: Data subject to review.

APPENDIX D-4S-9
TW-2D TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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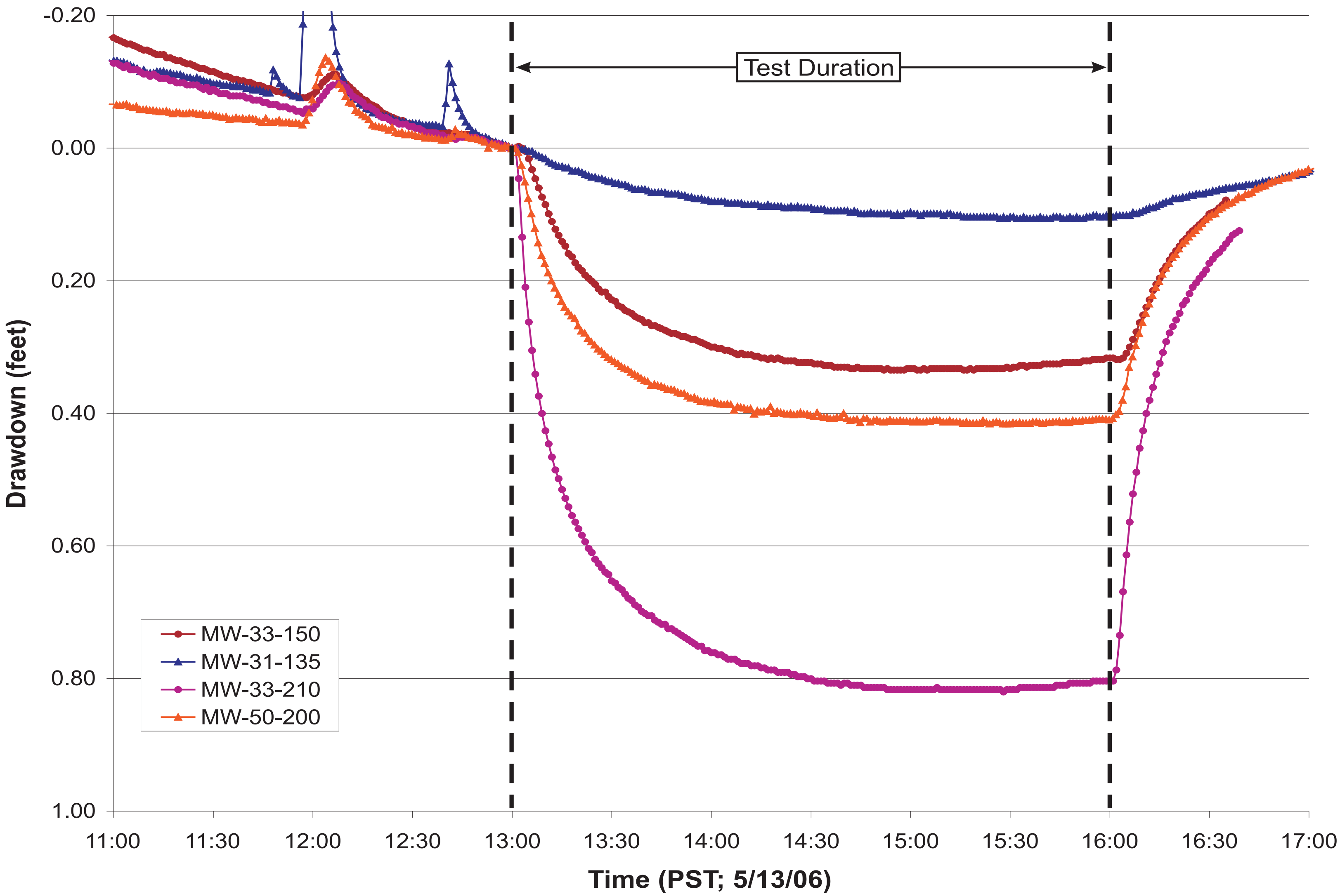
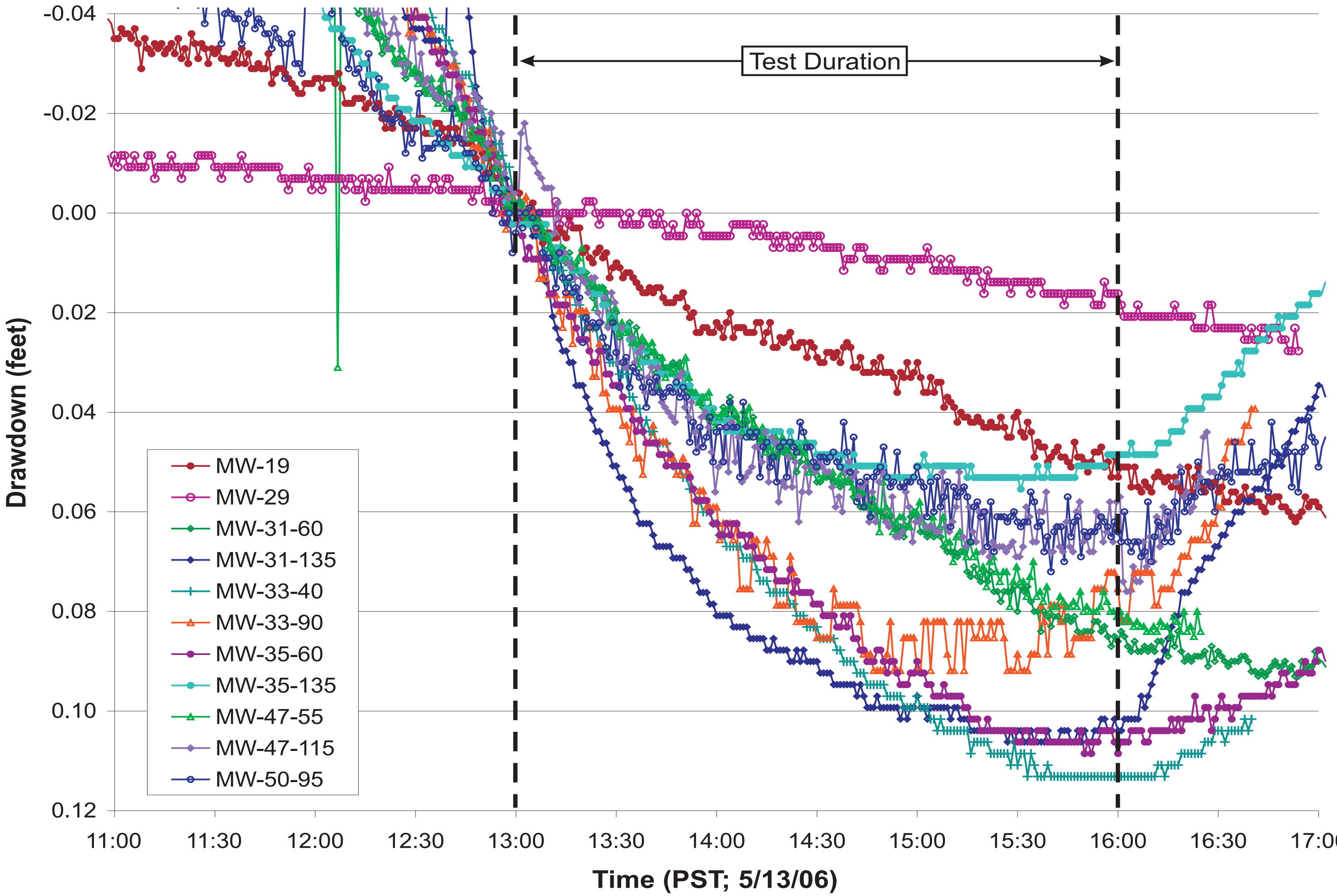


Notes:
Pumping well is TW-4; test began at 5/13/06 at 13:00.
Pumping rate = 28 gallons/minute; test duration = 180 minutes.

APPENDIX D-4T
TW-4 CONSTANT RATE TEST - DRAWDOWN AT SELECT OBSERVATION WELLS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

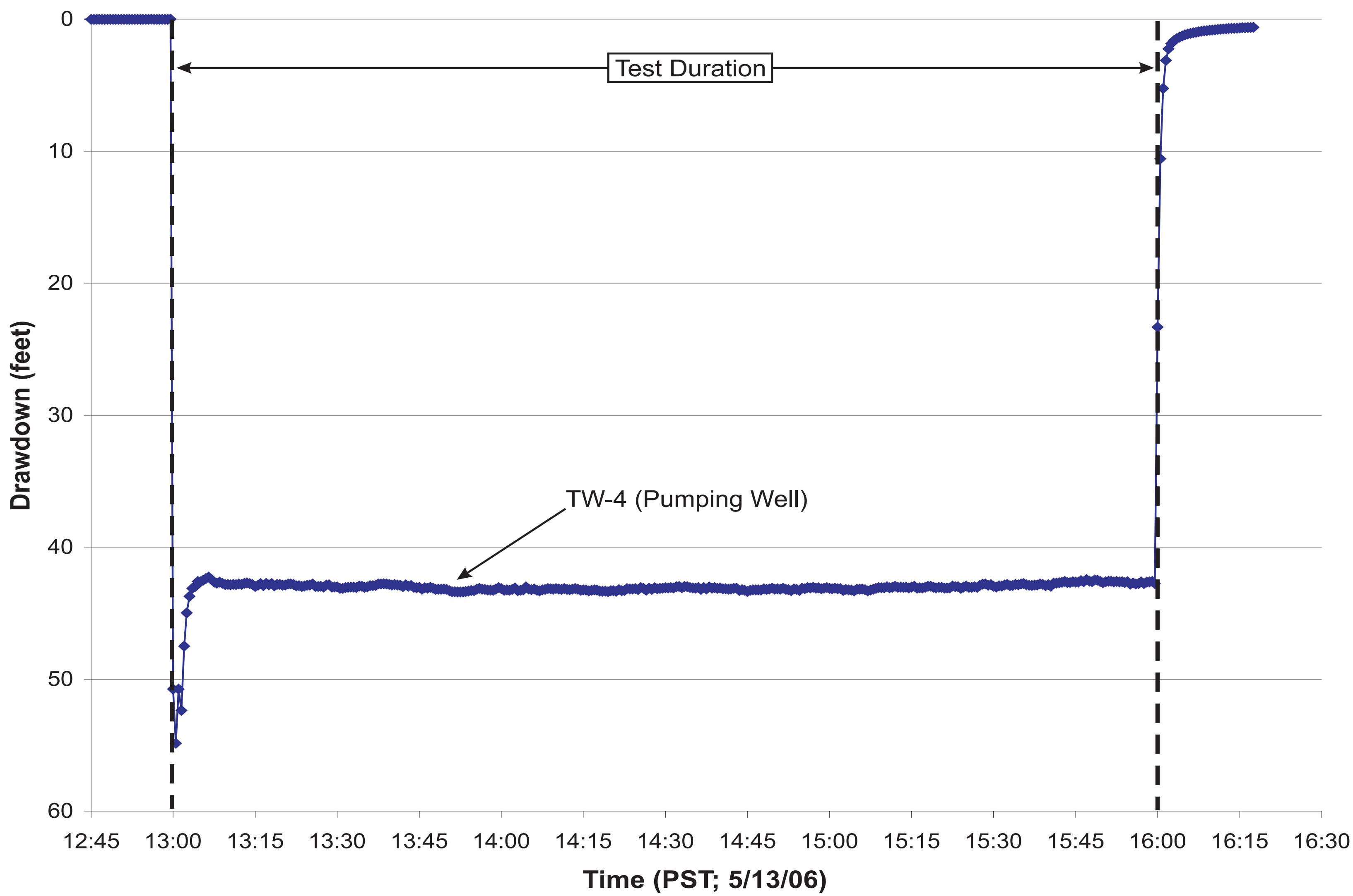


Notes:
Pumping well is TW-4; test began at 5/13/06 at 13:00.
Pumping rate = 28 gallons/minute; test duration = 180 minutes.

APPENDIX D-4U
TW-W CONSTANT RATE TEST - DRAWDOWN AT SELECT OBSERVATION WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Notes:
Pumping well is TW-4; test began at 5/13/06 at 13:00.
Pumping rate = 28 gallons/minute; test duration = 180 minutes.

APPENDIX D-4V
TW-4 CONSTANT RATE TEST
DRAWDOWN AT PUMPING WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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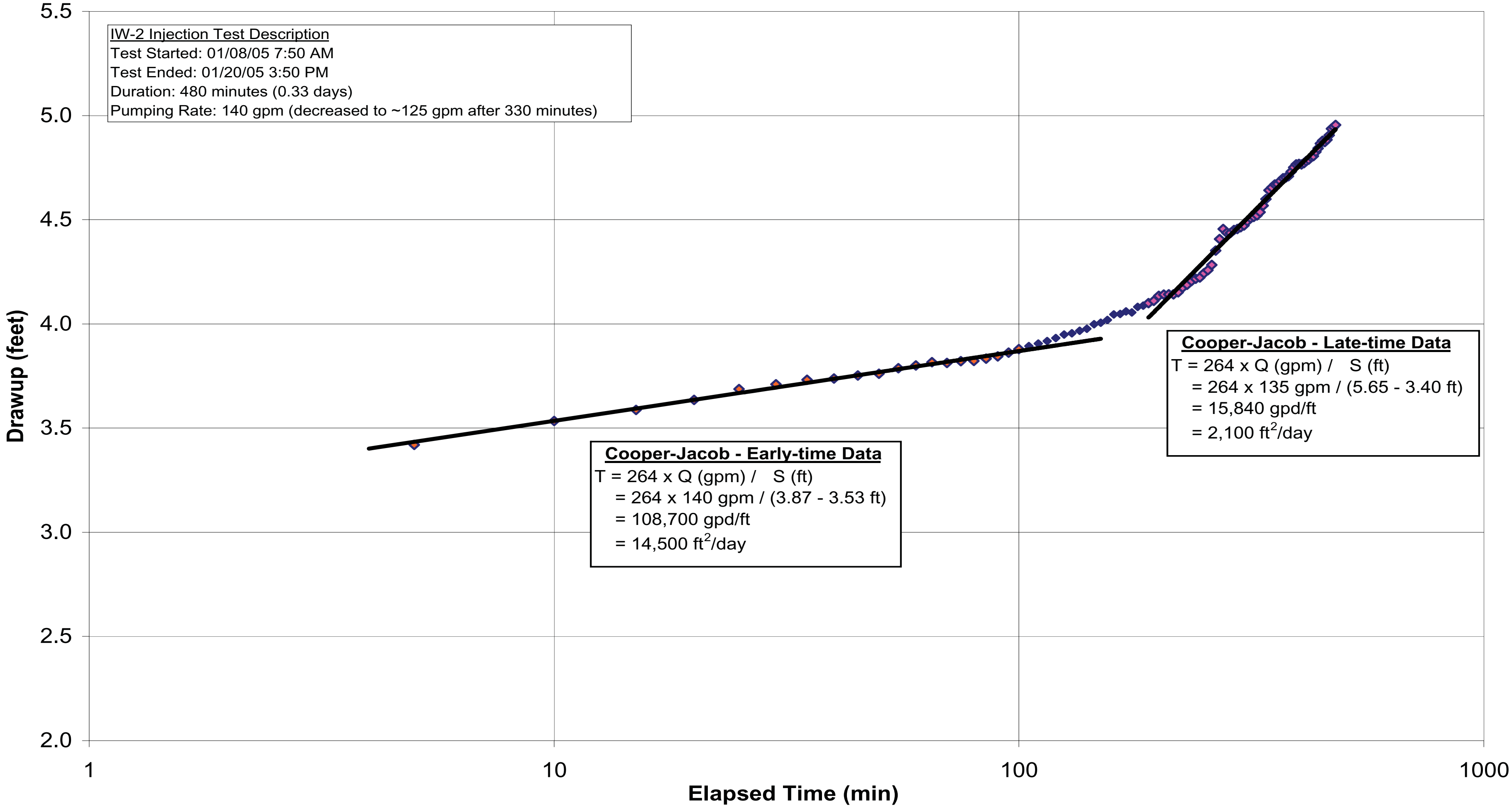
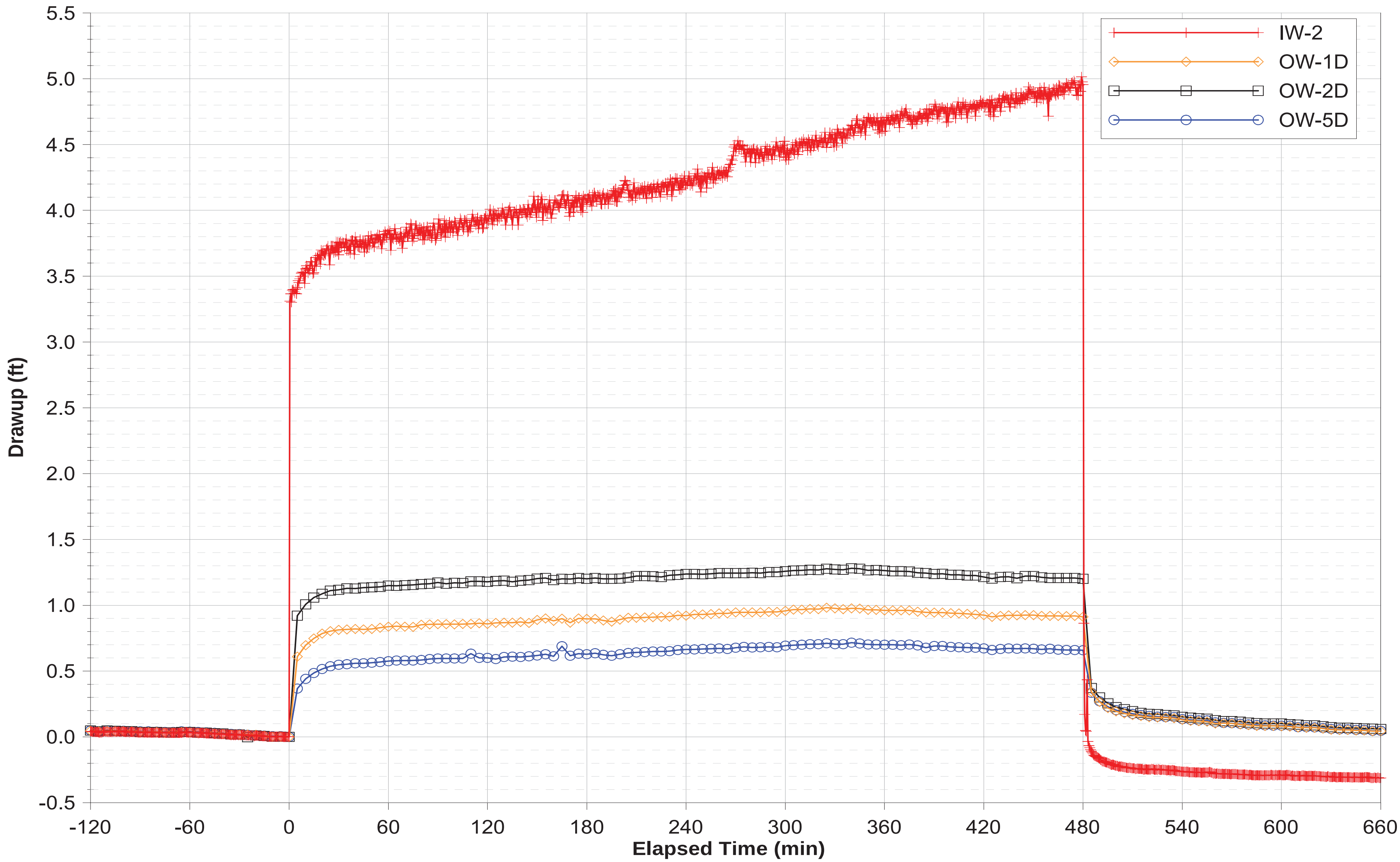
D5 Injection Tests

(Provided only on CD ROM)



APPENDIX D-5A
DRAWUP AT IW-2 INJECTION WELL

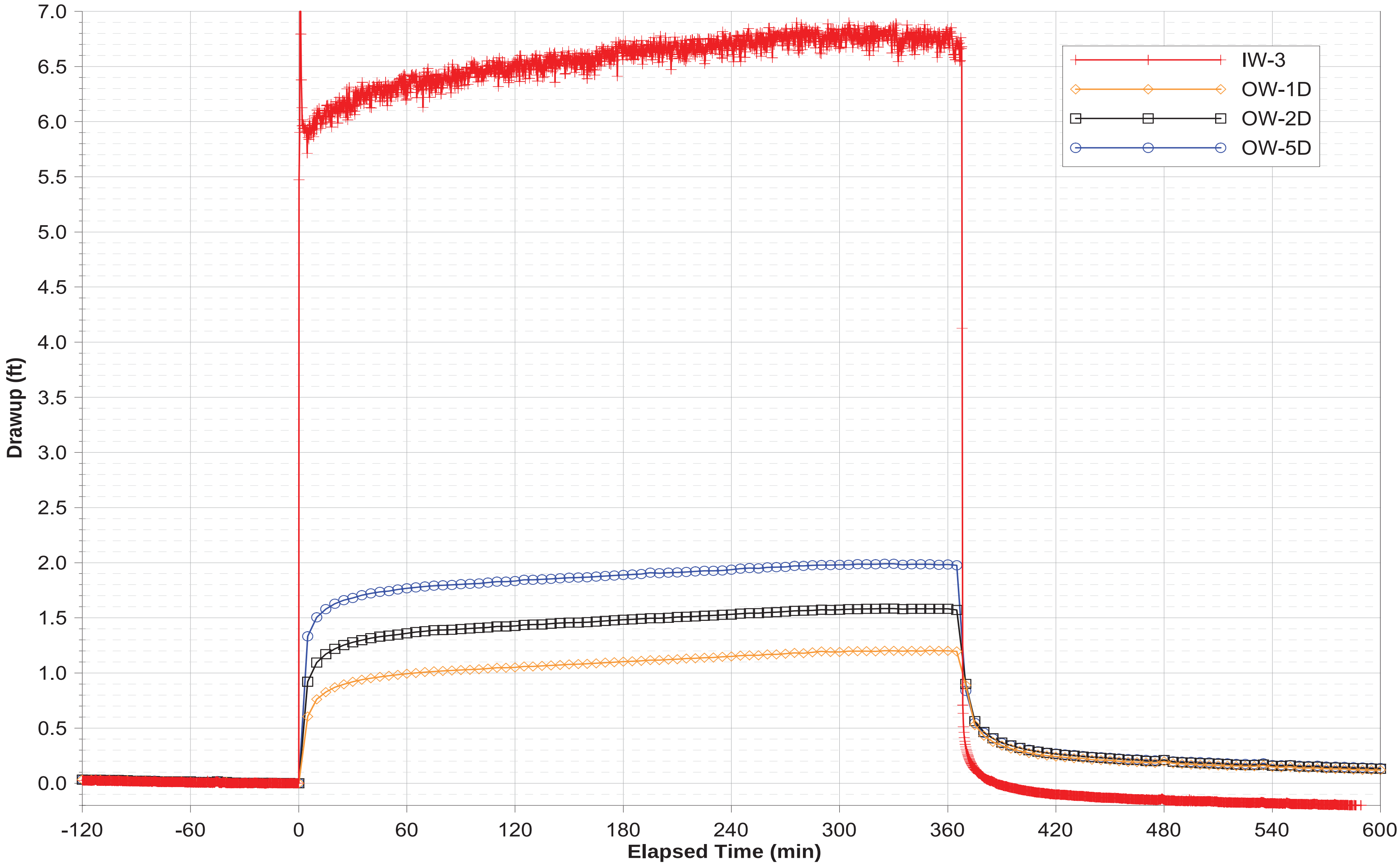
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes:
Injection conducted into IW-2 at 125-140 gpm
starting on 1/08/2005 7:50AM.

APPENDIX D-5B
IW-2 INJECTION TEST #1
DRAWUP AT IW-2 AND DEEP MONITORING WELL

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



Notes: Injection into IW-3 at 251 gpm starting on 1/20/2005 8:00 AM.

APPENDIX D-5C
IW-3 INJECTION TEST
DRAWUP AT IW-3 AND DEEP MONITORING WELLS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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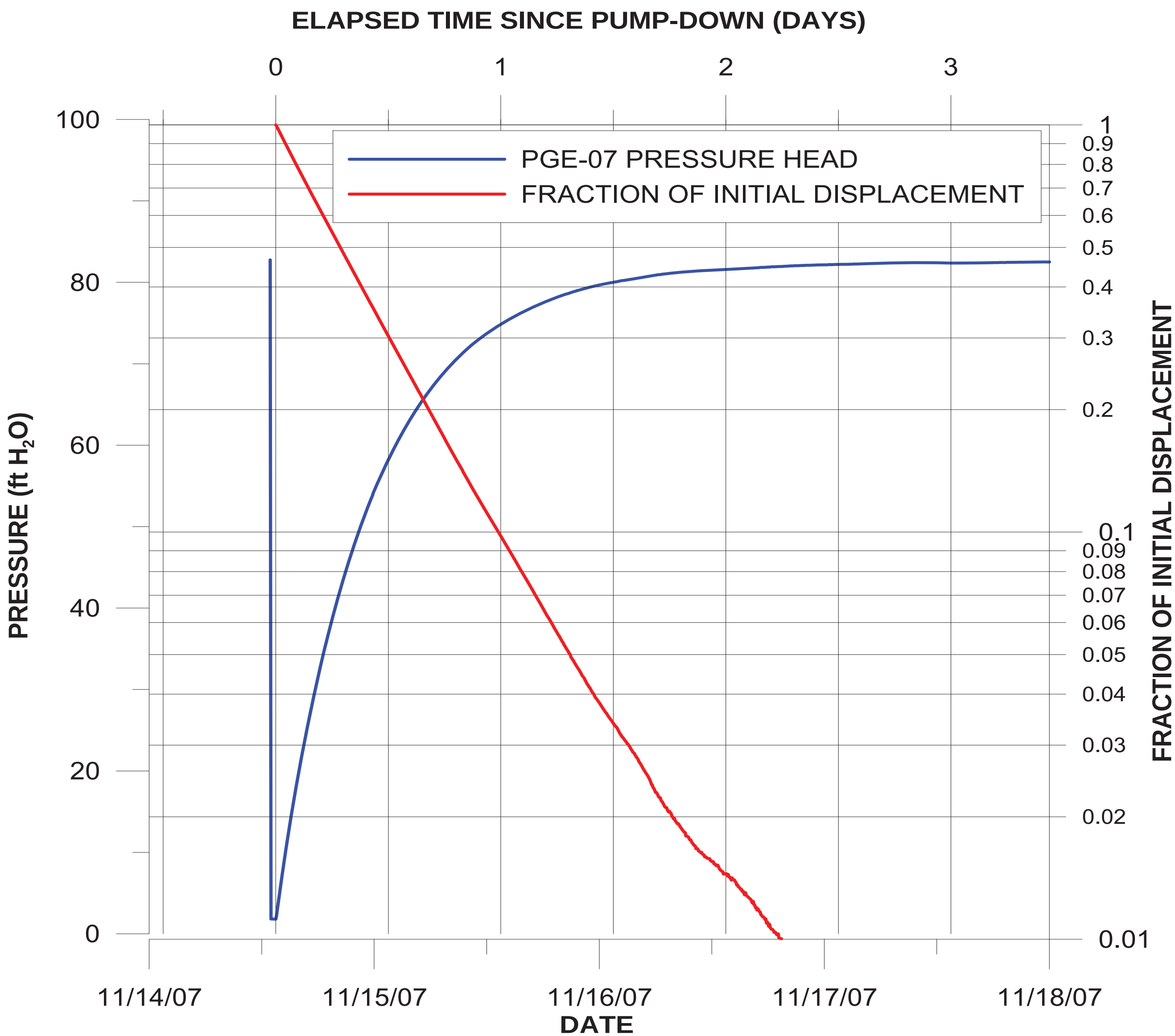
D6 Bedrock Hydraulic Testing

(Provided only on CD ROM)



APPENDIX D-6A

PGE-07 RECOVERY TEST RESULTS

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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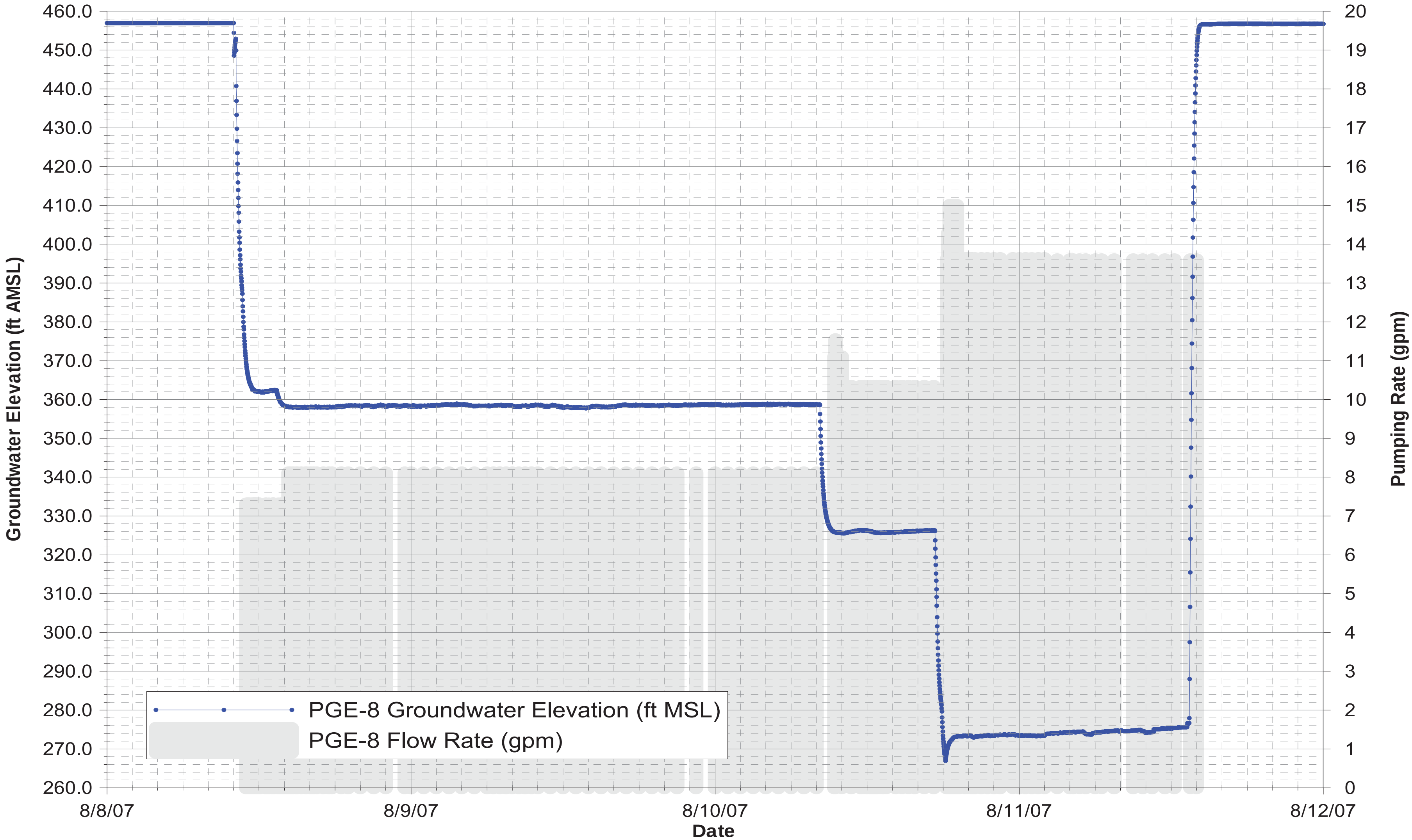

Note: Data subject to review.

APPENDIX D-6B
PGE-08 PUMPING TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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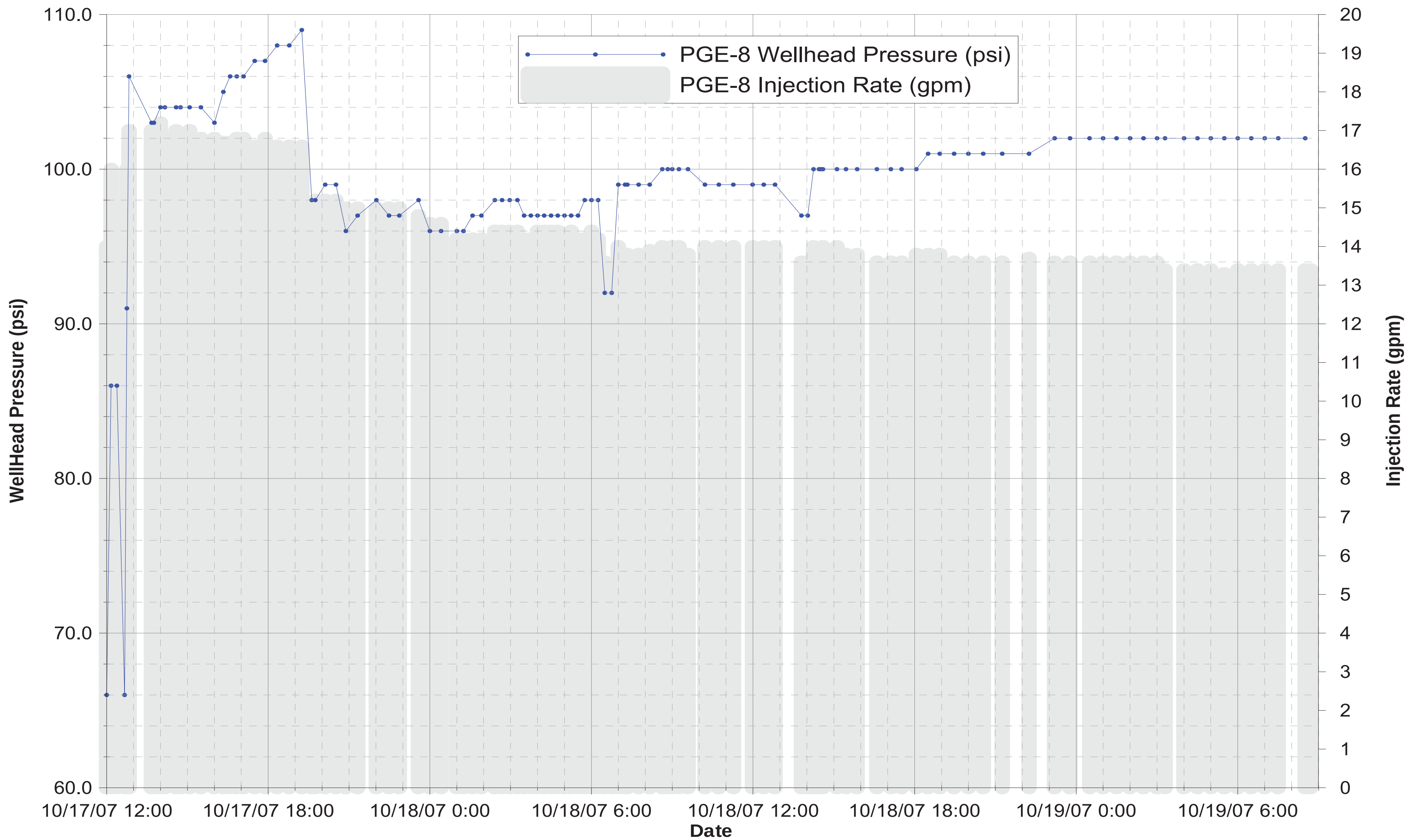
ES102007005BAO_Appendix_D_figures.indd_022808_lho



Note: Data subject to review.

APPENDIX D-6C
PGE-08 INJECTION TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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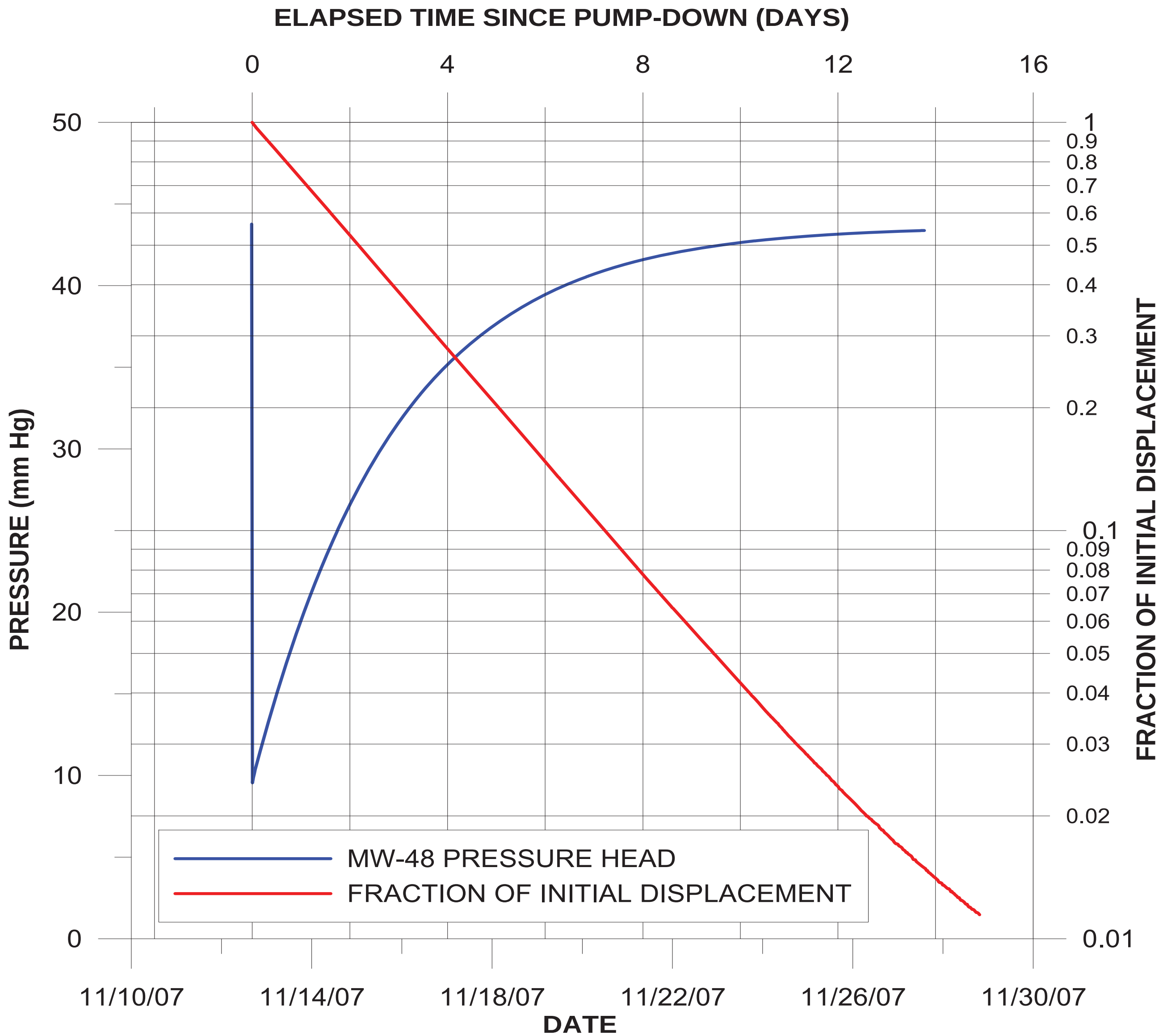
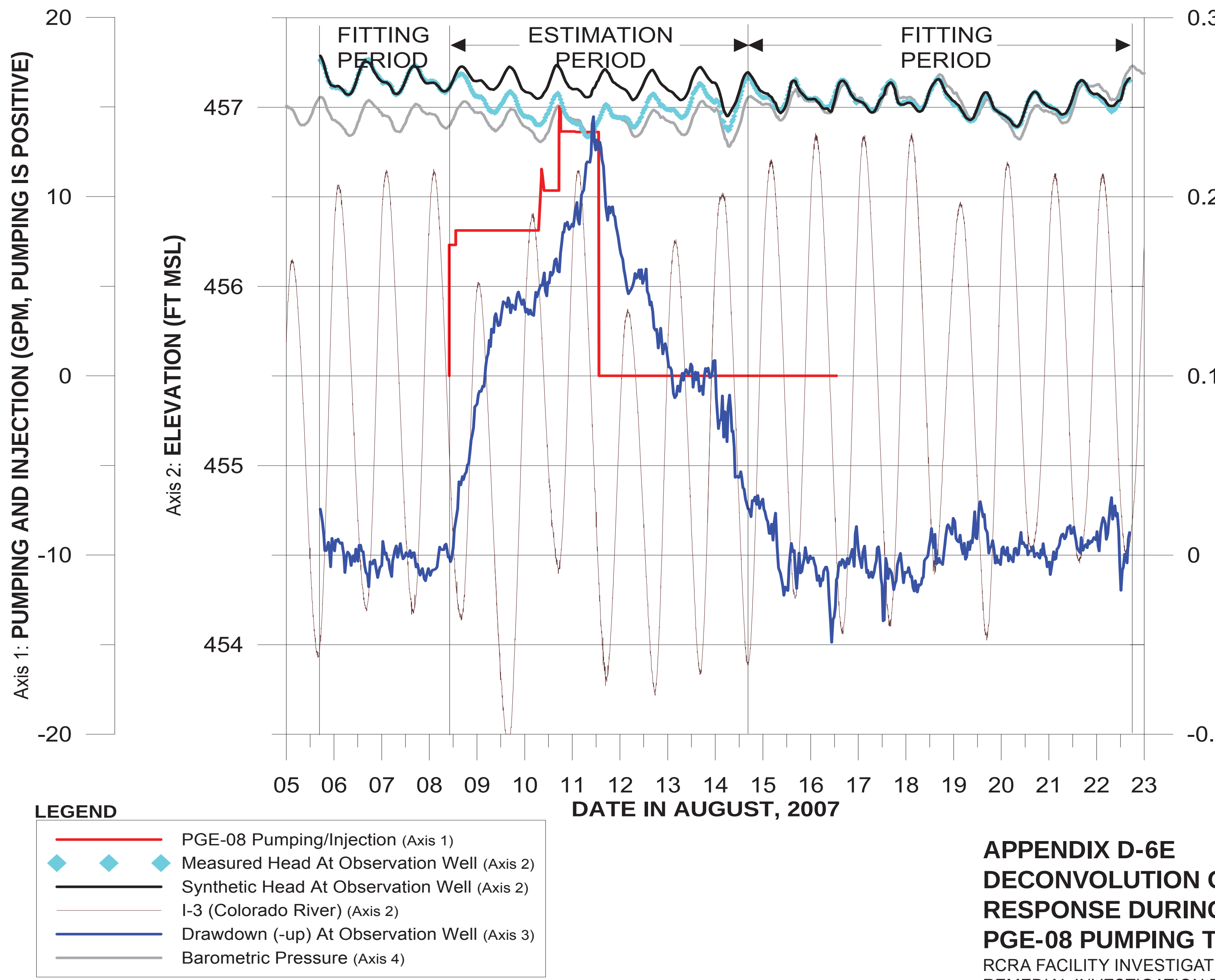
ES102007005BAO_Appendix_D_figures.indd_022808_lho



APPENDIX D-6D
MW-48 RECOVERY TEST RESULTS
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



APPENDIX D-6E
DECONVOLUTION OF MW-09 RESPONSE DURING AUGUST 2007 PGE-08 PUMPING TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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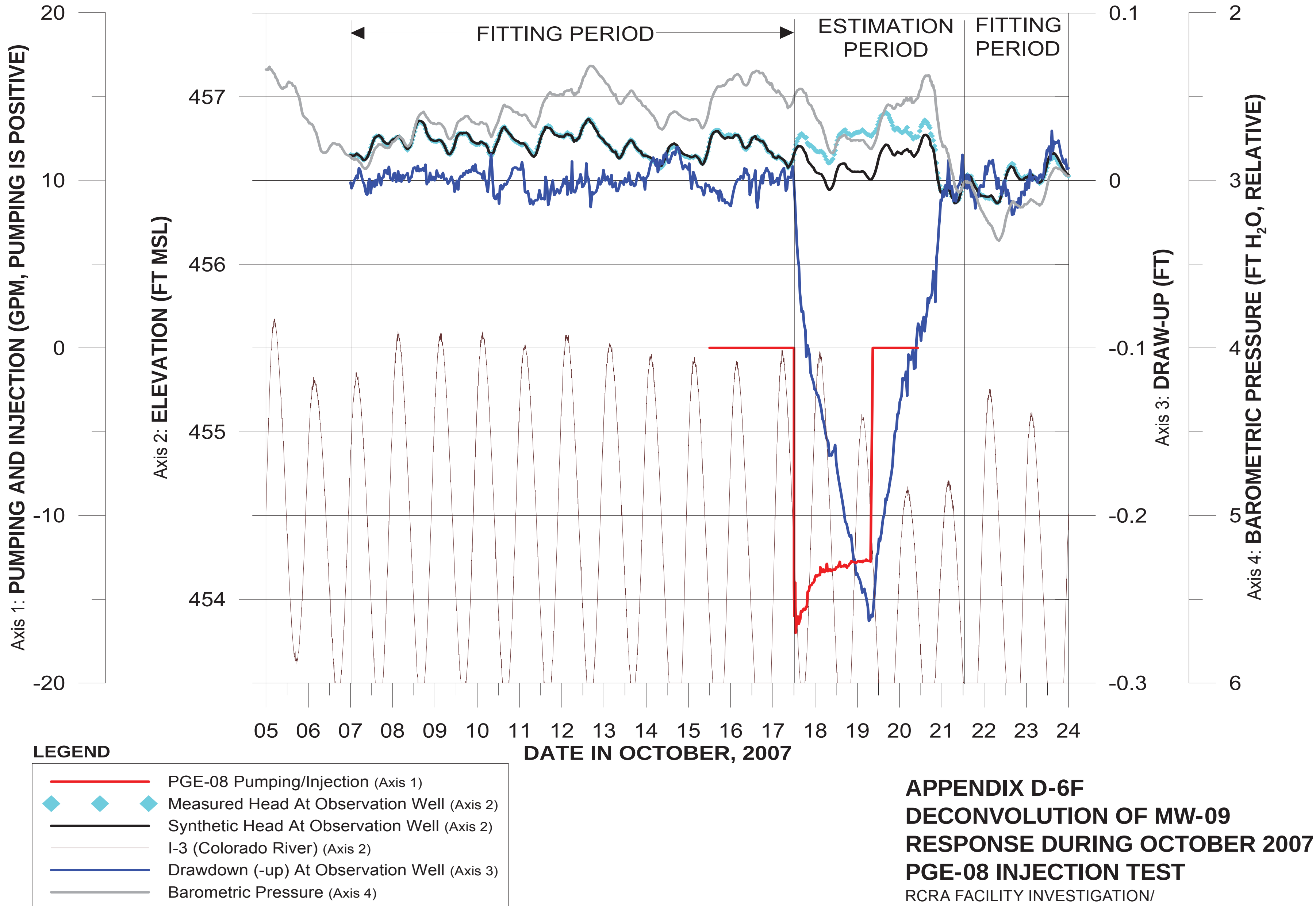
ES102007005BAO_Appendix_D_figures.indd_022808_lho



APPENDIX D-6F
DECONVOLUTION OF MW-09 RESPONSE DURING OCTOBER 2007 PGE-08 INJECTION TEST

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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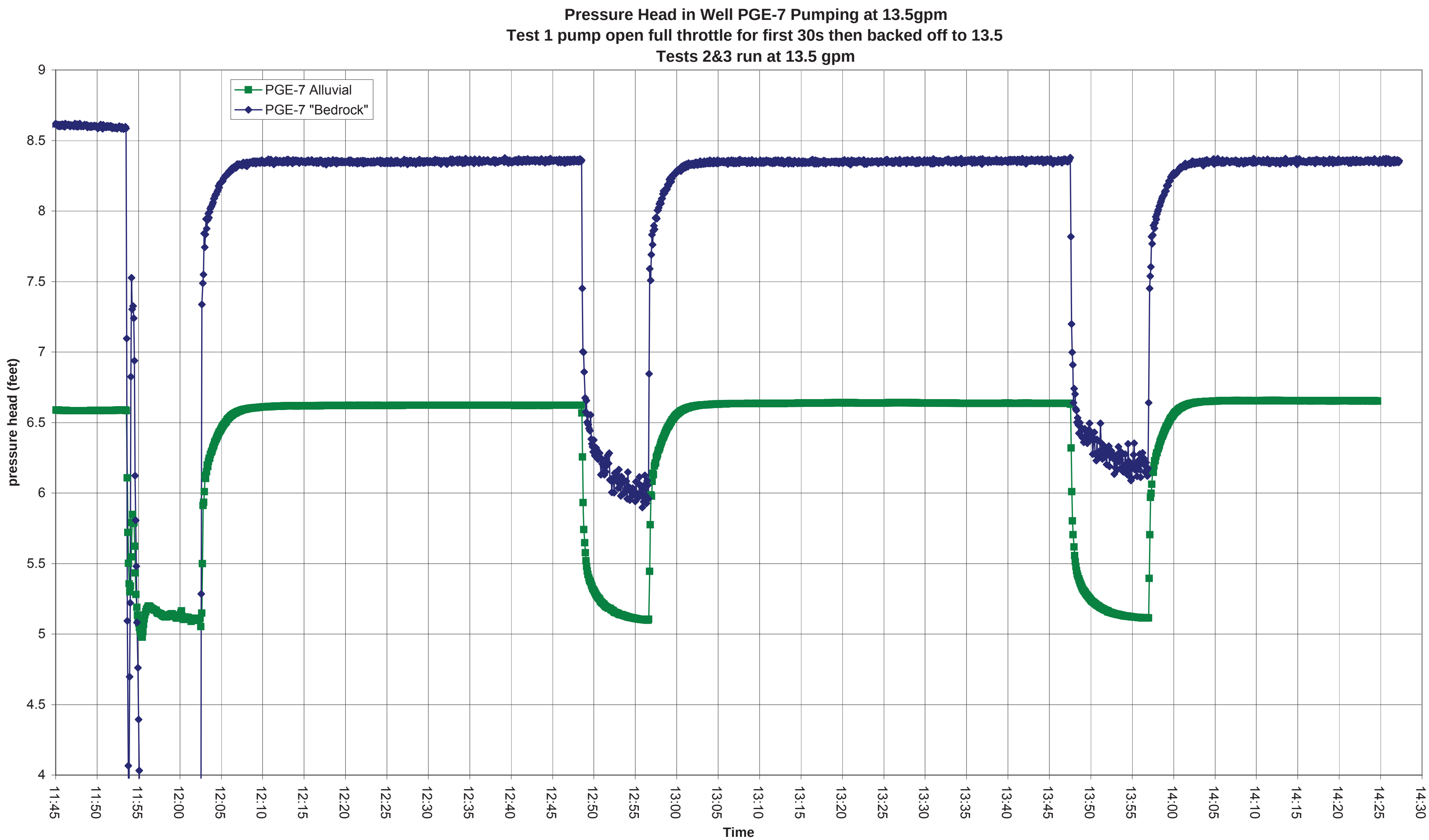

APPENDIX D-6G
PGE-7 PUMP TEST
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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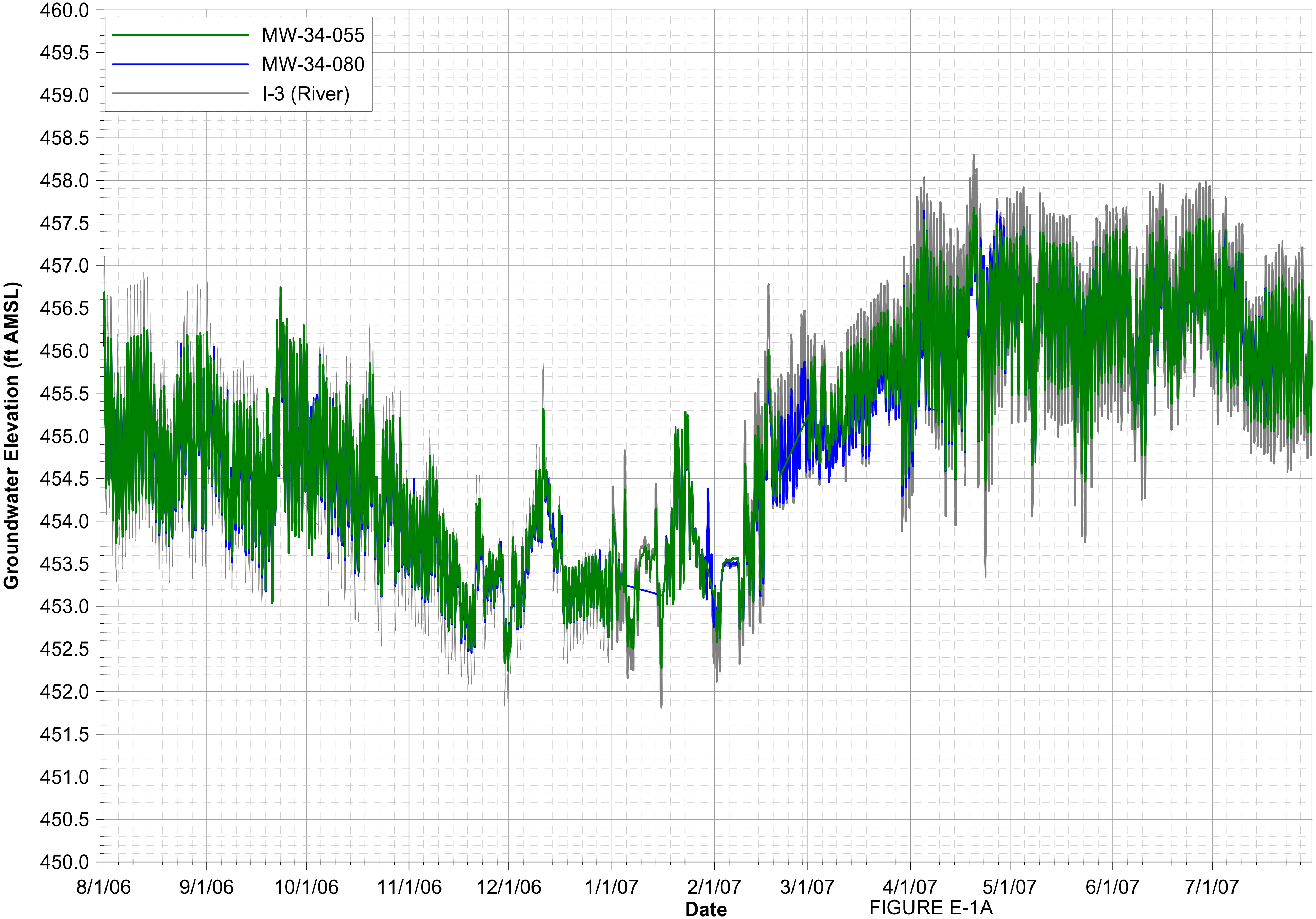
Appendix E
Groundwater and River Elevation Data and Hydrographs

Appendix E
Groundwater and River Elevation Data and Hydrographs

E1 Hydrographs for Selected Alluvial Aquifer Wells—Floodplain



Notes:
Data subject to review.
I-3 data unavailable from 9/18/2006 through 11/2/2006.
MW-34-055 data unavailable from 2/20/2007 through 3/1/2007.
MW-34-080 data unavailable from 1/3/2007 through 1/16/2007.
MW-34-100 data unavailable from 12/15/2006 through 1/16/2007.

FIGURE E-1A
MW-34 CLUSTER HYDROGRAPHS
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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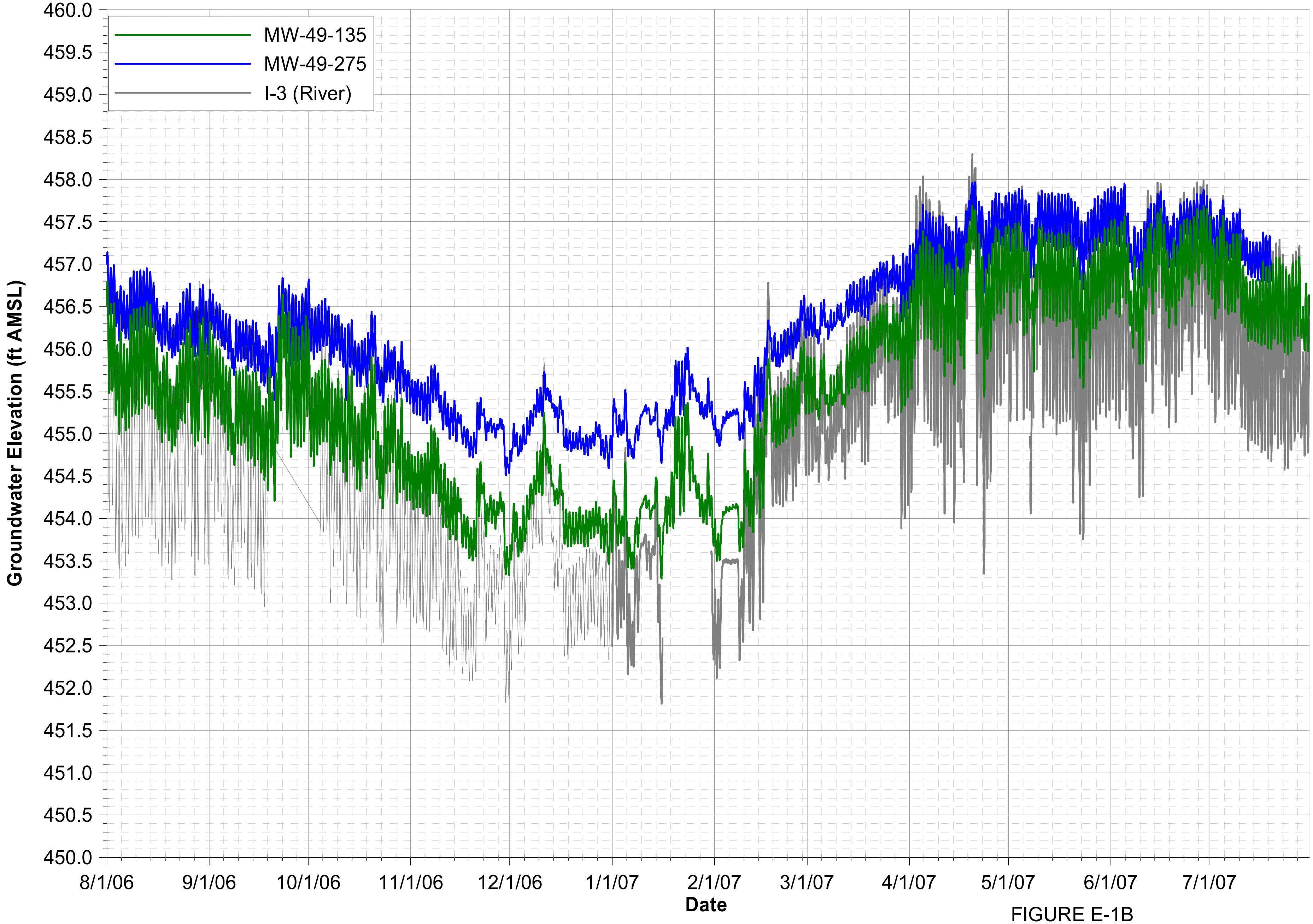

Notes:
Data subject to review.
I-3 data unavailable from 9/18/2006 through 11/2/2006.

FIGURE E-1B
MW-49 CLUSTER HYDROGRAPHS
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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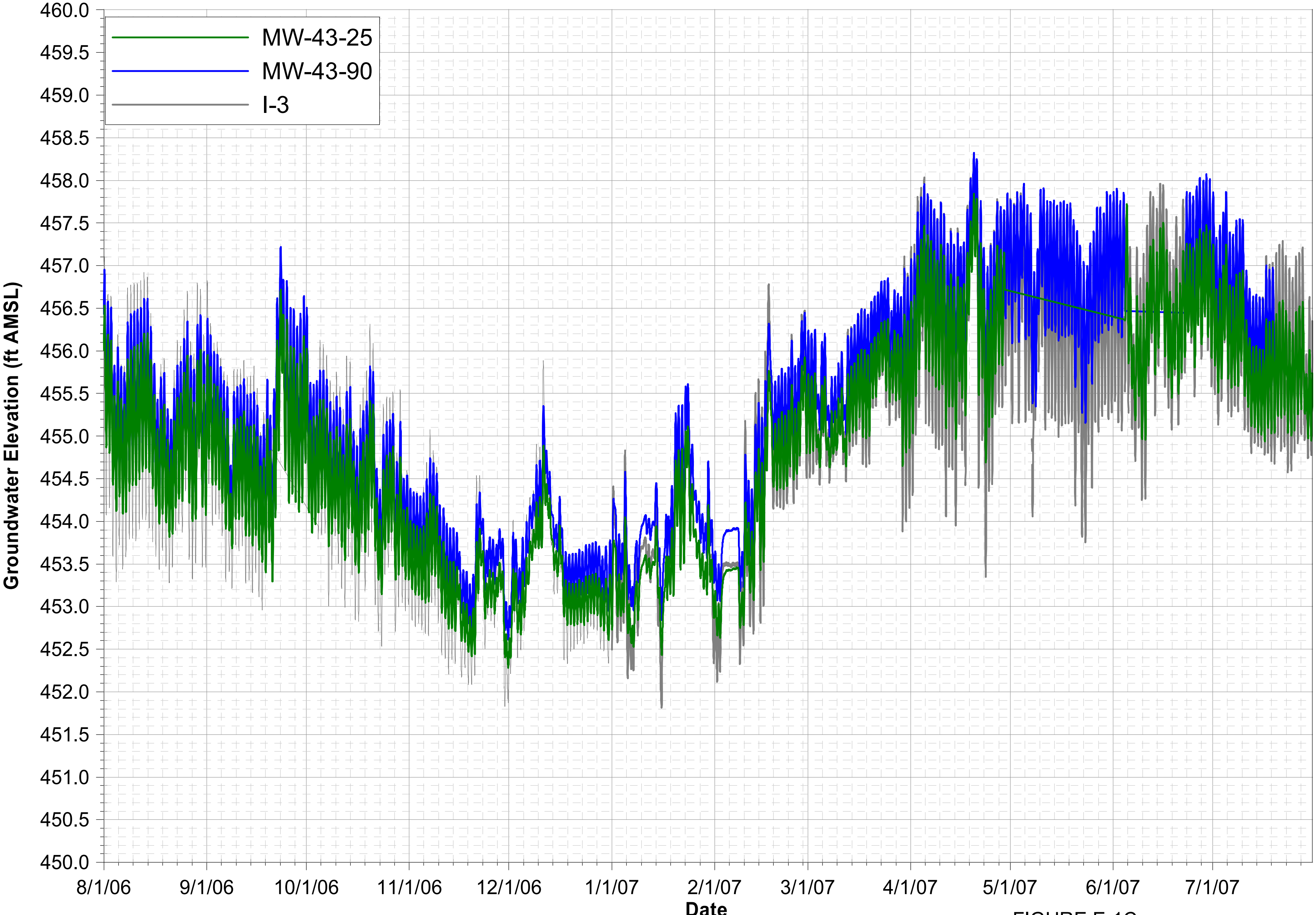

Notes:
Data subject to review.
I-3 data unavailable from 9/18/2006 through 11/2/2006.
MW-43-25 data unavailable from 4/30/2007 through 6/3/2007.

FIGURE E-1C
MW-43 CLUSTER HYDROGRAPHS
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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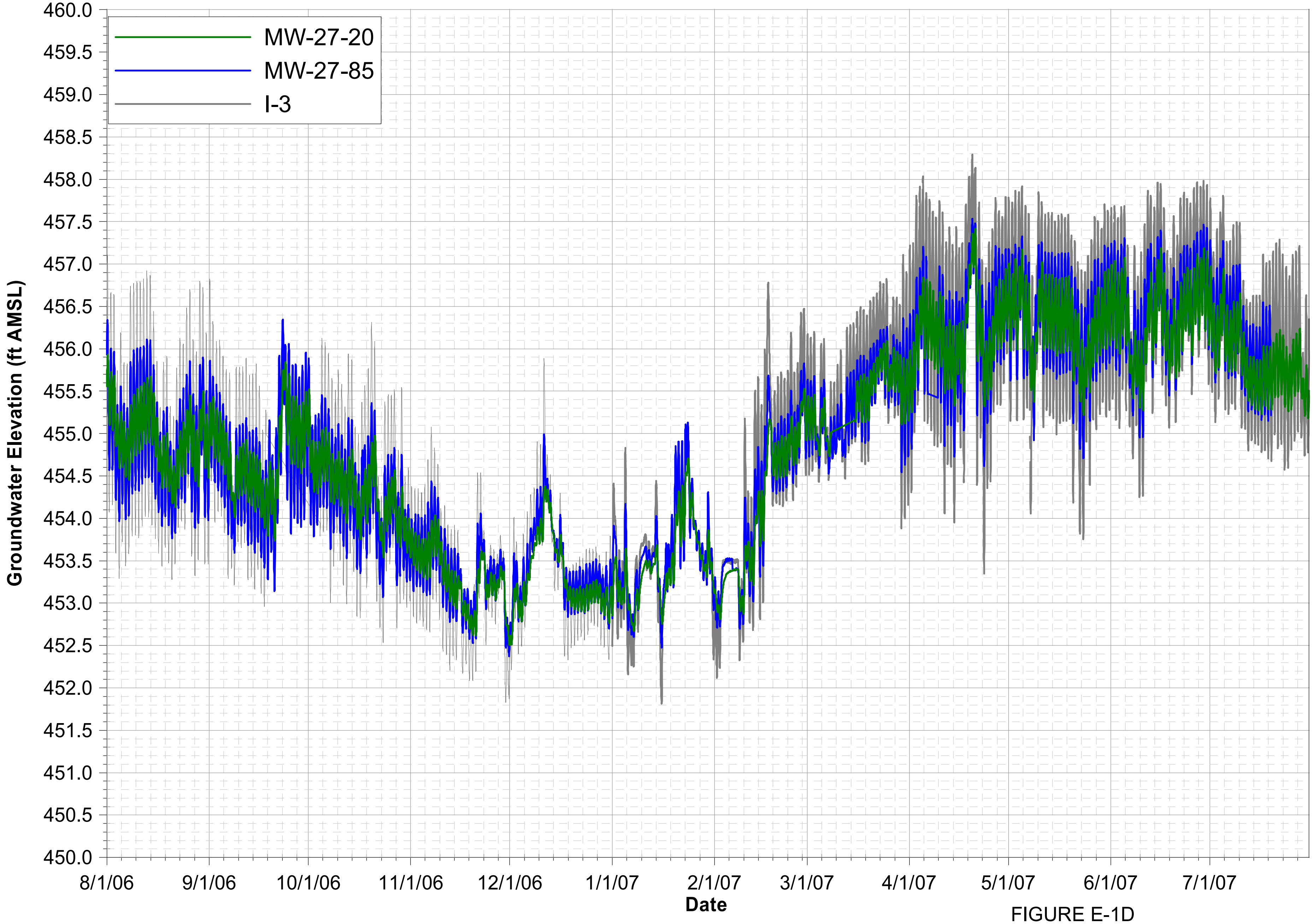

Notes:
Data subject to review.
I-3 data unavailable from 9/18/2006 through 11/2/2006.

FIGURE E-1D
MW-27 CLUSTER HYDROGRAPHS
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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\\Zinfandel\Proj\PacificGasElectricCo\TopockProgram\Project_GMP\Transducers\Hydrographs\RFI_Hydrographs

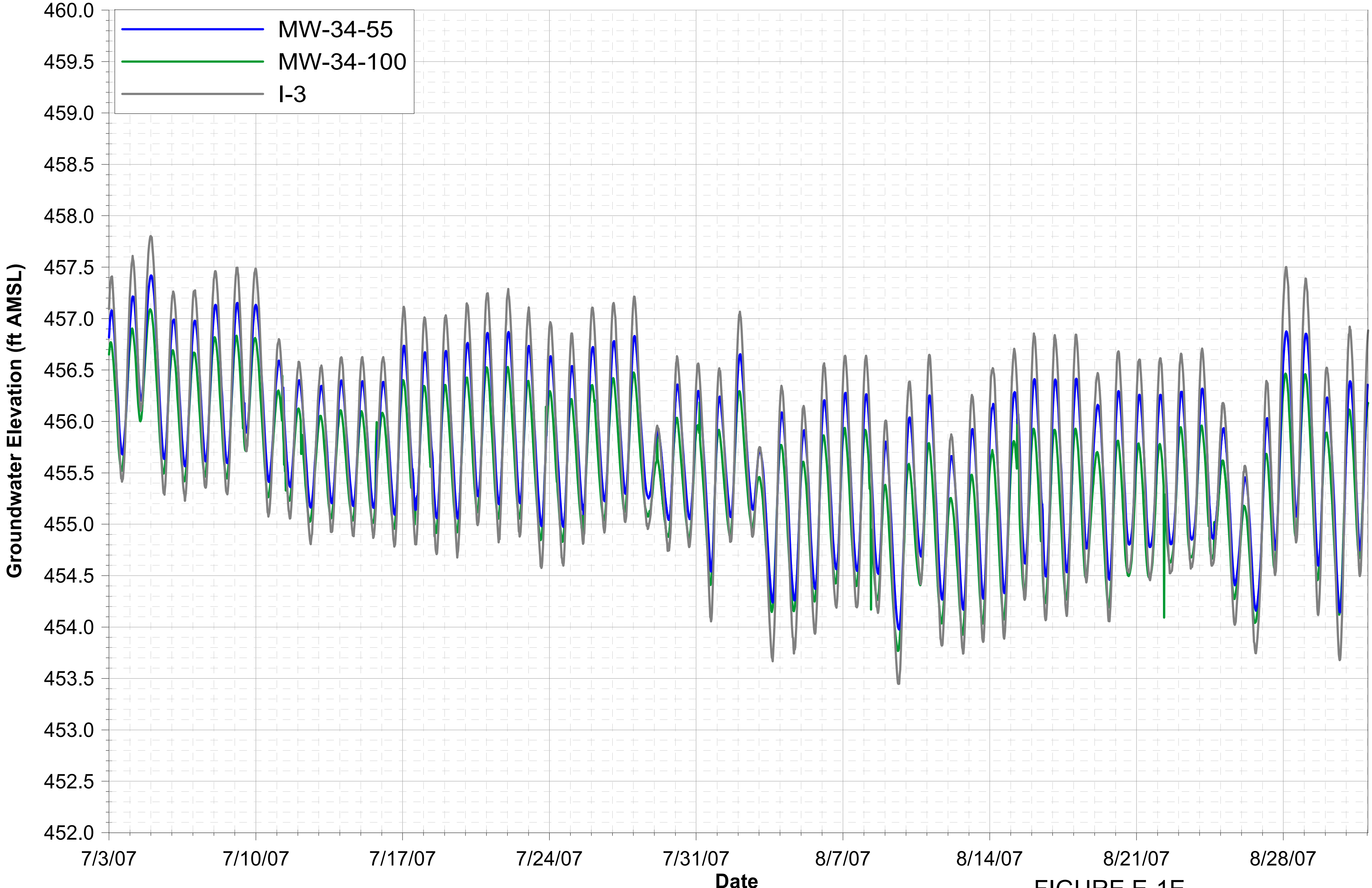

FIGURE E-1E
HYDROGRAPH OF FLOODPLAIN
WELLS MW-34-55 & MW-34-100
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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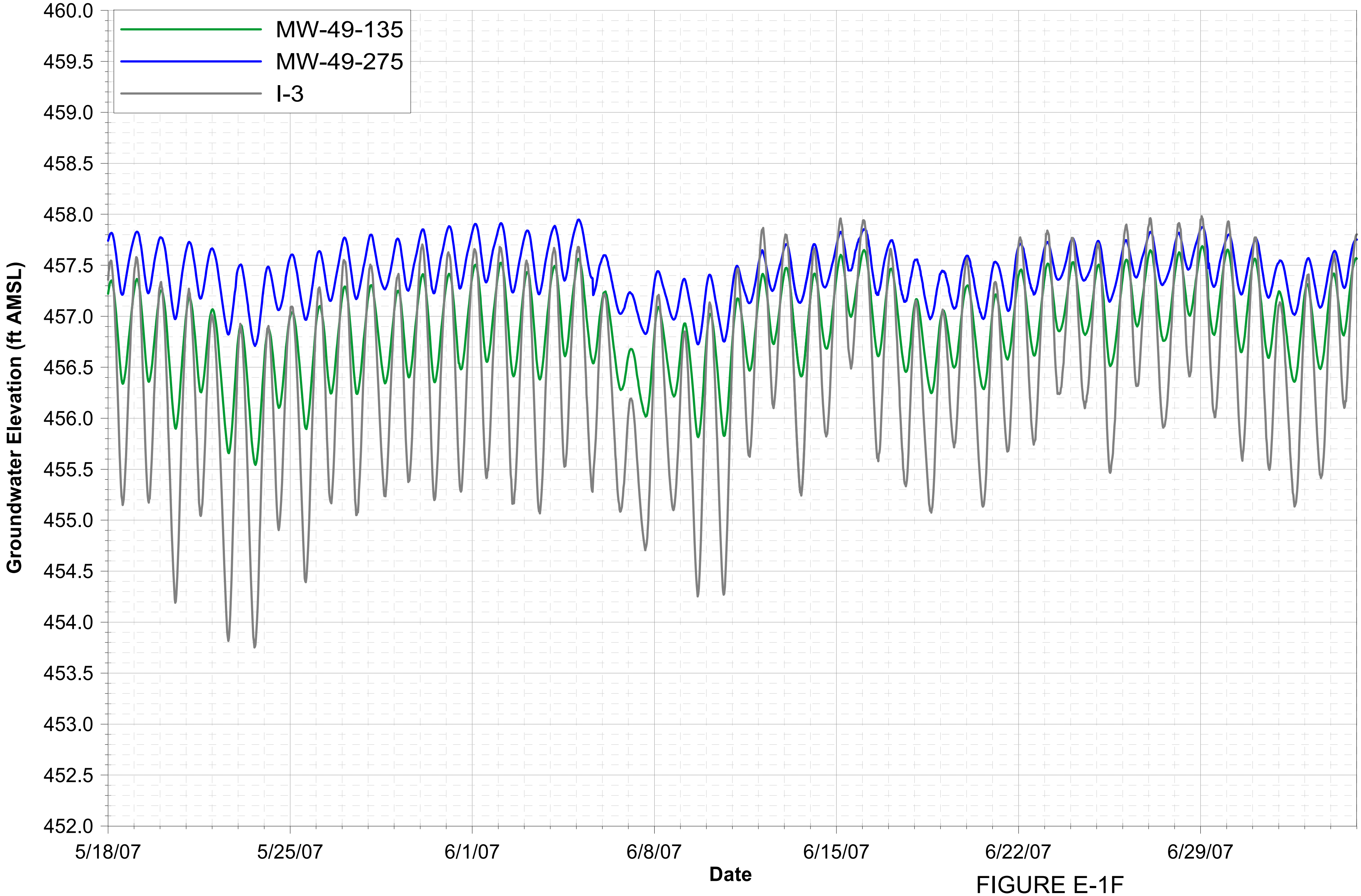

FIGURE E-1F
HYDROGRAPH OF WELLS
MW-49-135 & MW-49-275
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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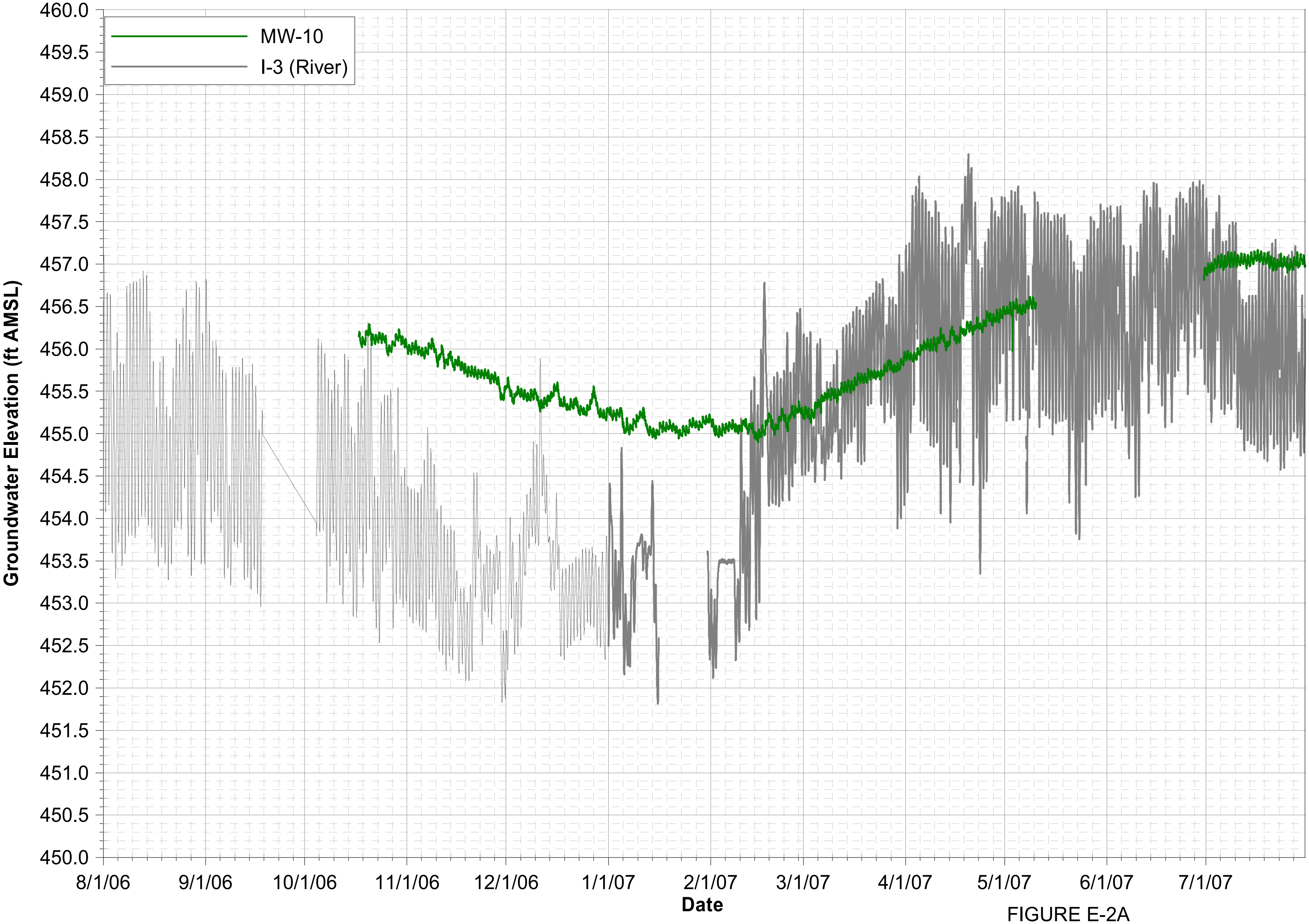
E2 Hydrographs for Selected Alluvial Aquifer Wells— Bat Cave Wash



Notes:
Data subject to review.
I-3 data unavailable from 9/18/2006 through 11/2/2006.
MW-10 data unavailable before 10/16/2006, and 5/9/2007 through 7/1/2007.

FIGURE E-2A
MW-10 HYDROGRAPH
RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
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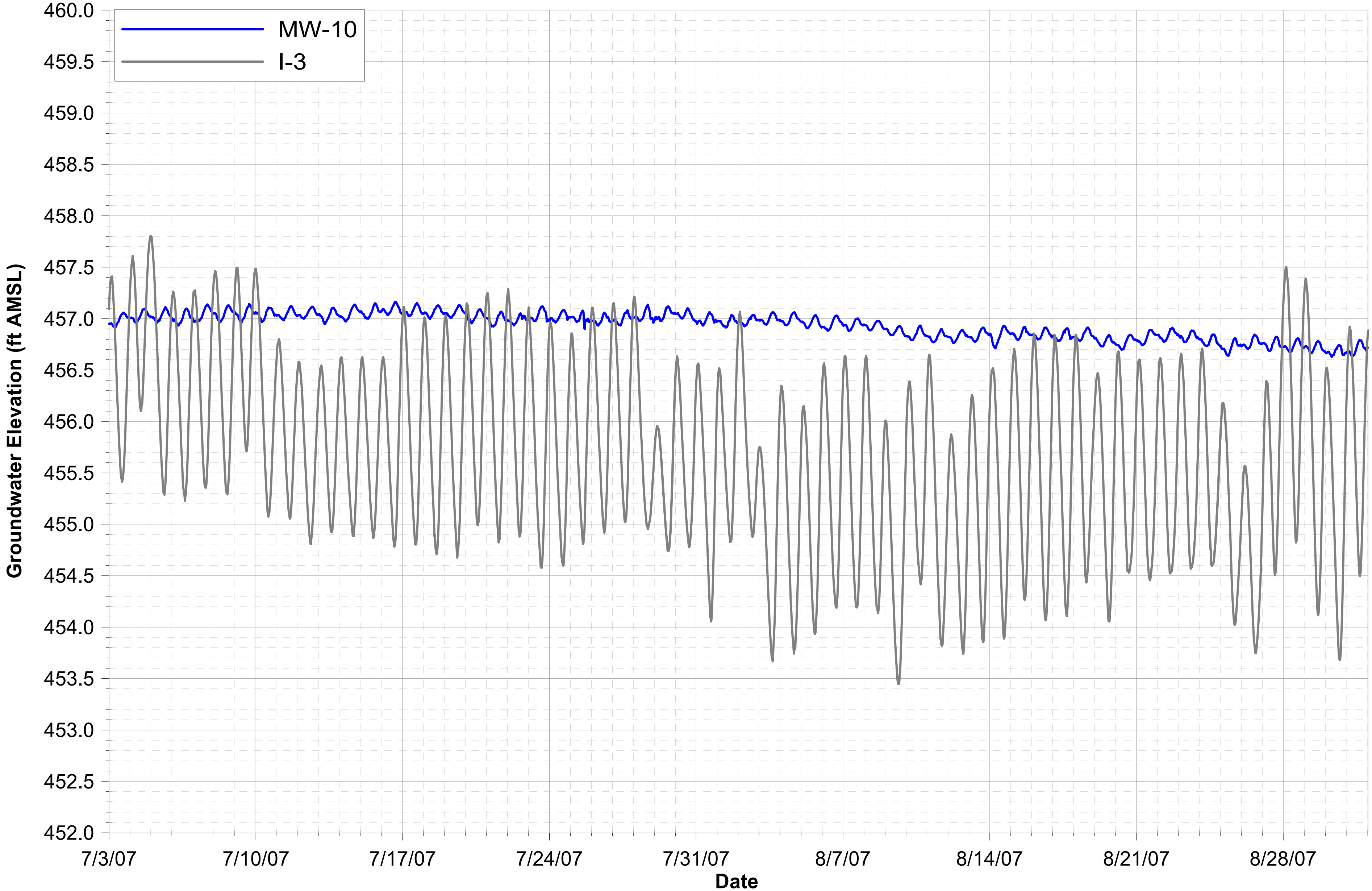

FIGURE E-2B
HYDROGRAPH OF WELL MW-10
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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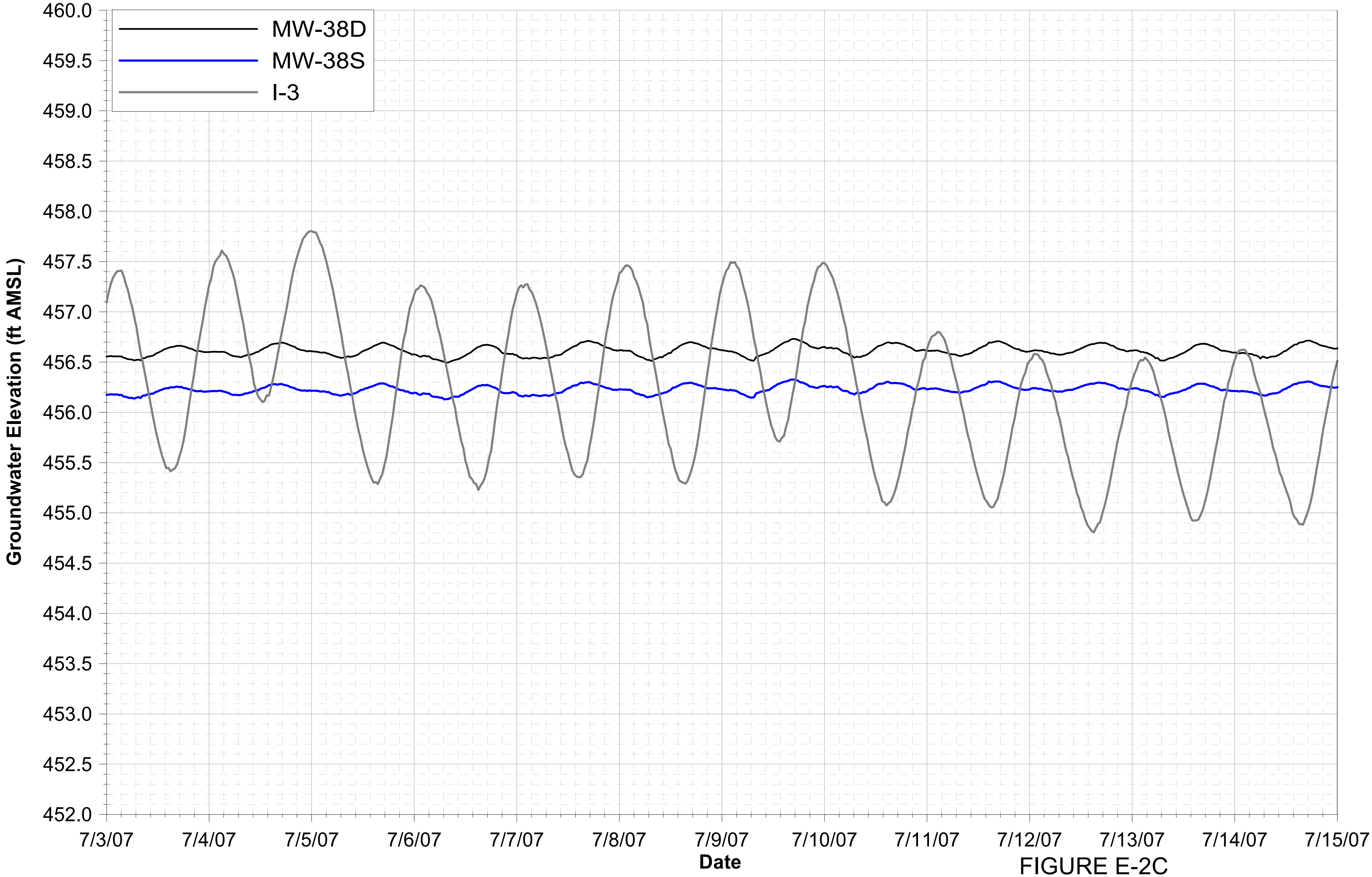

FIGURE E-2C
HYDROGRAPH OF WELLS
MW-38S AND MW-38D
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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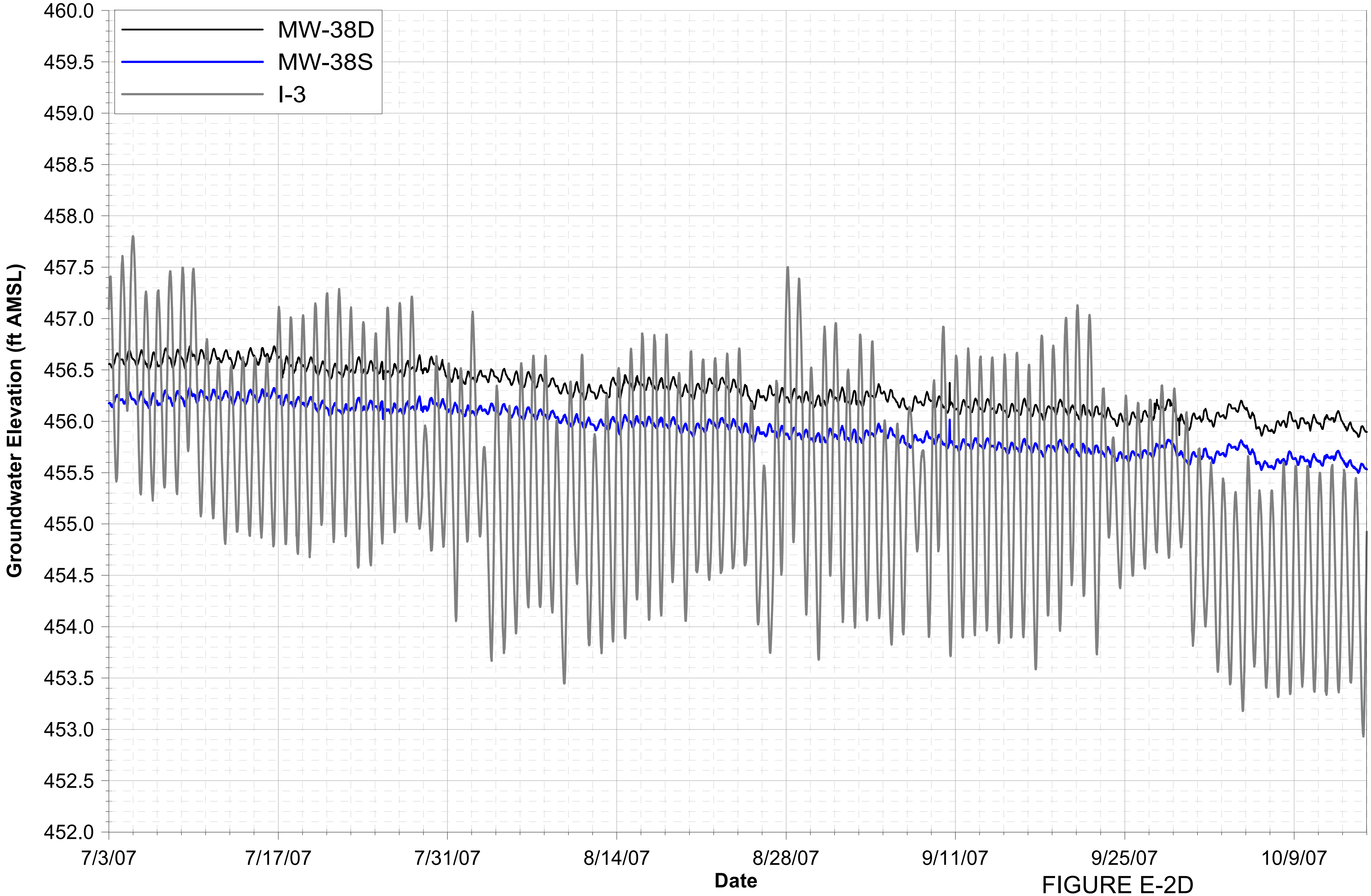

FIGURE E-2D
HYDROGRAPH OF WELLS
MW-38S AND MW-38D
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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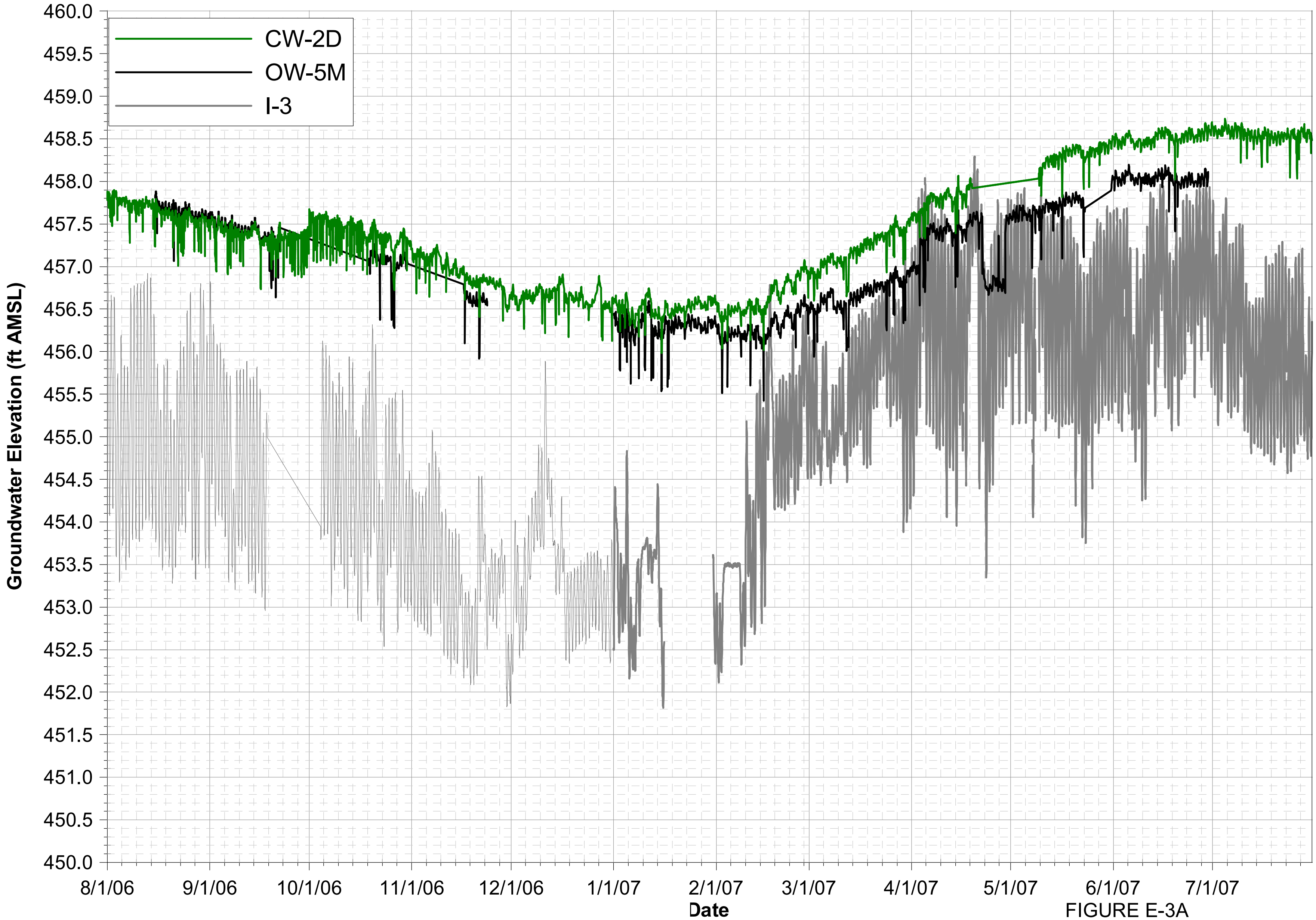
E3 Hydrographs for Selected Alluvial Aquifer Wells— Upgradient Interior Area



Notes:
Data subject to review.
I-3 data unavailable from 9/18/2006 through 11/2/2006.

FIGURE E-3A
OW&CW WELLS
HYDROGRAPHS

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

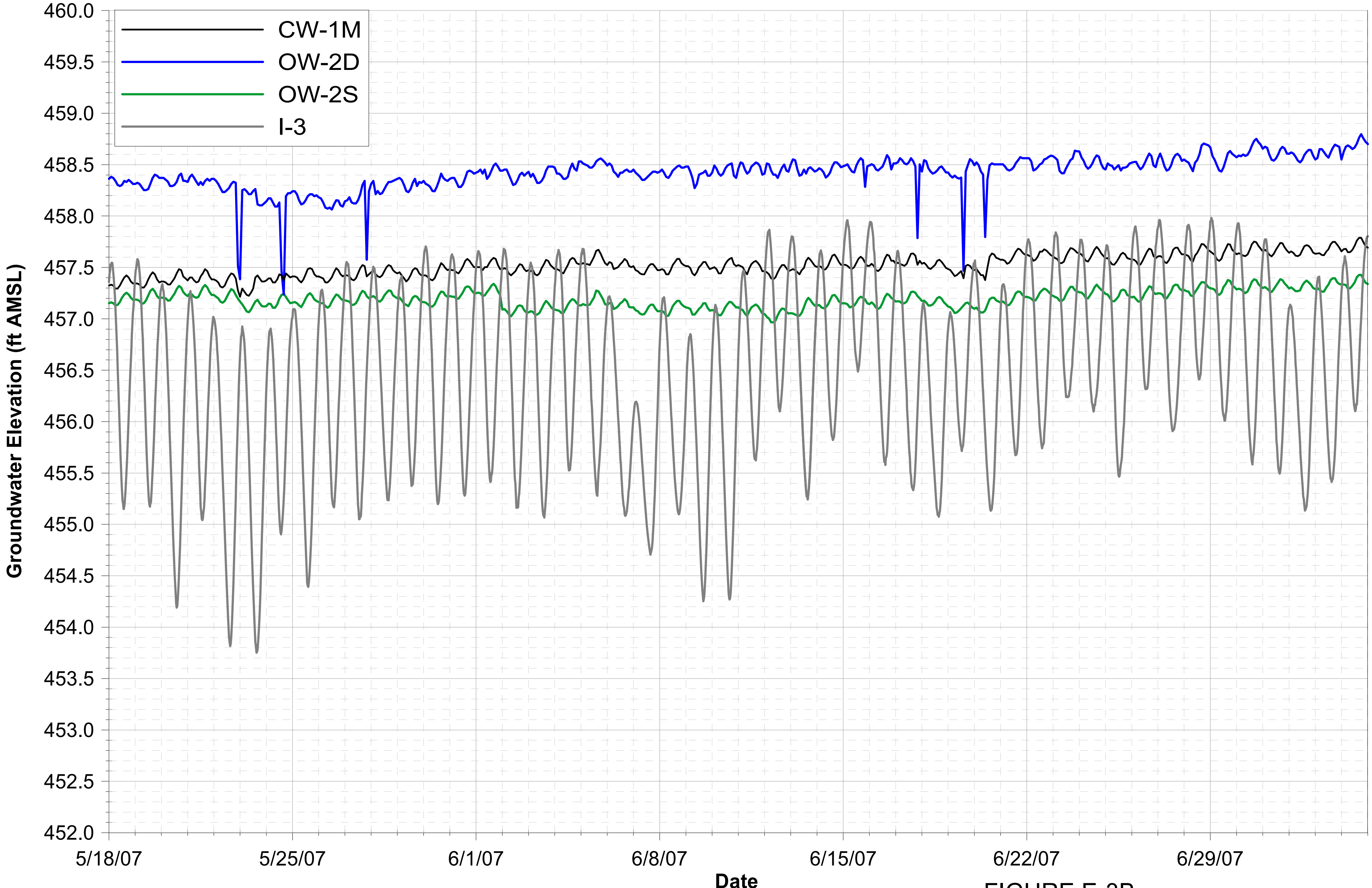


FIGURE E-3B
HYDROGRAPH OF INJECTION FIELD
WELLS CW-1M, OW-2D, & OW-2S
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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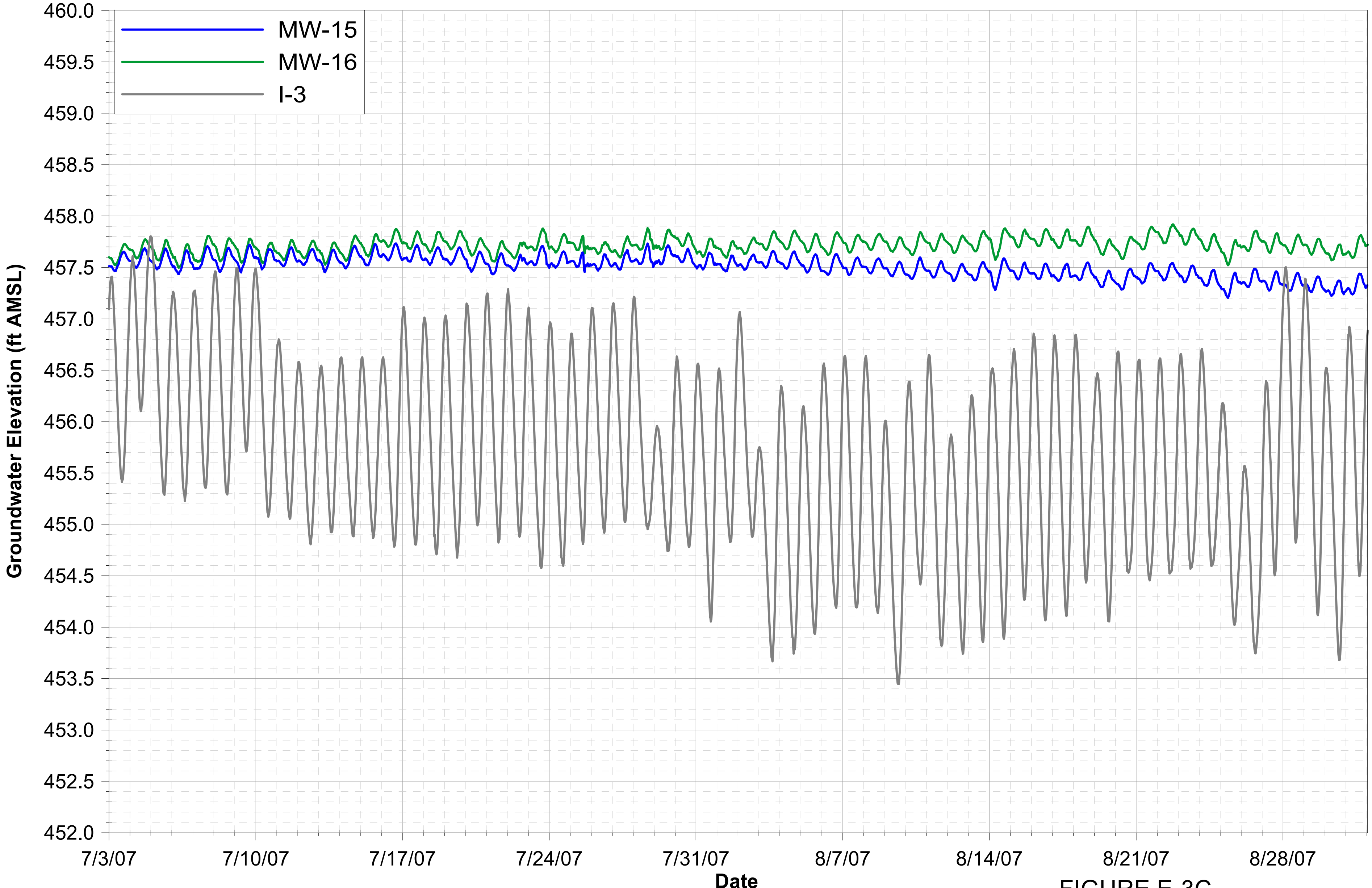

FIGURE E-3C
HYDROGRAPH OF INTERIOR
WELLS MW-15 & MW-16

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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E4 Hydrographs for Bedrock Wells

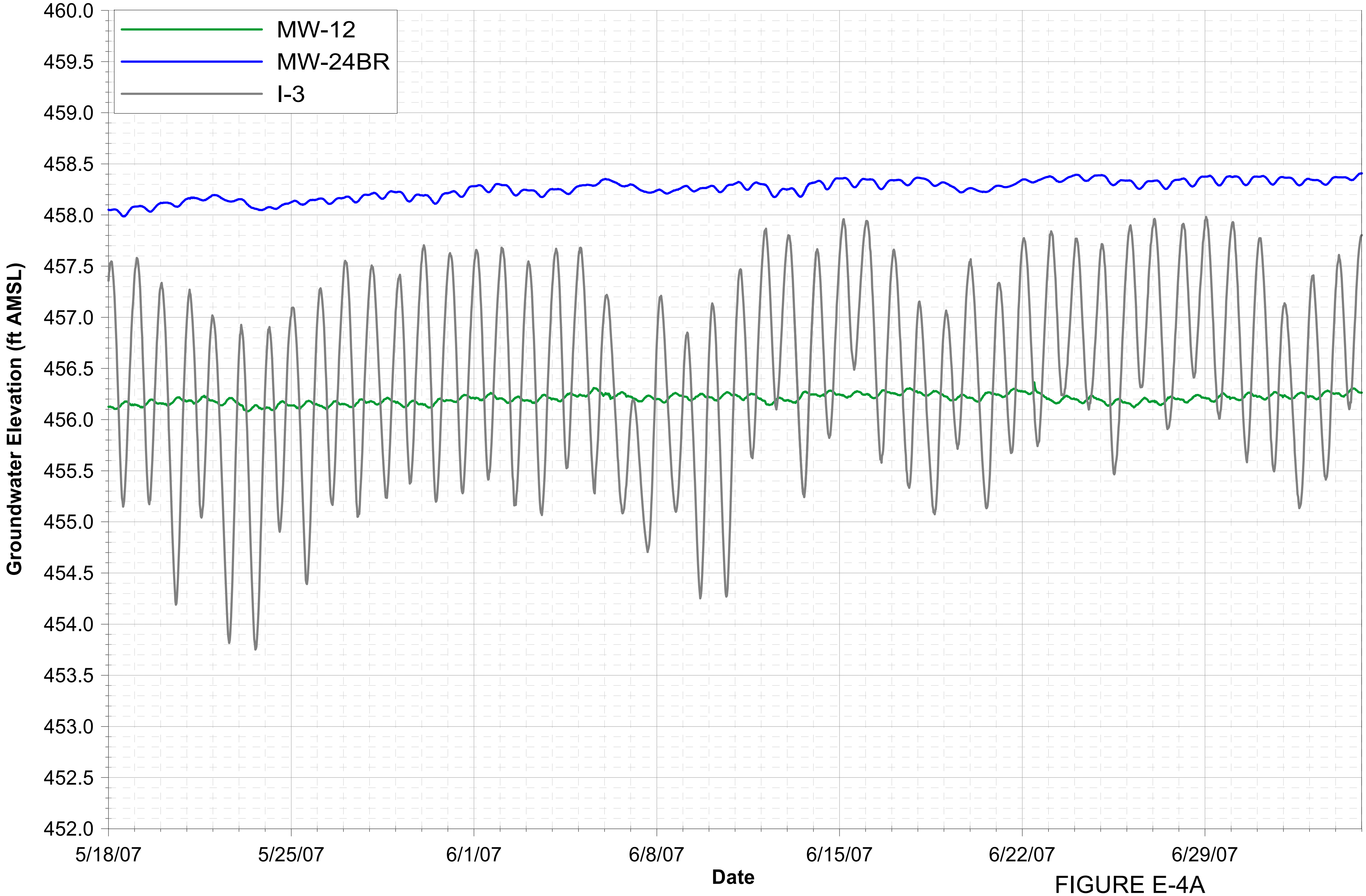

FIGURE E-4A
HYDROGRAPH OF WELLS
MW-24BR & MW-12
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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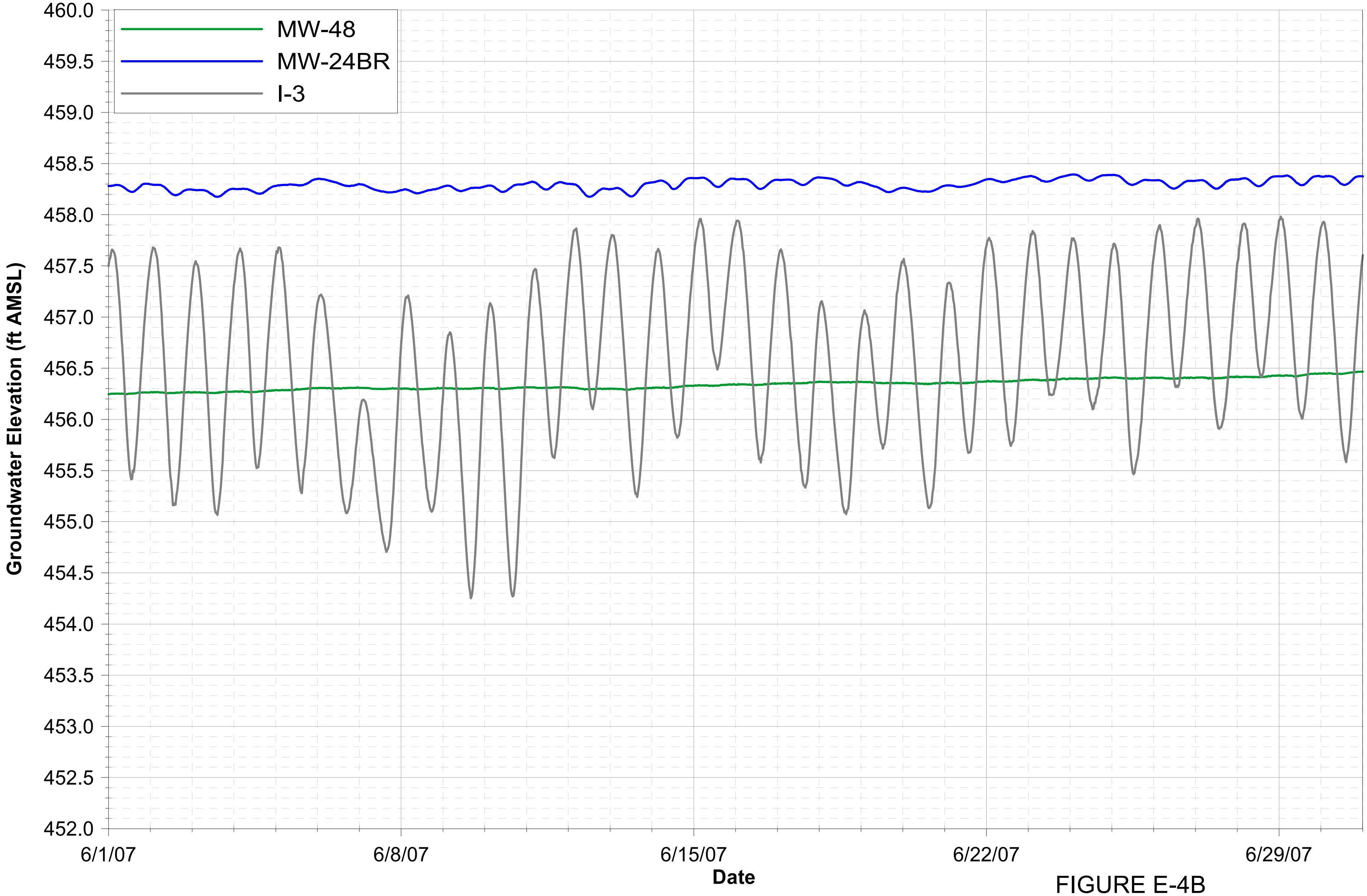

FIGURE E-4B
HYDROGRAPH OF WELLS
MW-24BR & MW-48
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
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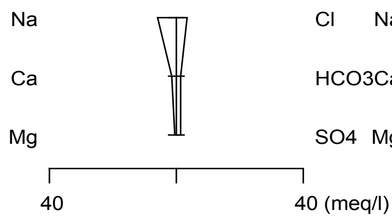
Appendix F
Water Chemistry Plots

F1 Stiff Diagrams

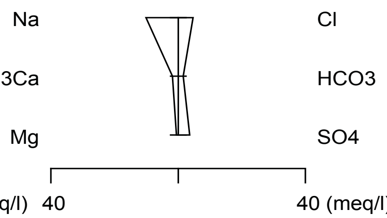
Appendix F1:
Table of Contents for Chemical Stiff Diagrams

LOW TDS

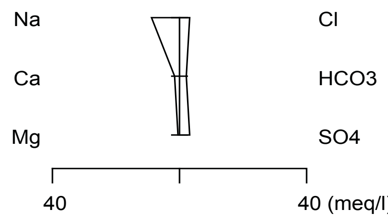
MW-01, 7/18/2005



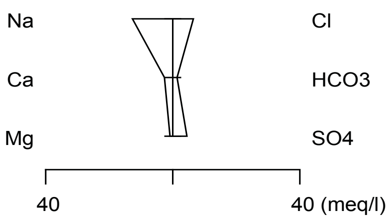
MW-03, 7/18/2005



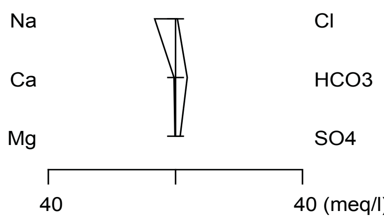
MW-04, 7/18/2005



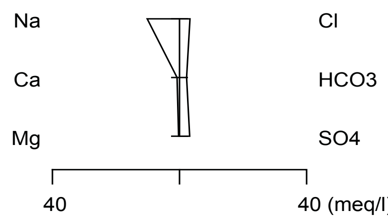
MW-05, 7/18/2005



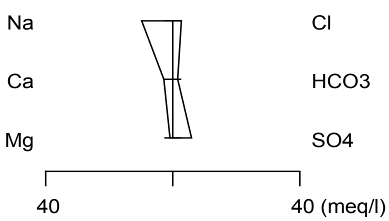
MW-06, 7/18/2005



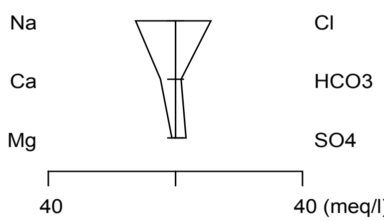
MW-07, 7/18/2005



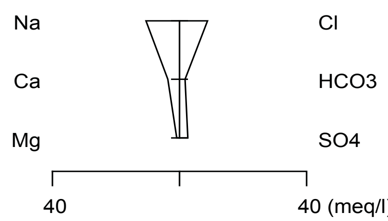
MW-08, 7/18/2005



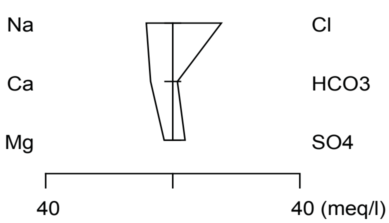
MW-13, 5/2/2006



MW-14, 5/2/2006



MW-15, 5/4/2007



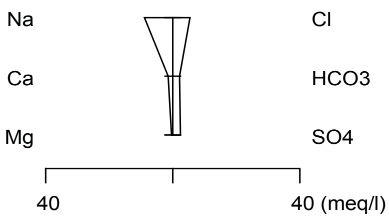
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
UPPER ALLUVIAL NON-PLUME
1 OF 2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

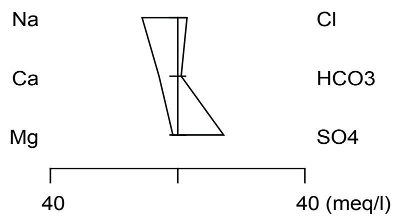
CH2MHILL

LOW TDS

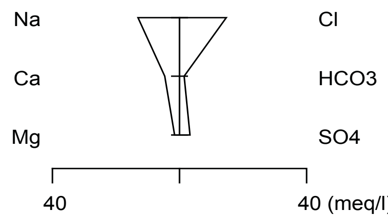
MW-16, 5/3/2006



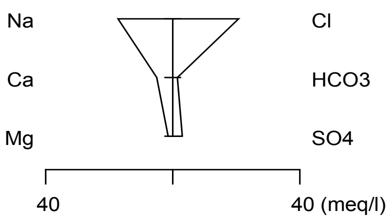
MW-17, 5/9/2006



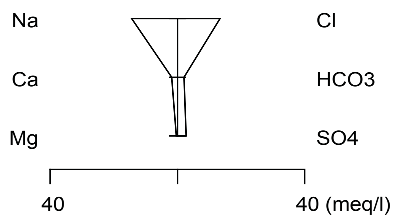
MW-40S, 5/3/2006



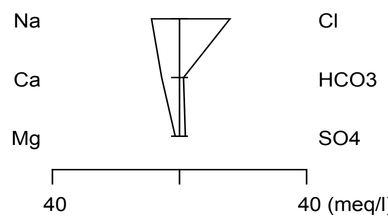
OW-01S, 5/1/2007



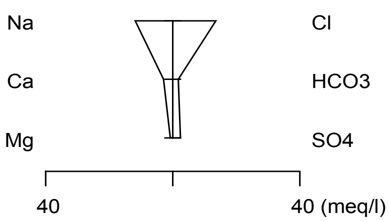
OW-02S, 4/30/2007



OW-03S, 4/30/2007

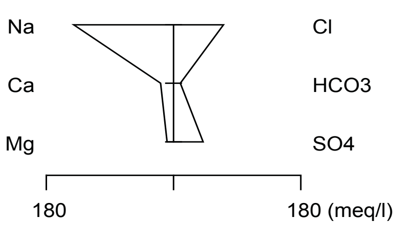


OW-05S, 4/30/2007



HIGH TDS

MW-21, 6/8/2004



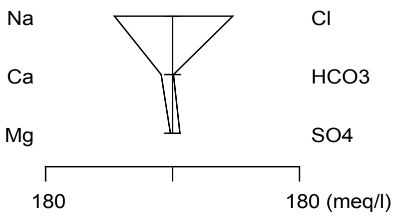
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
UPPER ALLUVIAL NON-PLUME
2 OF 2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

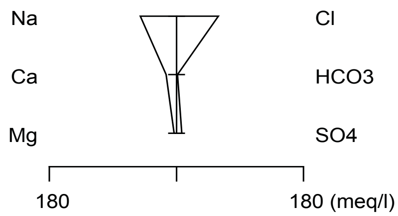
CH2MHILL

HIGH TDS

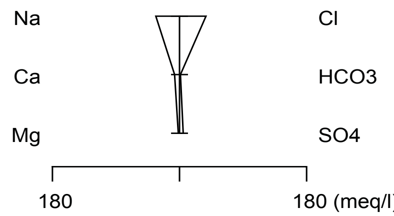
MW-33-090, 5/3/2006



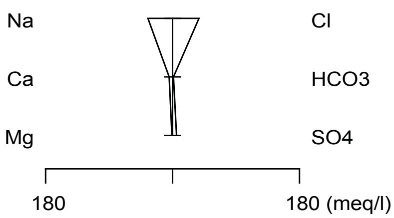
MW-35-060, 5/2/2006



MW-37S, 5/4/2006



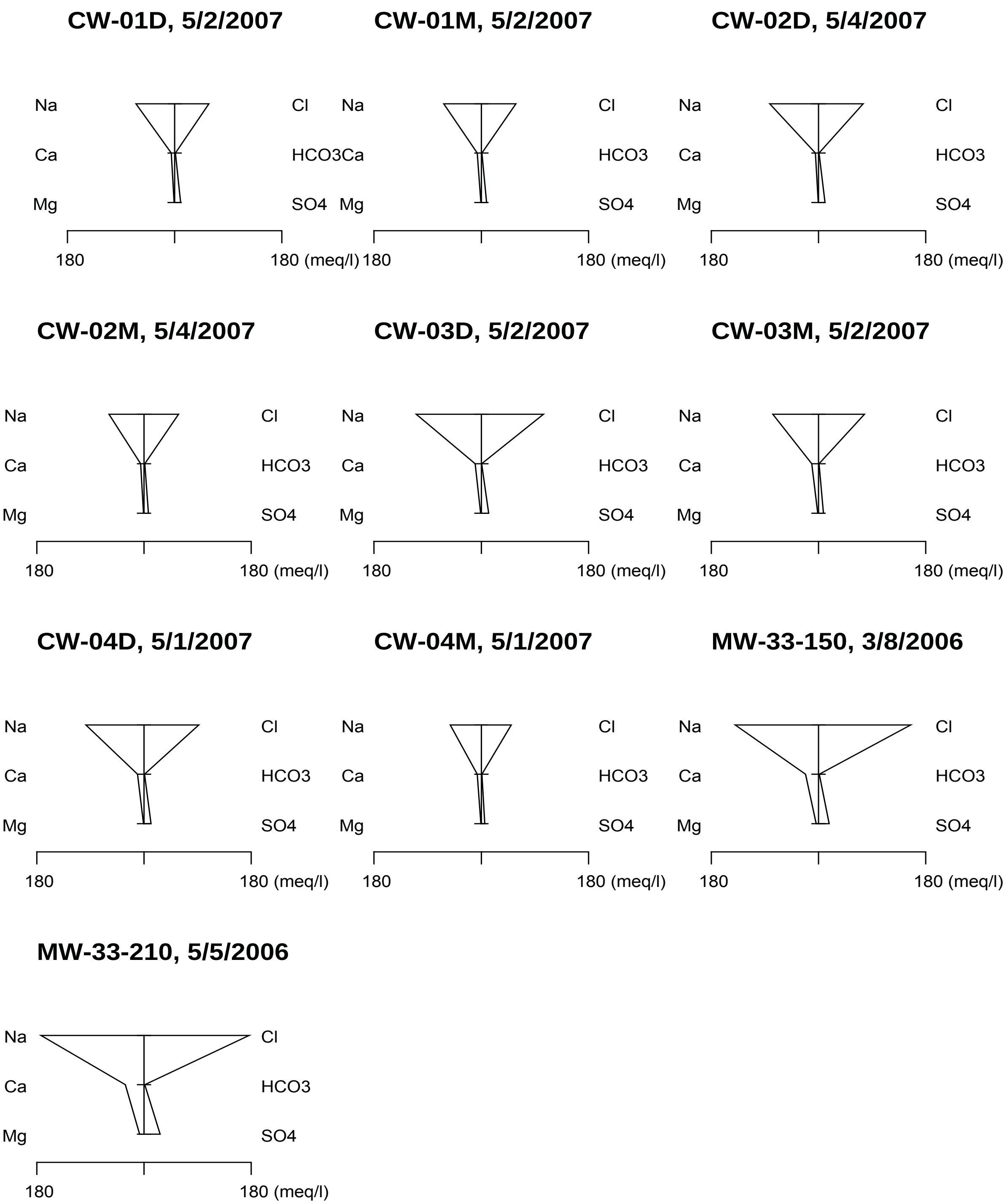
MW-41S, 3/13/2006



APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
MIDDLE ALLUVIAL NON-PLUME
1 OF 1

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

HIGH TDS



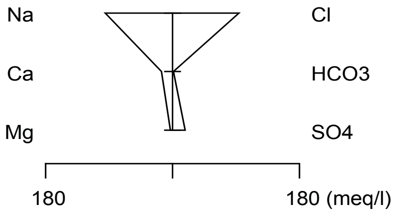
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER ALLUVIAL NON-PLUME
1 OF 3

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

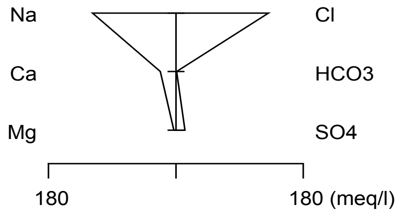
CH2MHILL

HIGH TDS

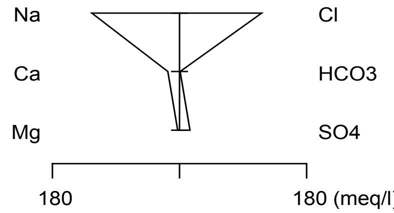
MW-35-135, 5/4/2007



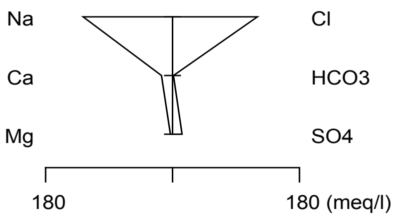
MW-41M, 3/13/2006



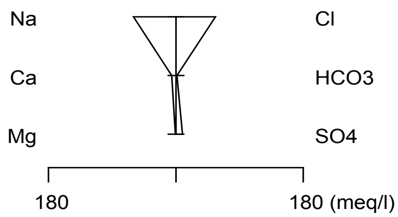
MW-47-115, 3/23/2006



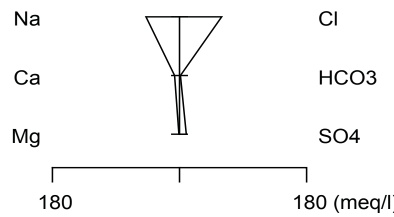
MW-49-135, 4/25/2006



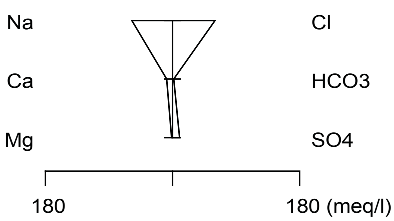
OW-01D, 5/2/2007



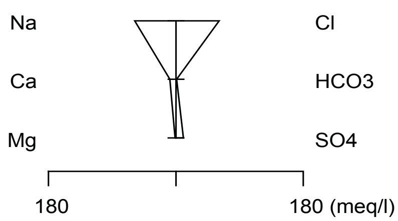
OW-01M, 5/1/2007



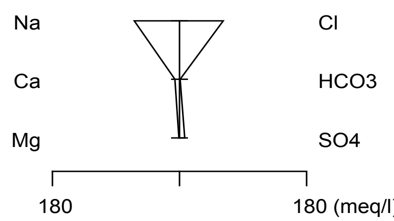
OW-02D, 4/30/2007



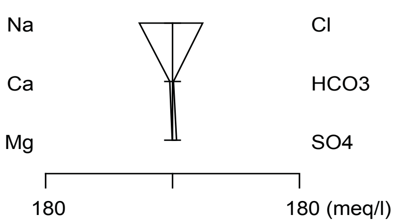
OW-02M, 4/30/2007



OW-03D, 3/9/2006



OW-03M, 5/1/2007



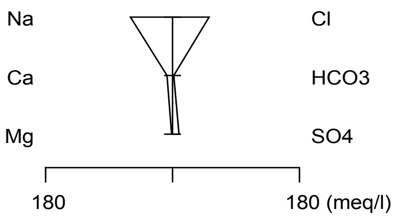
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER ALLUVIAL NON-PLUME
2 OF 3

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

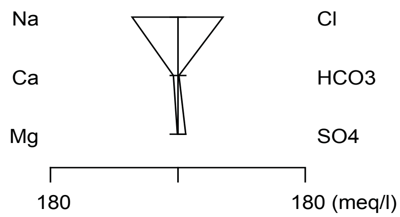
CH2MHILL

HIGH TDS

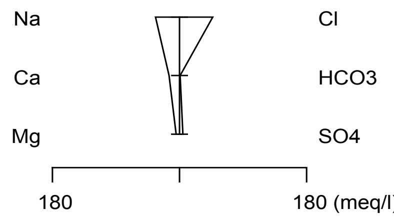
OW-05D, 5/1/2007



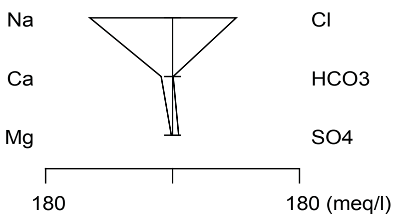
OW-05M, 4/30/2007



P-2, 5/2/2007

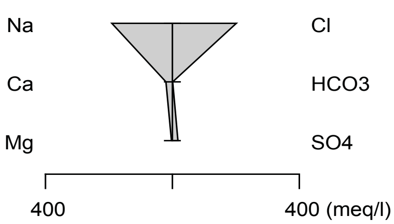


TW-05, 5/10/2006

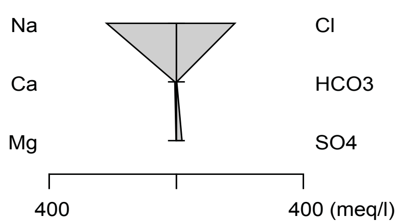


VERY HIGH TDS

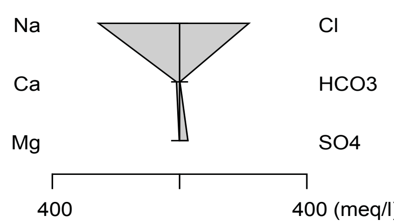
MW-41D, 3/15/2006



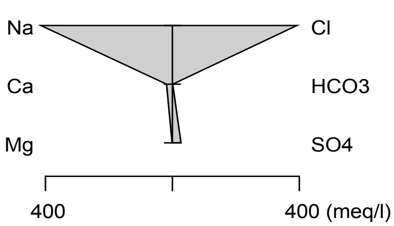
MW-46-205, 3/14/2006



MW-49-275, 4/25/2006



MW-49-365, 4/26/2006



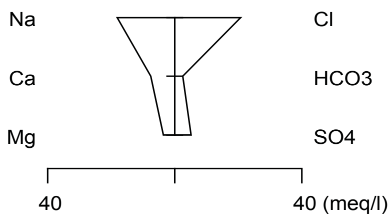
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER ALLUVIAL NON-PLUME
3 OF 3

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

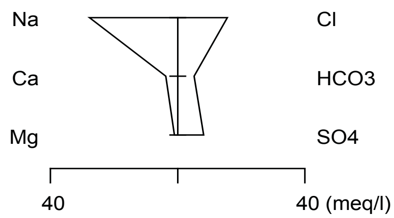
CH2MHILL

LOW TDS

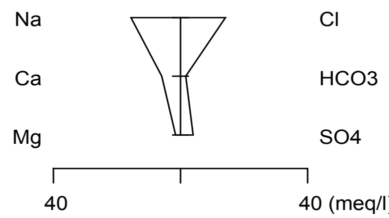
MW-09, 5/3/2007



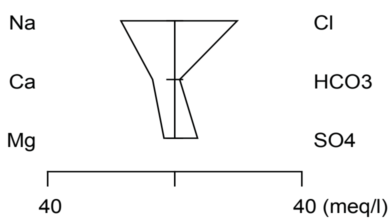
MW-10, 5/4/2006



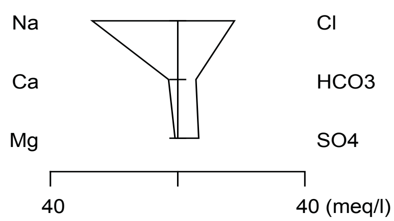
MW-19, 5/2/2006



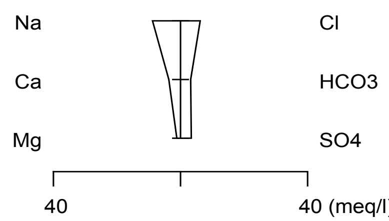
MW-20-070, 5/3/2007



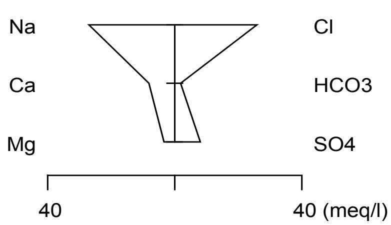
MW-24A, 3/6/2006



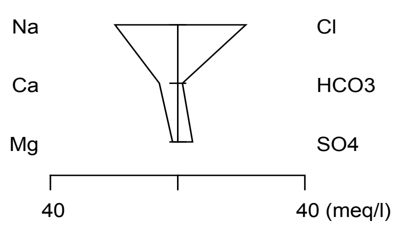
MW-25, 3/6/2007



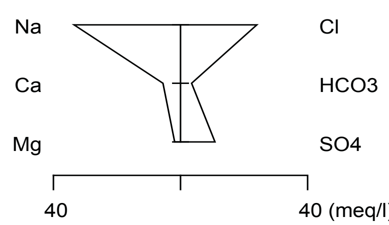
MW-26, 3/12/2007



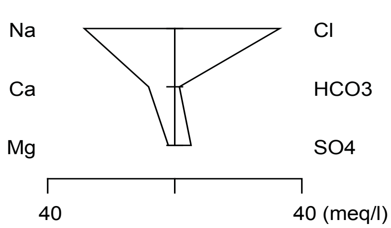
MW-31-060, 3/12/2007



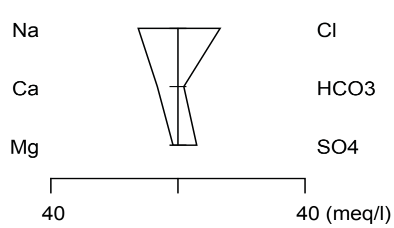
MW-38S, 5/4/2006



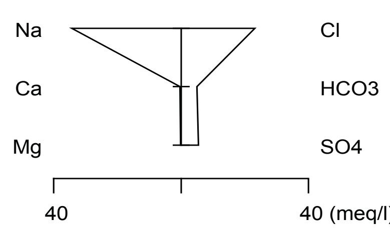
MW-47-055, 5/4/2007



MW-11, 5/3/2007



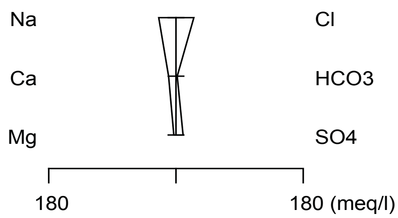
MW-12, 4/18/2006



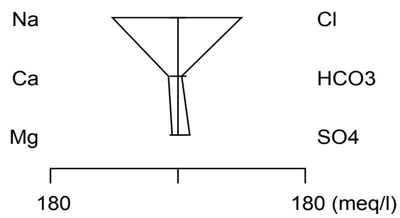
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
UPPER ALLUVIAL PLUME - 1 OF 1
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

HIGH TDS

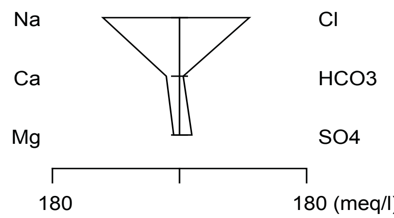
MW-20-100, 5/3/2007



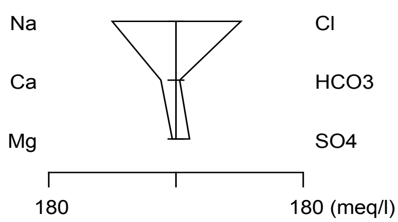
MW-39-050, 3/8/2006



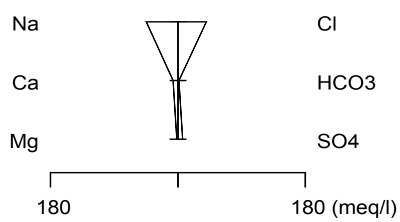
MW-39-060, 5/2/2006



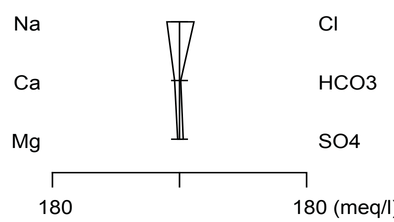
MW-39-070, 3/8/2006



MW-50-095, 5/9/2006



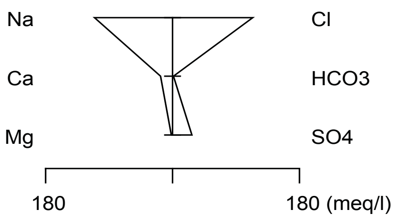
TW-02S, 3/15/2006



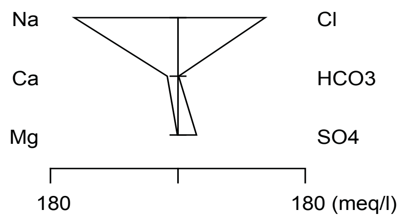
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
MIDDLE ALLUVIAL PLUME - 1 OF 1
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

HIGH TDS

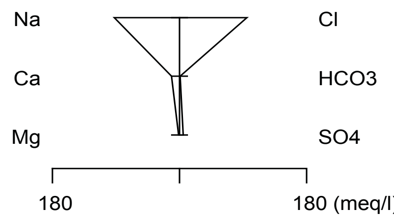
MW-20-130, 5/3/2007



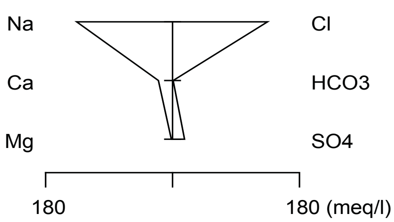
MW-24B, 5/4/2006



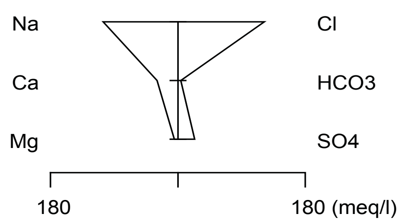
MW-31-135, 5/1/2007



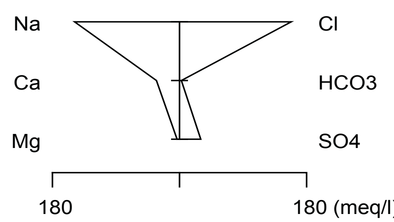
MW-37D, 5/3/2006



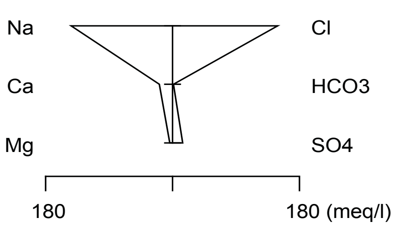
MW-39-080, 3/8/2006



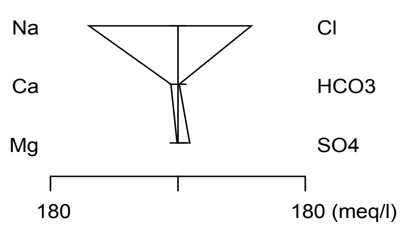
MW-39-100, 3/13/2006



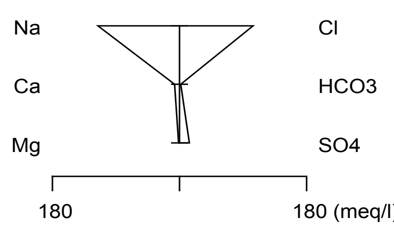
MW-40D, 5/4/2007



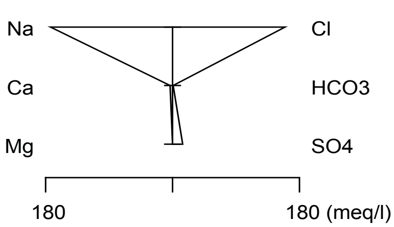
MW-44-115, 3/14/2006



MW-44-125, 5/3/2007



MW-46-175, 5/4/2007



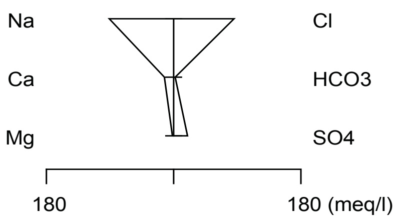
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER ALLUVIAL PLUME
1 OF 2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

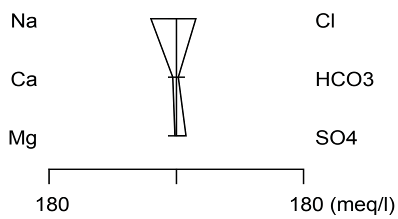
CH2MHILL

HIGH TDS

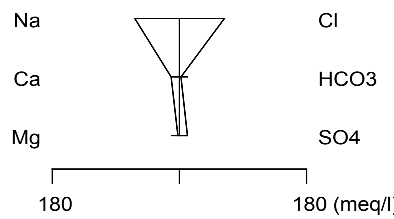
MW-51, 5/12/2006



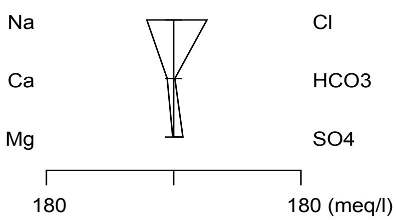
PGE-06, 11/29/2001



TW-02D, 3/15/2006

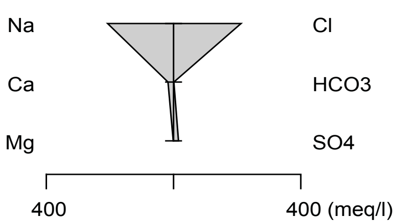


TW-03D, 11/5/2005

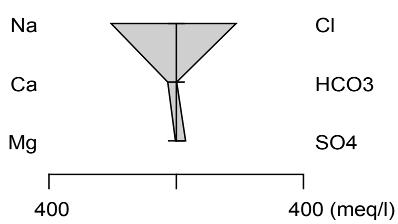


VERY HIGH TDS

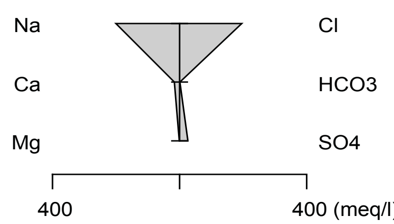
MW-38D, 5/3/2007



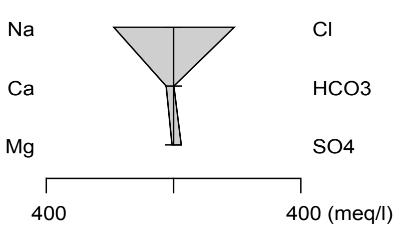
MW-50-200, 5/9/2006



PGE-07, 7/30/2007



TW-04, 5/18/2006



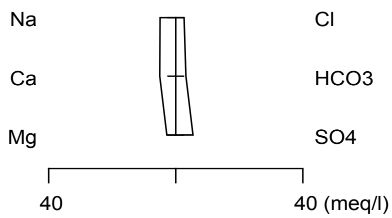
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER ALLUVIAL PLUME
2 OF 2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

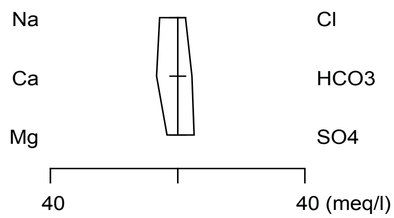
CH2MHILL

LOW TDS

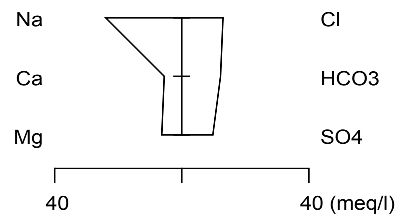
MW-27-020, 10/3/2006



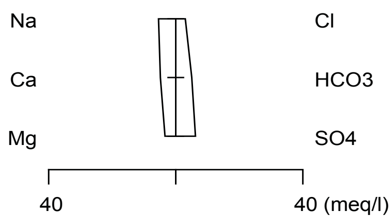
MW-28-025, 10/11/2006



MW-29, 5/11/2004

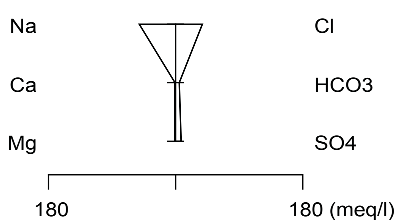


MW-43-025, 3/10/2006

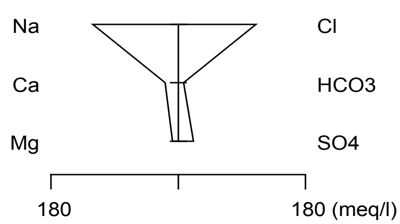


HIGH TDS

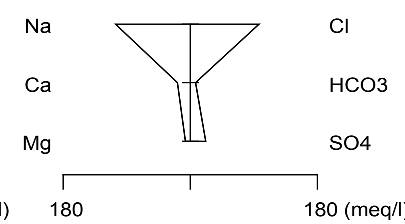
MW-33-040, 3/9/2006



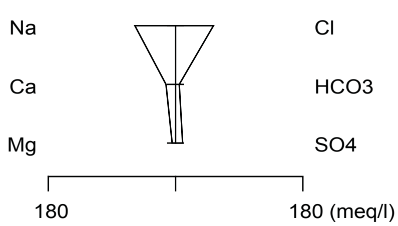
MW-36-020, 3/7/2006



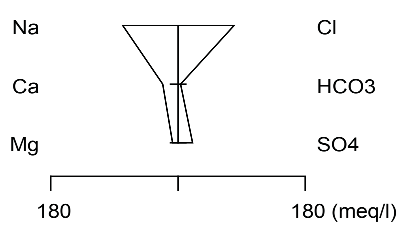
MW-36-040, 3/7/2006



MW-39-040, 3/7/2006



MW-42-030, 3/7/2006



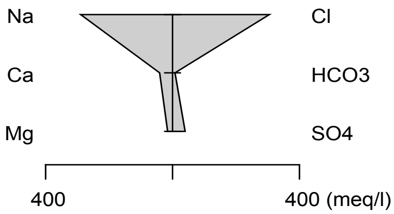
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
UPPER FLUVIAL NON-PLUME - 1 OF 2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

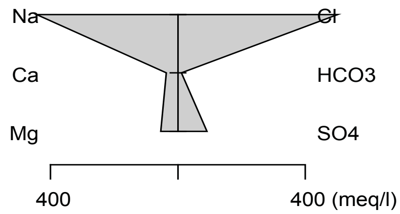
CH2MHILL

VERY HIGH TDS

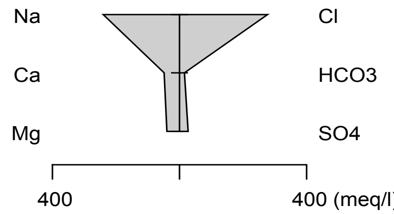
MW-22, 3/15/2006



MW-30-030, 10/10/2006



MW-32-020, 4/30/2007

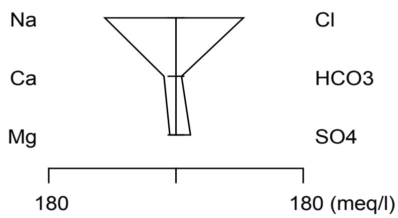


APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
UPPER FLUVIAL NON-PLUME
2 OF 2

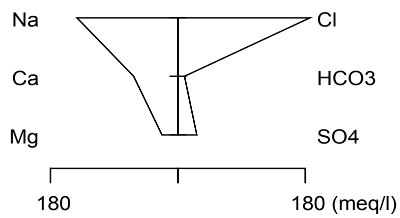
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

HIGH TDS

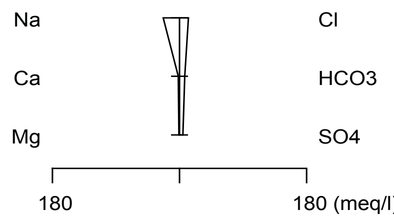
MW-27-060, 3/7/2006



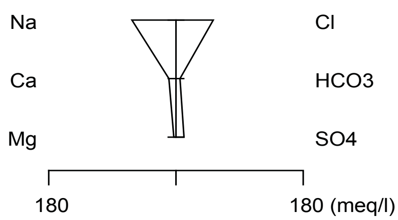
MW-32-035, 4/30/2007



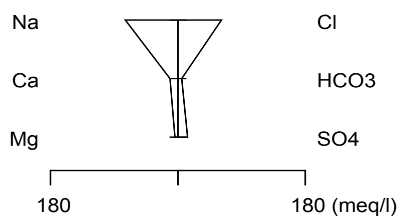
MW-34-055, 10/4/2006



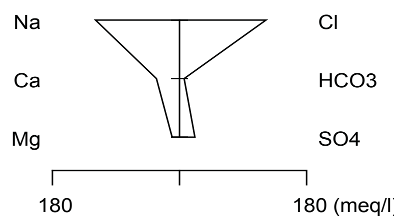
MW-36-050, 3/7/2006



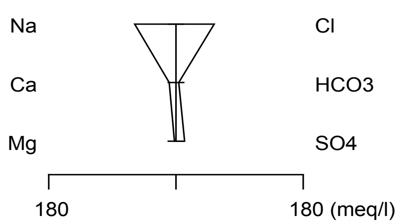
MW-36-070, 3/7/2006



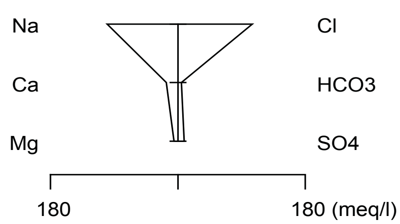
MW-42-055, 3/7/2006



MW-44-070, 3/23/2006



MW-52S, 5/1/2007



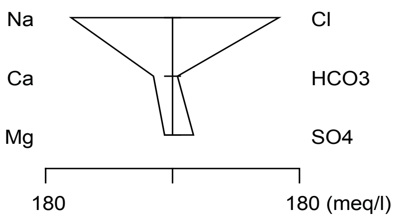
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
MIDDLE FLUVIAL NON-PLUME
1 OF 1

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

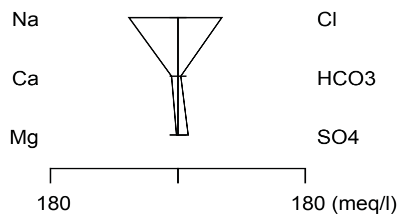
CH2MHILL

HIGH TDS

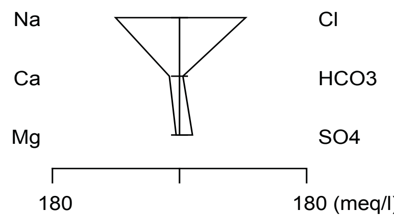
MW-27-085, 3/6/2006



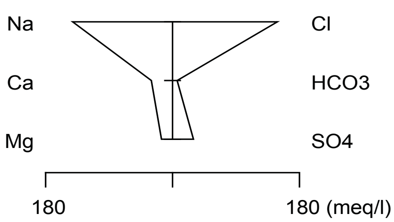
MW-28-090, 3/6/2006



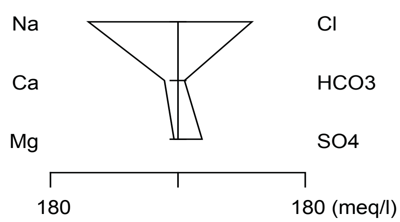
MW-34-080, 4/30/2007



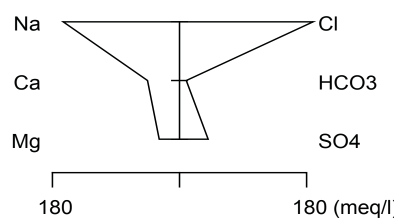
MW-42-065, 3/7/2006



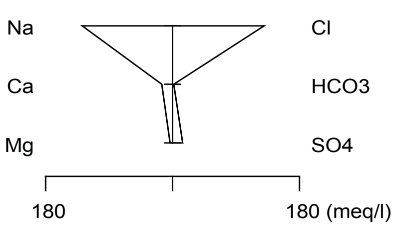
MW-43-075, 3/10/2006



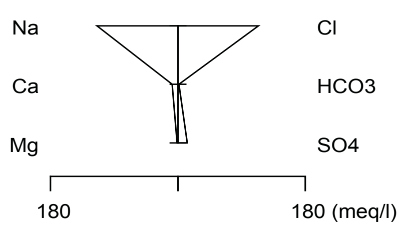
MW-43-090, 3/10/2006



MW-52M, 5/1/2007

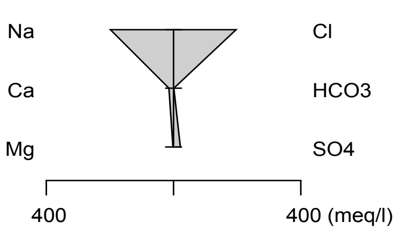


MW-53M, 5/1/2007

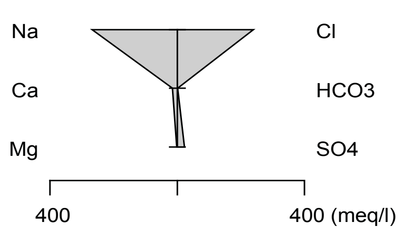


VERY HIGH TDS

MW-52D, 5/1/2007



MW-53D, 5/2/2007

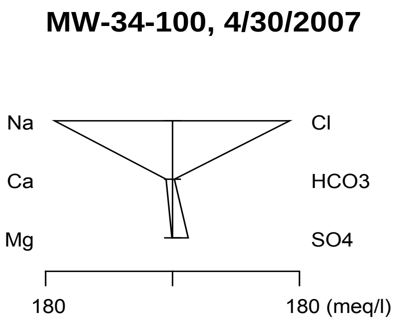


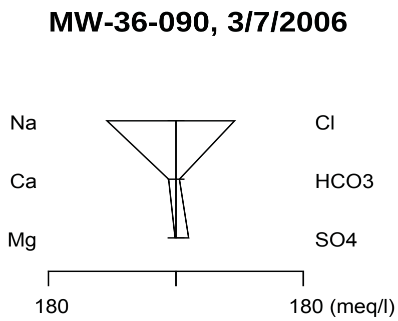
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER FLUVIAL NON-PLUME - 1 OF 1

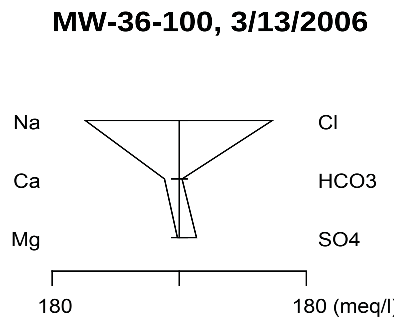
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

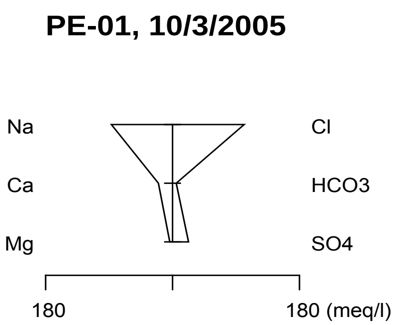
CH2MHILL

HIGH TDS





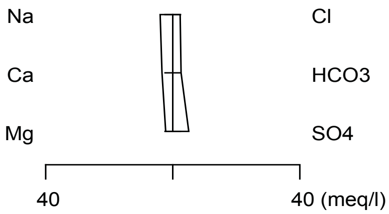




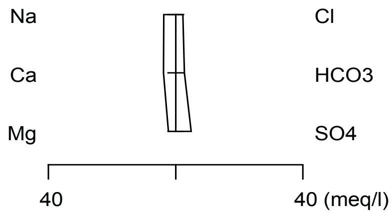
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
LOWER FLUVIAL PLUME - 1 OF 1
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

LOW TDS

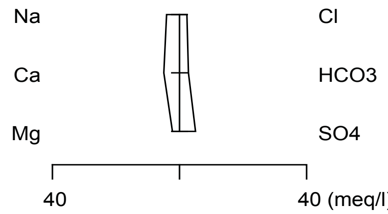
A-Dock, 7/1/1997



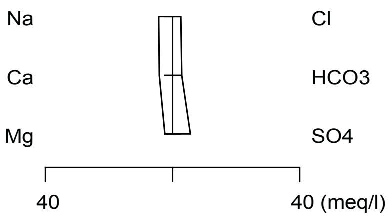
CON, 6/11/2003



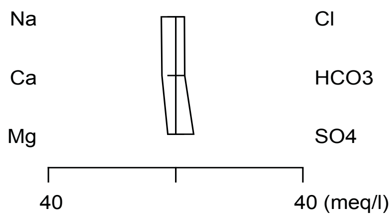
I-3, 6/10/2004



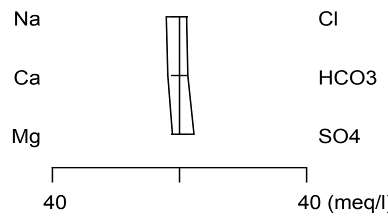
R-27, 5/8/2007



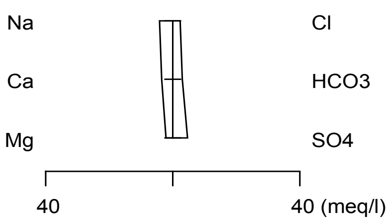
R-28, 5/9/2007



RRB, 7/1/1997



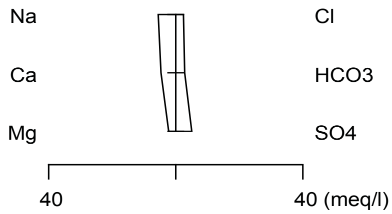
Vernal-Pool, 7/1/1997



APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
SITE RIVER NON-PLUME
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

LOW TDS

NR-1, 6/11/2004

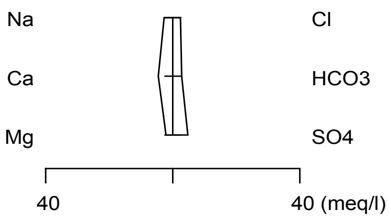


APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
OFFSITE RIVER NON-PLUME
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

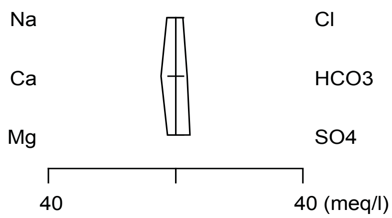
CH2MHILL

LOW TDS

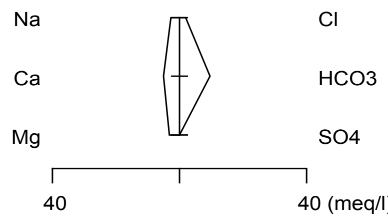
PW-03B, 1/5/2006



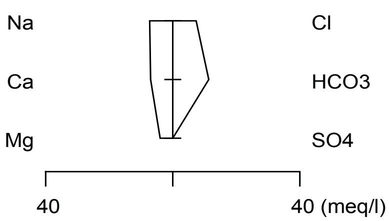
PW-05B, 1/6/2006



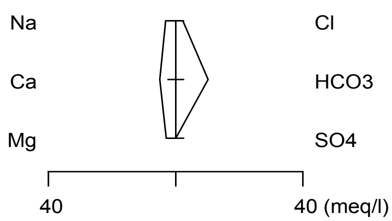
PW-07B, 1/6/2006



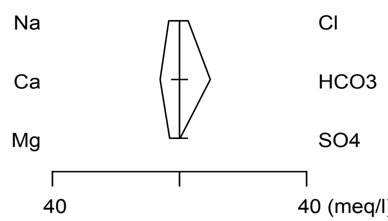
PW-08B, 1/7/2006



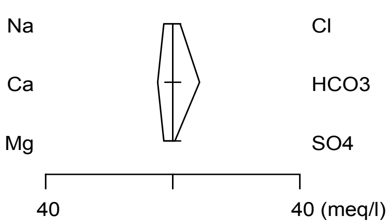
PW-09B, 1/4/2006



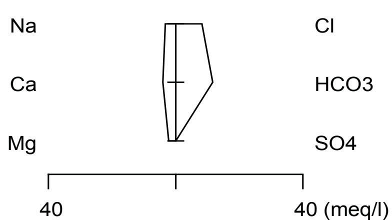
PW-11B, 1/5/2006



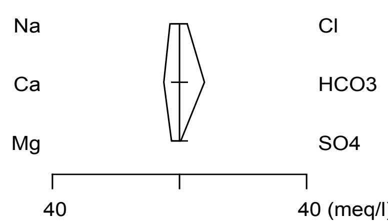
PW-12B, 1/6/2006



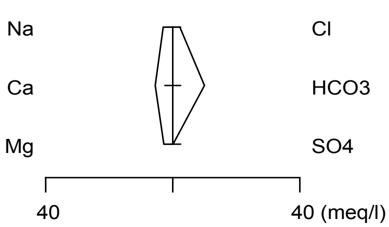
PW-13B, 1/6/2006



PW-14B, 1/7/2006



PW-15B, 1/7/2006

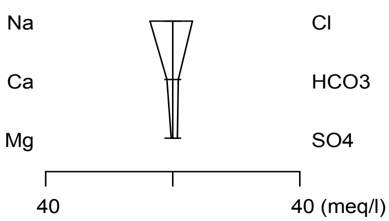


APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
RIVER PORE WATER SAMPLES
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

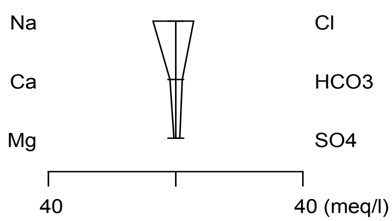
CH2MHILL

LOW TDS

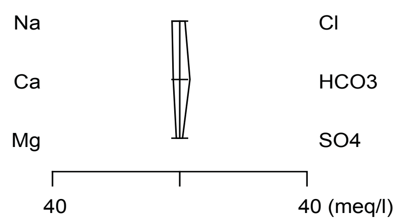
ADOT New Well, 5/2/2006



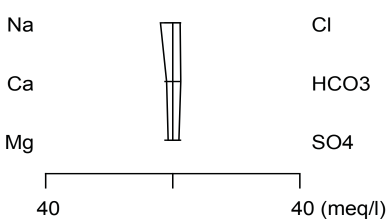
EPNG-2, 5/2/2007



GSRV-2, 7/10/2007



GSWC-1, 5/1/2006



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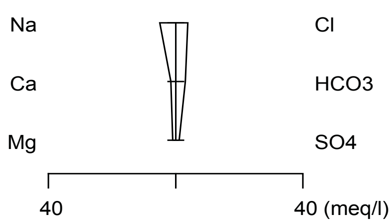
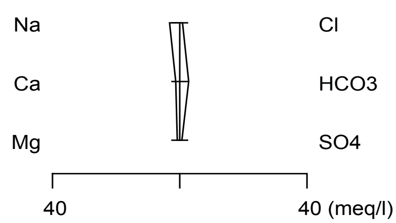


GSWC-3, 7/22/2005



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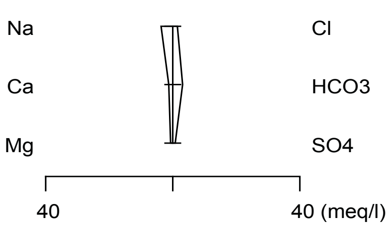
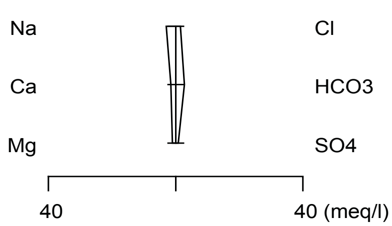
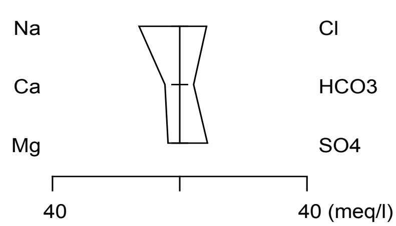


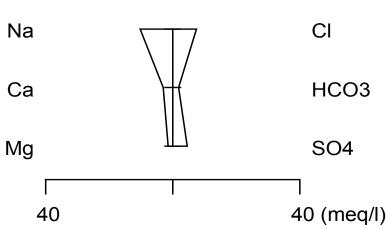
Langmaack, 5/2/2007



Lily Hill, 5/1/2006



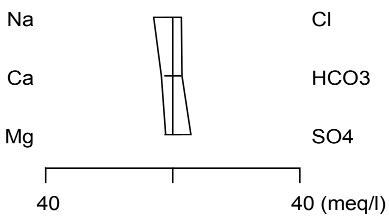
CA Agriculture Station, 5/1/2006



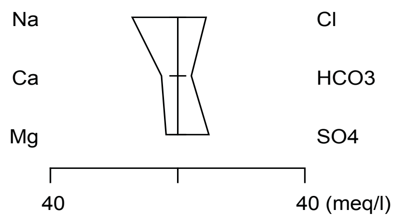
APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
OFFSITE ALLUVIAL NON-PLUME - 1 OF 2
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

LOW TDS

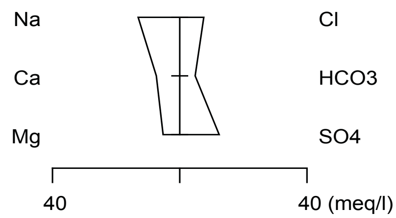
Needles MW-10, 5/2/2006



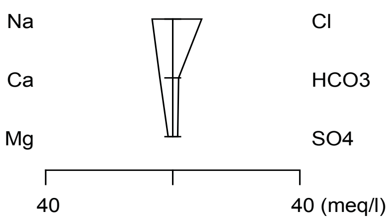
Needles MW-11, 5/2/2007



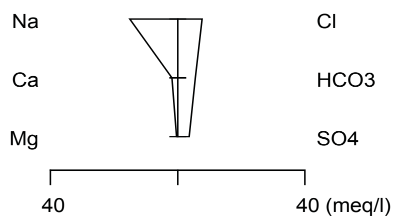
Needles MW-12, 5/2/2006



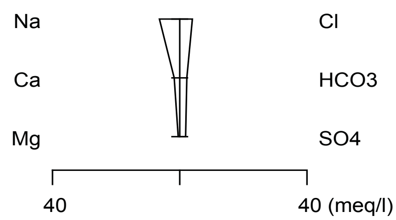
PMM-Supply, 5/1/2006



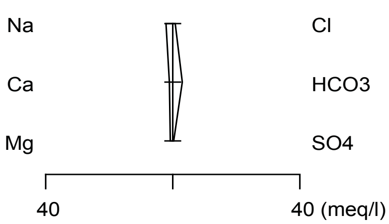
Sanders, 5/2/2006



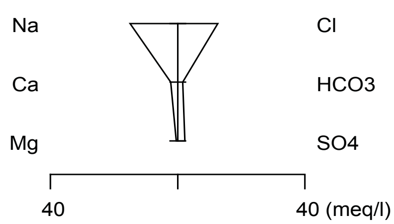
Tayloe, 5/2/2007



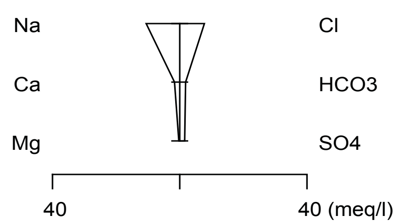
TMLP-2, 5/3/2007



Topock-2, 6/30/2006

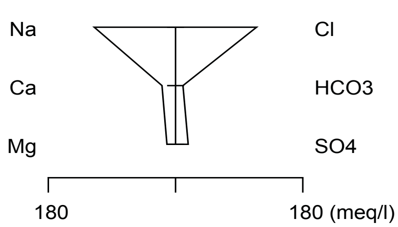


Topock-3, 8/11/2005

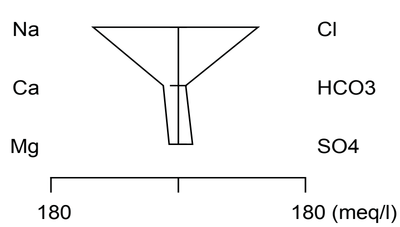


HIGH TDS

PGE-09N, 7/20/2005



PGE-09S, 5/3/2006



APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
OFFSITE ALLUVIAL NON-PLUME - 2 OF 2

RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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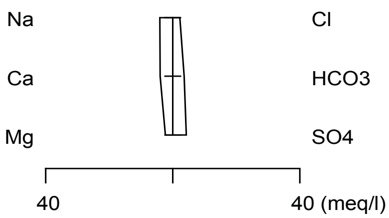
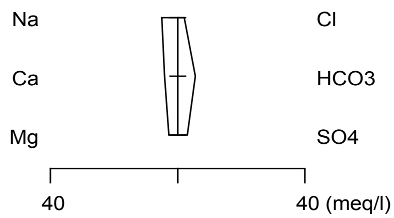
LOW TDS

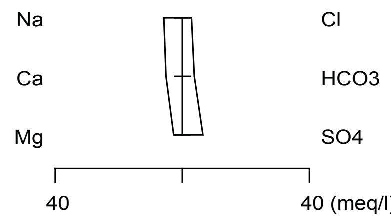
BOR-2, 5/3/2006



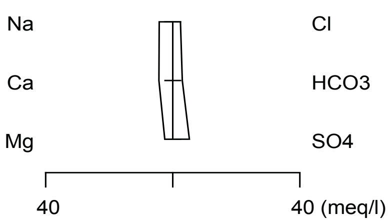
BOR-3, 7/21/2005



New Farm Well, 5/3/2006



USFW-5, 5/3/2006



APPENDIX F-1
CHEMICAL STIFF DIAGRAMS
OFFSITE FLUVIAL NON-PLUME
RCRA FACILITY INVESTIGATION/
REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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F2 *Stable Isotope Plots*

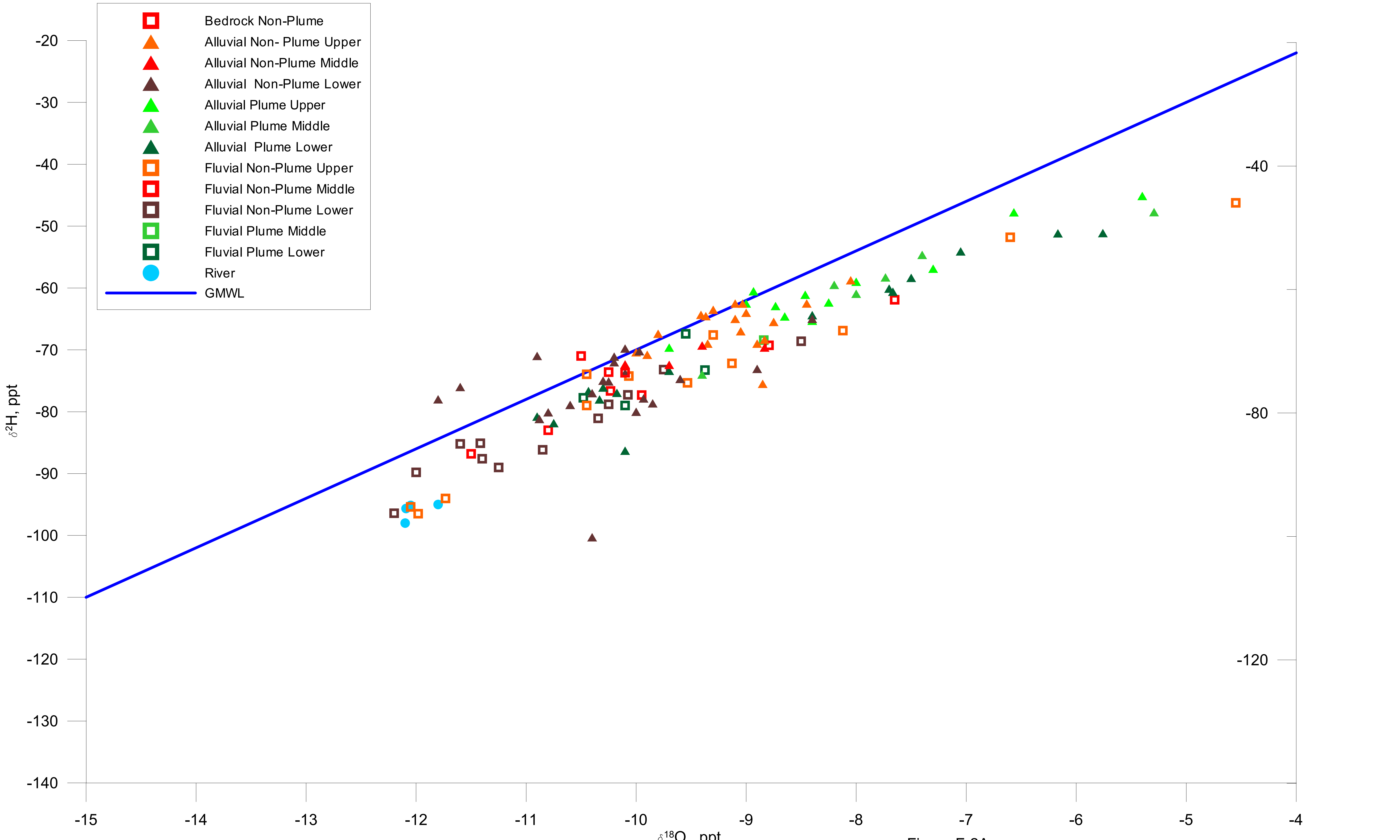

Figure F-2A
AVERAGE STABLE ISOTOPES OF OXYGEN AND DUETERIUM
TOPOCK COMPRESSOR STATION AND GREATER AREA
RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
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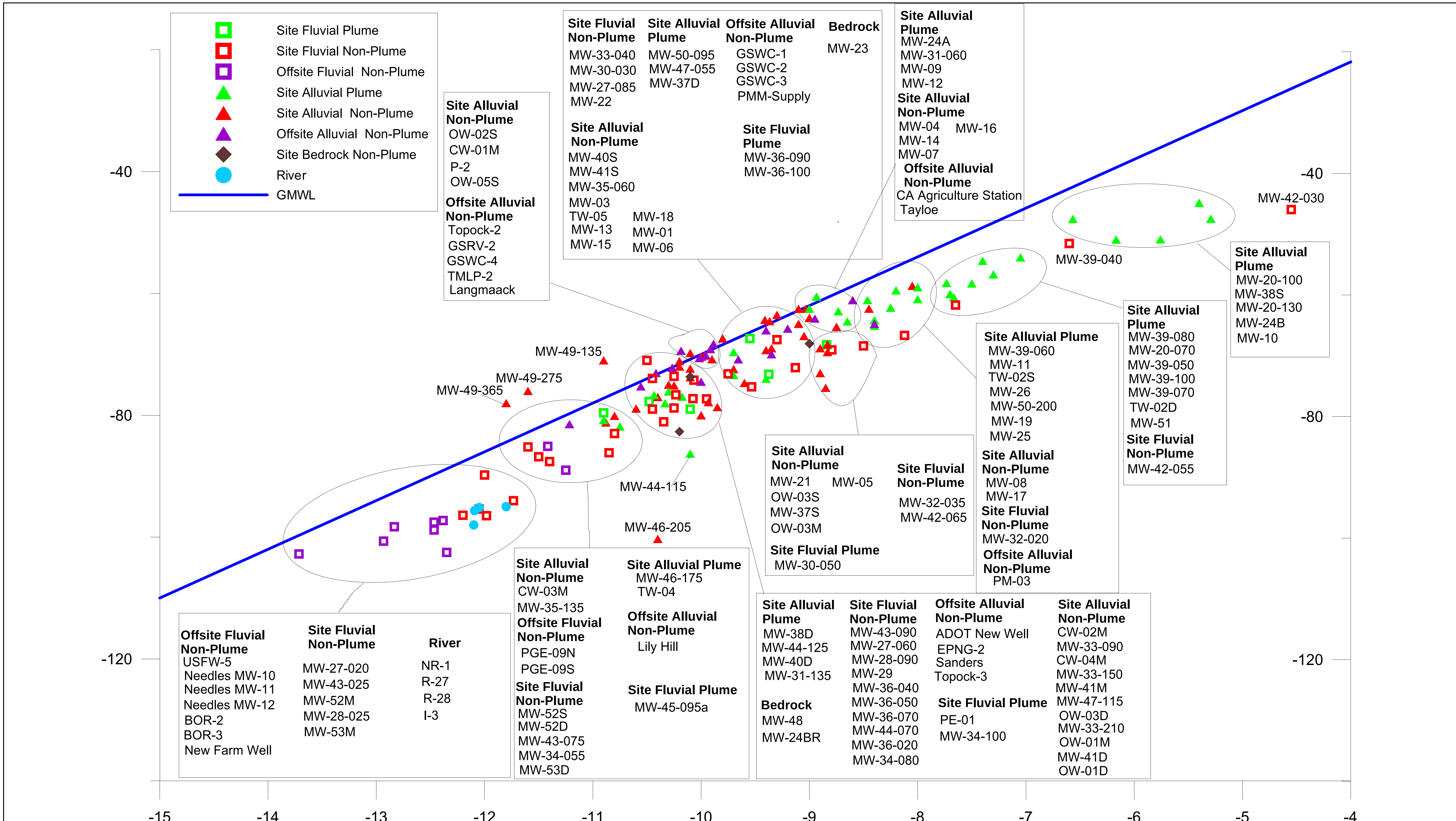

Figure F-2B
AVERAGE STABLE ISOTOPES OF OXYGEN AND DUETERIUM
TOPOCK COMPRESSOR STATION AND GREATER AREA
RCRA FACILITY INVESTIGATION/
REMEDIALINVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION

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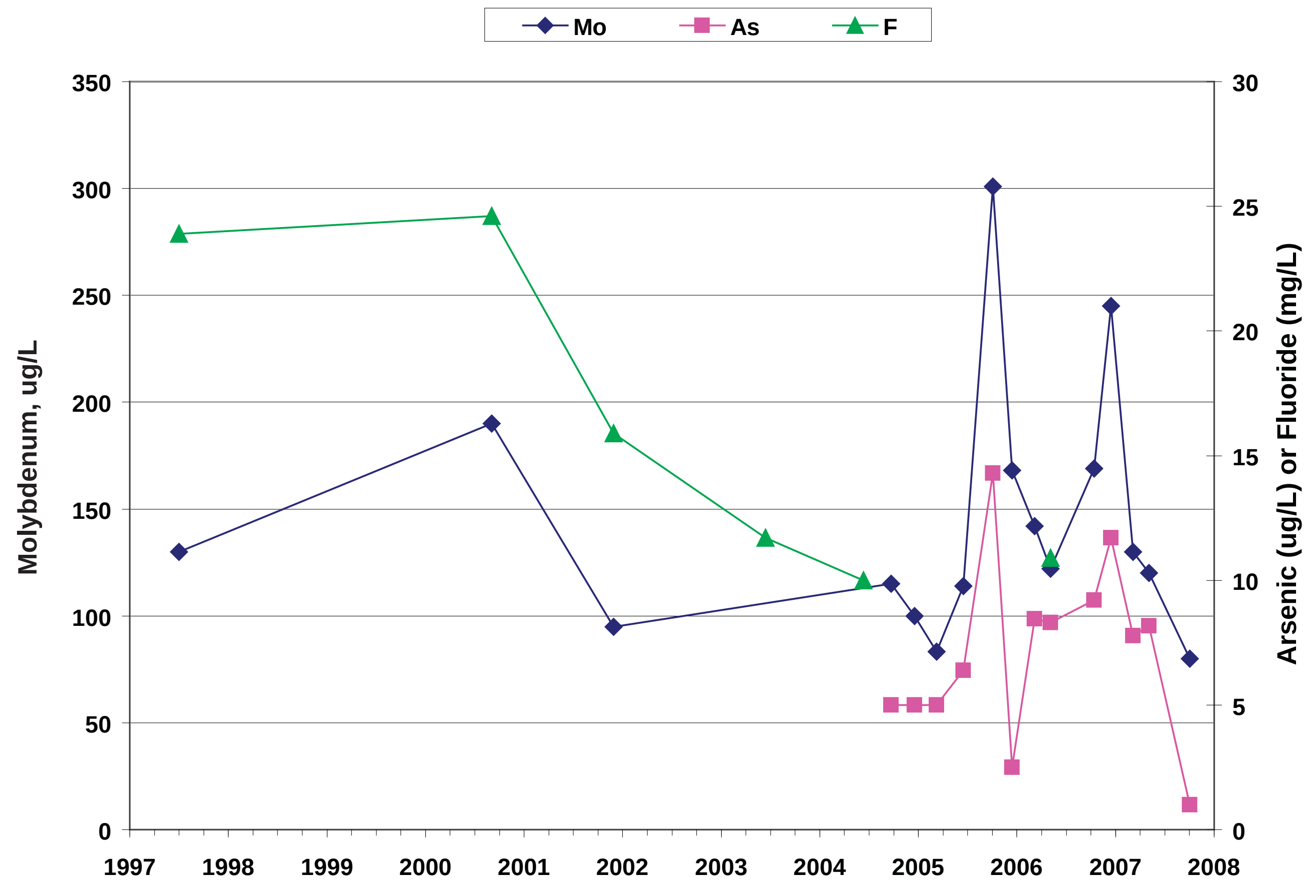
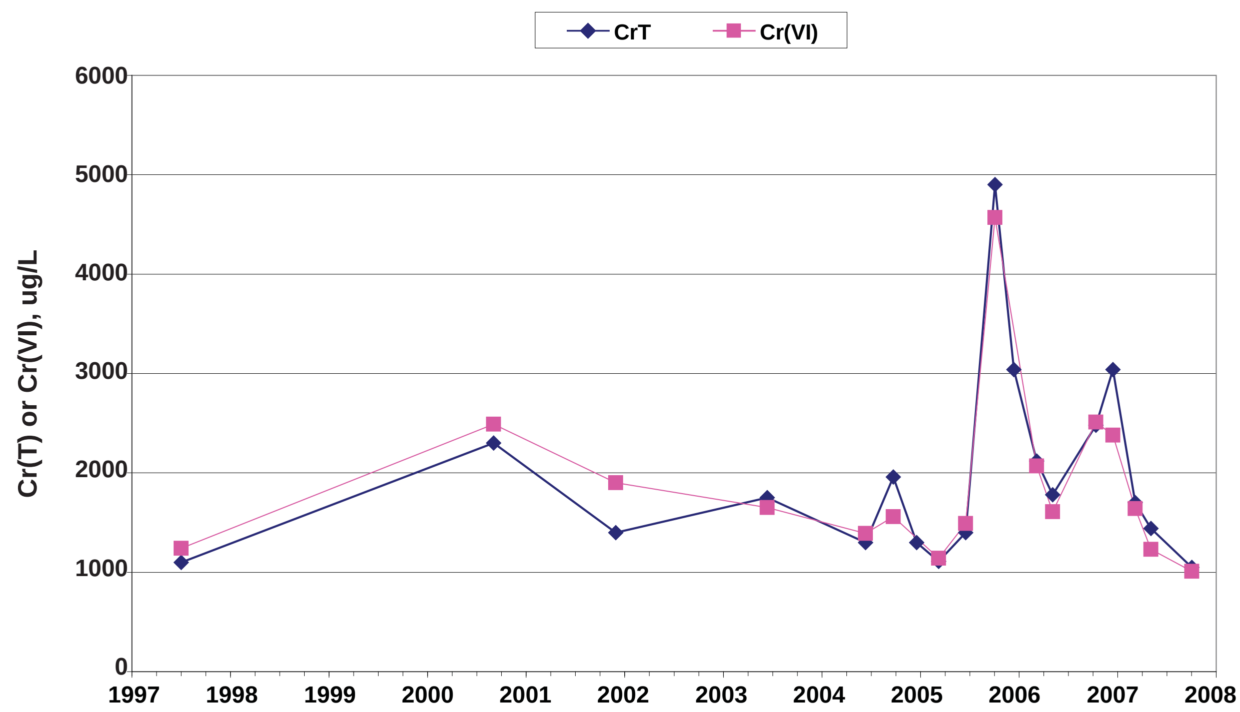
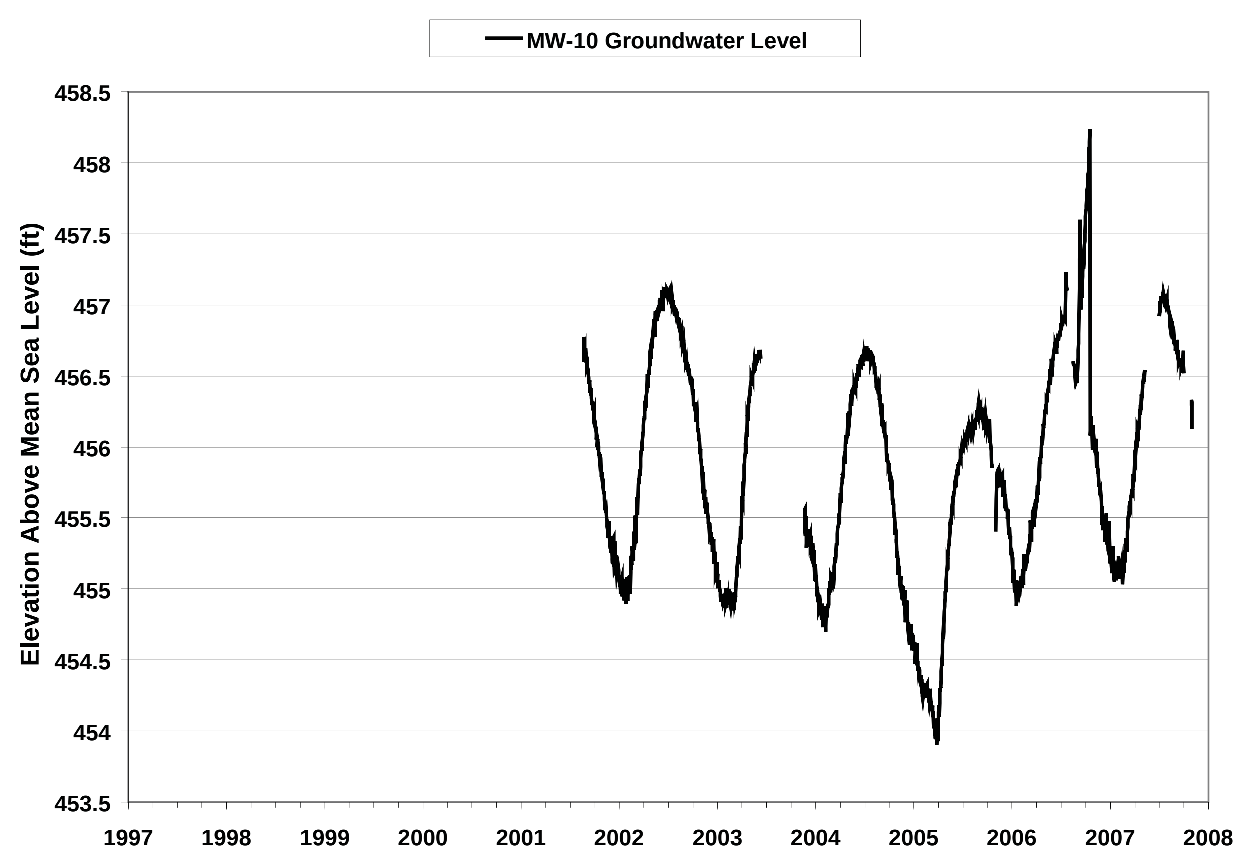
F3 Concentrations of Elements Over Time Plots







CONCENTRATIONS OF ELEMENTS OVER TIME IN WELL MW-10

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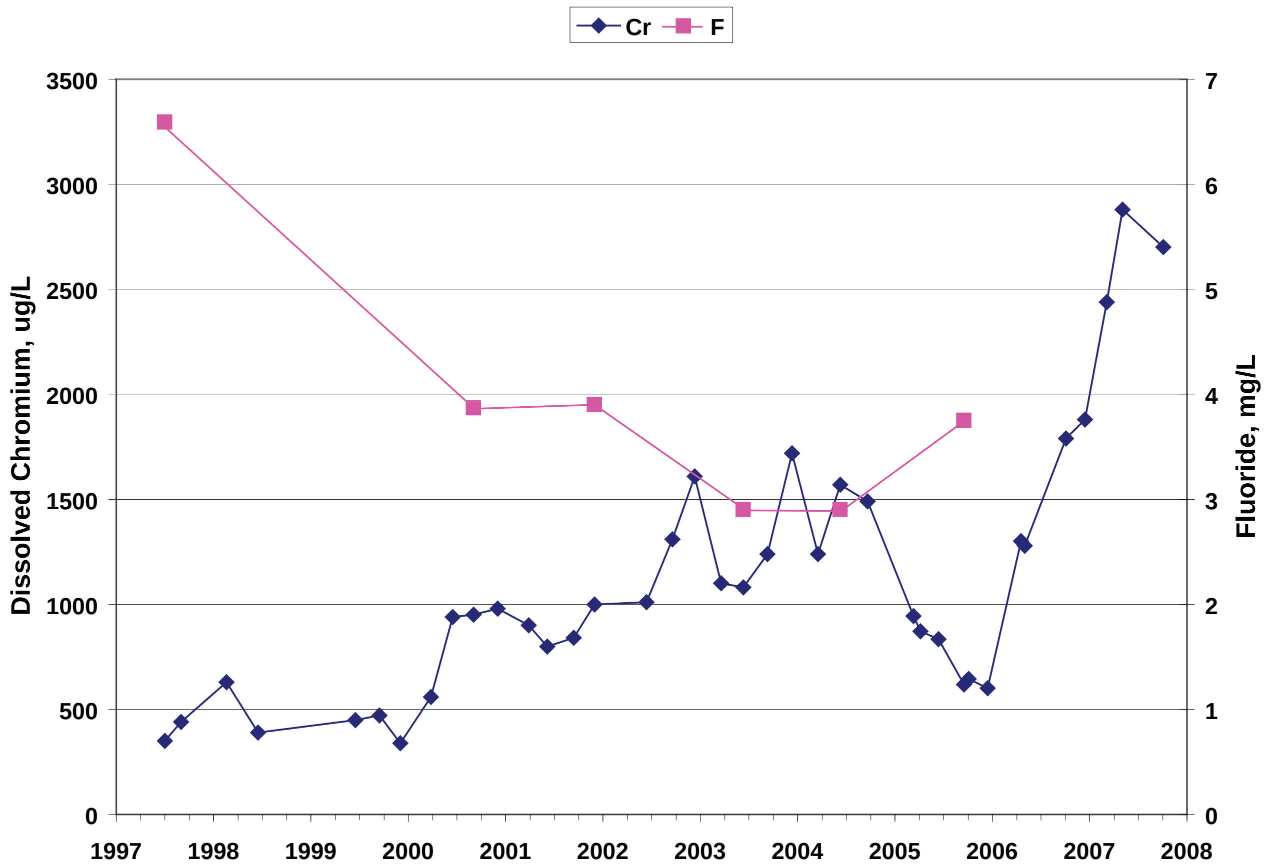

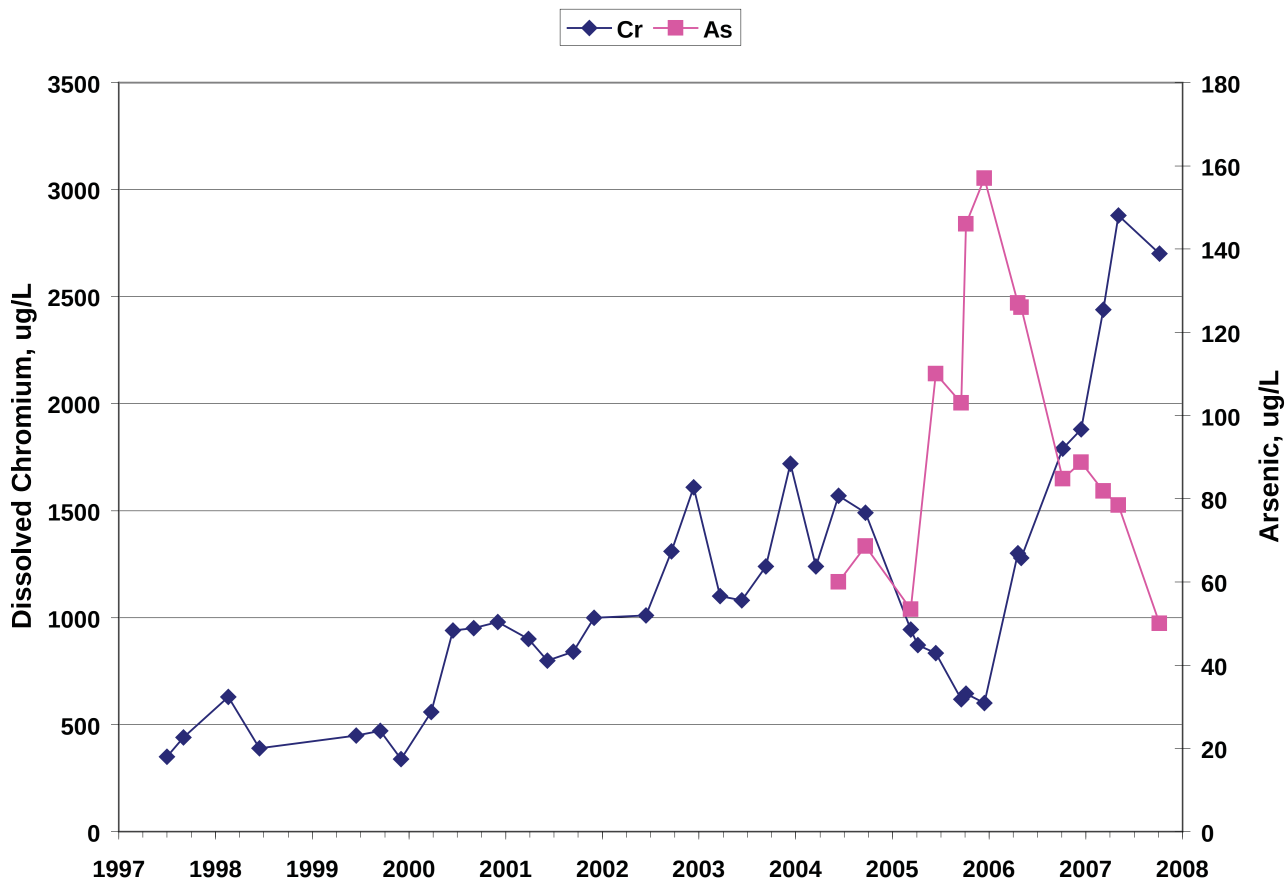

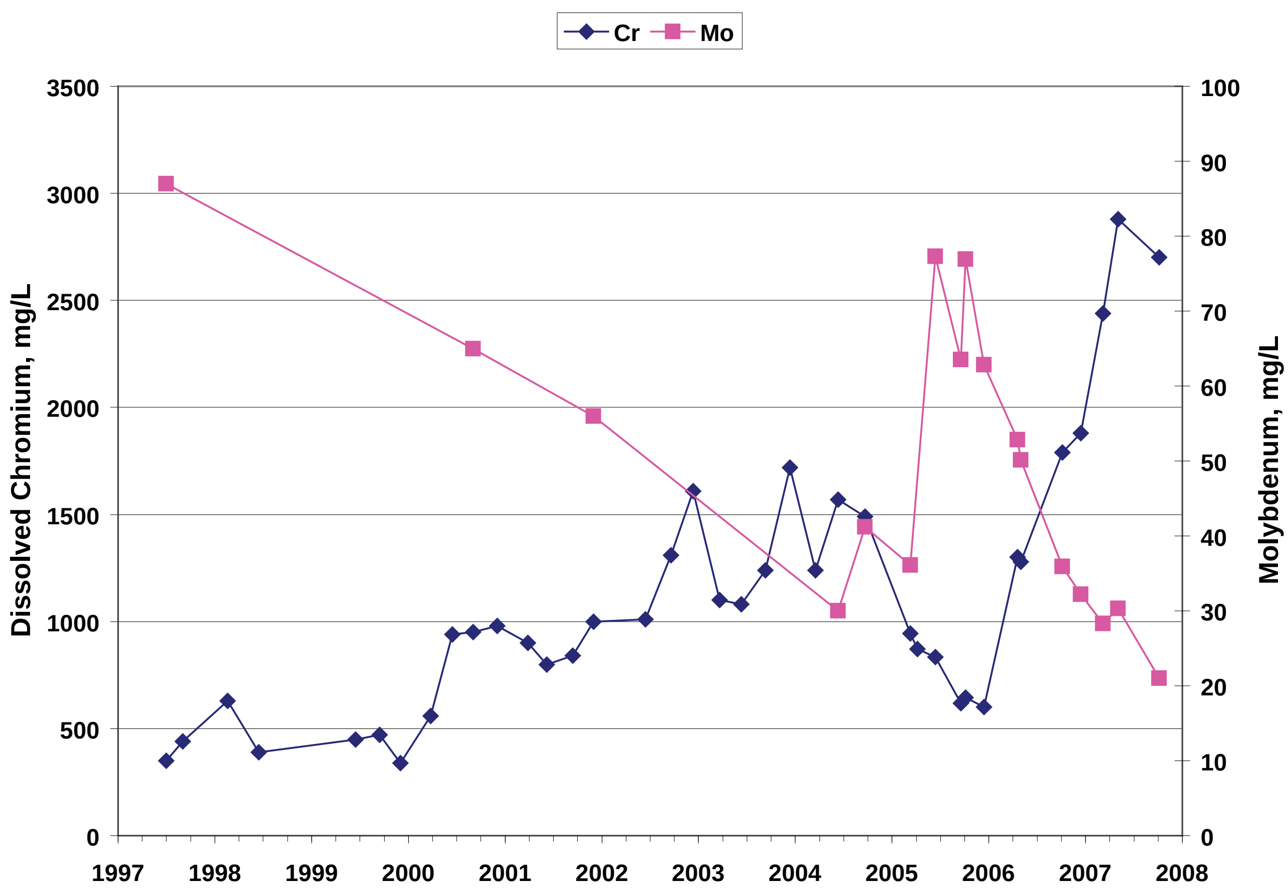

CONCENTRATIONS OF ELEMENTS OVER TIME IN WELL MW-12

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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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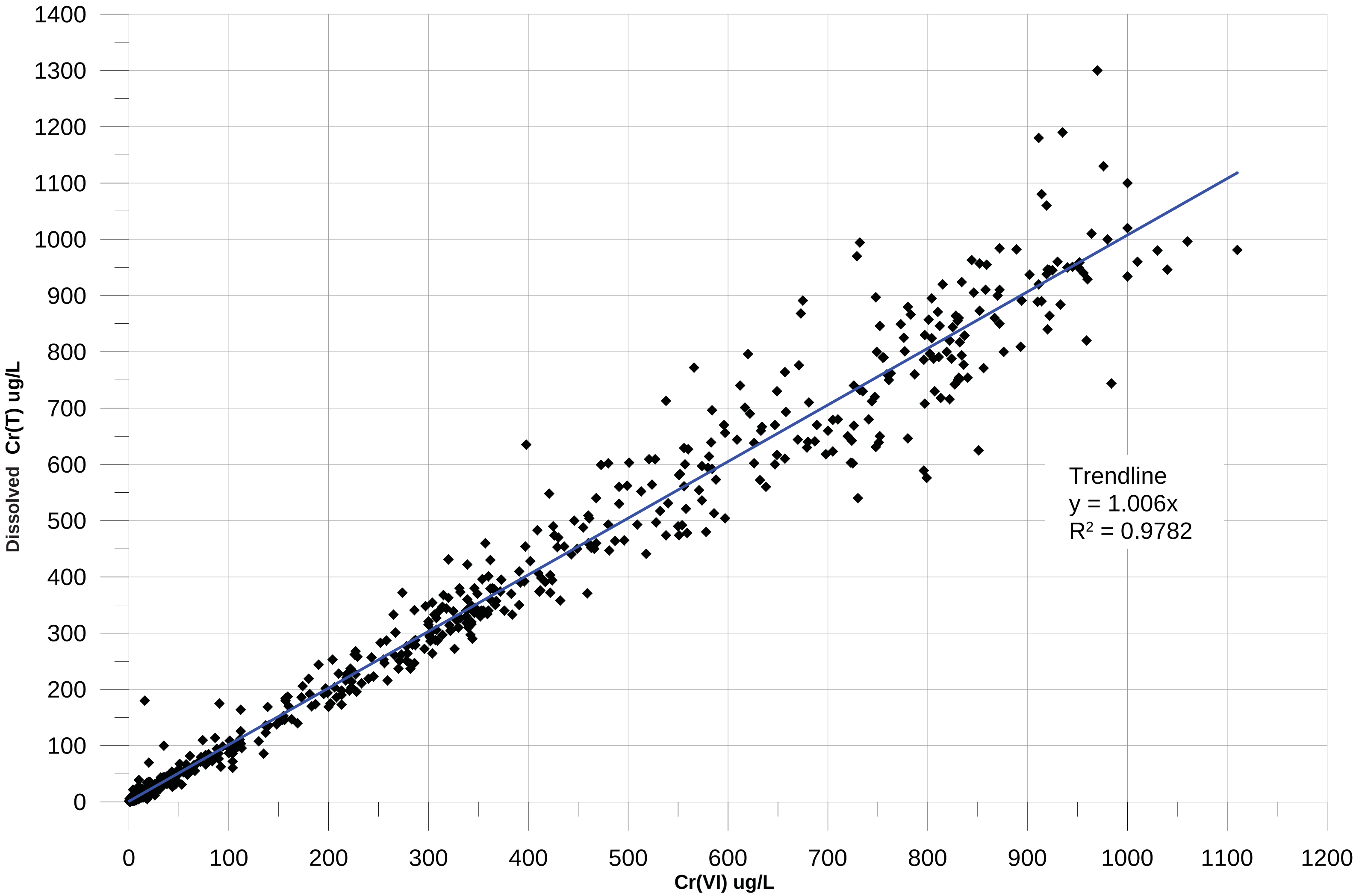
F4 Chromium Cross Plots



Note: Detected concentrations plotted for hexavalent chromium (Cr[VI]) and dissolved total chromium (Cr[T]) between method reporting limit and 1,000 micrograms per liter (ug/L).

TOTAL AND HEXAVALENT CHROMIUM CONCENTRATION CROSS-PLOT RFI/RI GROUNDWATER DATA, JULY 1997 – OCTOBER 2007

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NEEDLES, CALIFORNIA

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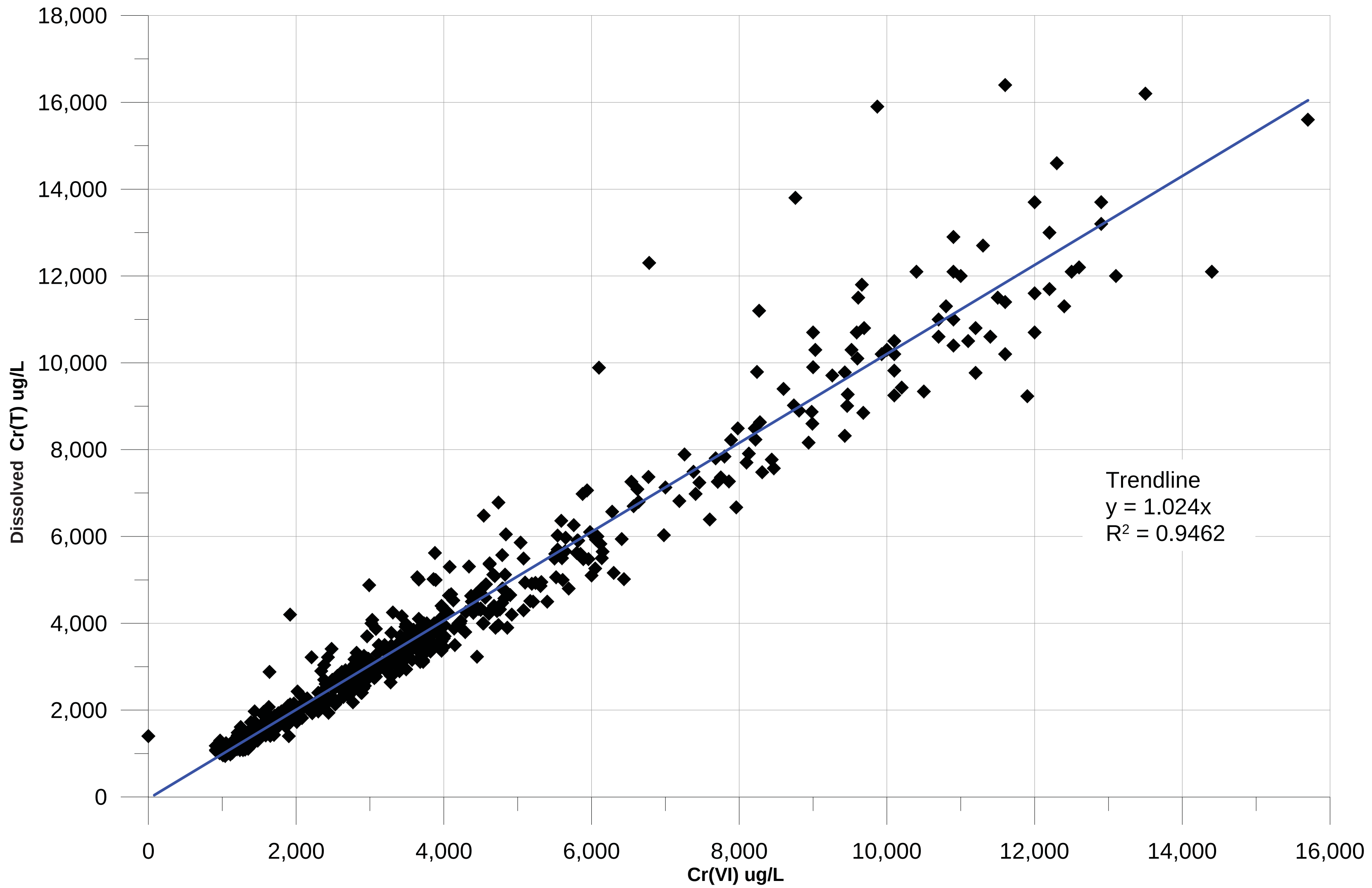
ES102007005BAO_Total-HexaChrom_Plot.indd_123008_lho



Note: Detected concentrations between 1,000 micrograms per liter (ug/L) and 20,000 ug/L.

TOTAL AND HEXAVALENT CHROMIUM CONCENTRATION CROSS-PLOT RFI/RI GROUNDWATER DATA, JULY 1997 – OCTOBER 2007

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Appendix G
Applicable or Relevant and Appropriate Requirements

United States Department of the Interior

OFFICE OF THE SOLICITOR

Preliminary Determination of Applicable, or Relevant and Appropriate, Requirements
Pacific Gas & Electric Topock CERCLA Site

The United States Department of the Interior, the Bureau of Land Management, the U.S. Fish and Wildlife Service, and the Bureau of Reclamation (collectively, the "Federal Agencies"), have made the following preliminary determination of the applicable, or relevant and appropriate, requirements ("ARARs") that must be attained by any remedial action selected to address the release of a hazardous substance from the Pacific Gas and Electric ("PG&E") Compressor Station located near Topock, Arizona (the "Site"). Attached to this narrative is a table showing the Federal Agencies' preliminary determination of ARARs for the Site.

Background – General ARARs Information

The identification of ARARs is performed pursuant to Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), which states that a remedial action selected for a CERCLA site shall attain a degree of cleanup which assures protection of human health and the environment, and attains "legally applicable or relevant and appropriate standard(s), requirement(s), criteria, or limitation(s)."

There are four basic criteria that define ARARs. ARARs are: (1) substantive rather than administrative, (2) applicable *or* relevant and appropriate, (3) promulgated State requirements which are more stringent than comparable federal standards, and (4) categorized as Chemical-specific, Location-specific, or Action-specific.

First, ARARs are substantive requirements, meaning that they are requirements that pertain directly to actions or conditions in the environment at the subject property. Examples of substantive requirements include: quantitative health- or risk-based restrictions on concentrations of hazardous substances (e.g. water quality standards), technology-based requirements for actions taken upon hazardous substances, or restrictions upon certain activities in certain special locations. Conversely, administrative or procedural obligations do not qualify as ARARs. Administrative requirements include requirements which facilitate identification and implementation of the substantive requirements, such as permitting procedures or recordkeeping.

Second, ARARs must be either Applicable or Relevant and Appropriate. Applicable requirements are laws and regulations that would be enforceable at the particular site even if there were no CERCLA remedial action taking place. These could include requirements applicable to a particular hazardous substance, remedial action, location, or other circumstance found at the site. Determining applicable ARARs, therefore, is an objective, site-specific analysis. Relevant and appropriate requirements, on the other hand, are obligations that, while not "applicable," address situations sufficiently similar and are well suited to the particular site. A relevant and appropriate determination can necessitate more subjective analysis.

Third, in addition to federal regulations, relevant State laws may be determined to be ARARs. In order to be considered an ARAR, state standards must be: promulgated, identified by the state in a timely manner, and more stringent than any comparable federal standard, requirement, criteria, or limitation.

Finally, once statutes and regulations have been determined as ARARs, they may be grouped into three categories: Chemical-specific, Location-specific, and Action-specific. There will be situations where a particular requirement will fall in two or more categories. Ultimately, if a requirement is deemed an ARAR, it will not be relevant in which category it resides.

Once an analysis is complete, there may be materials which do not meet all of the requirements of an ARAR, but which still may be considered when determining what is protective when evaluating the remedial action alternatives for a CERCLA site. These documents to be considered, or "TBCs," can include guidance documents, advisories, or other criteria.

Identification of ARARs for the Topock CERCLA Site

On April 28, 2006, the Federal Agencies invited support agencies and the numerous stakeholders involved with the Site to participate in the ARARs identification process by submitting proposed ARARs for the Federal Agencies' consideration.[1] The Federal Agencies received responses from five parties. In addition to evaluating the ARARs proposed by the interested parties, the Federal Agencies supplemented the list with additional potential ARARs. The identification of ARARs is a site-specific process, therefore, the list of ARARs for a site is refined and augmented with increasing certainty as the Remedial Investigation and Feasibility Study ("RI/FS") process proceeds and more specific information is available. As more information is gathered during the Topock Site RI/FS, and as more comments are received from all of the interested parties, the ARARs list is likely to be further refined.

An important final note: ARARs are requirements which must be attained within the CERCLA remedial action process; even if a law or regulation does not qualify as an ARAR, it may still be necessary to satisfy that law or regulation outside of the CERCLA remedial process.

[1] The April 28, 2006 request for potential ARARs was distributed to the following parties: Fort Mojave Indian Tribe, Chemehuevi Indian Tribe, Twenty-Nine Palms Indian Tribe, Yavapai-Prescott Tribe, Cocopah Tribe, Colorado River India Tribes, Havasupai Tribe, Hualapai Tribe, Ft. Yuma Quechan Tribe, California Department of Toxic Substances Control, Arizona Department of Environmental Quality, State Water Resources Control Board, Metropolitan Water District of Southern California, U.S. Environmental Protection Agency (Region 9), and the Topock Site Consultative Workgroup members.

Preliminary Determination of Potential ARARs and TBCs

PG&E Topock Compressor Station CERCLA site

June 25, 2008

Note: Only substantive requirements of these proposed ARARs must be attained for on-site remedial actions. Compliance with administrative, procedural, and permitting requirements of the proposed ARARs is not required for on-site actions.

PROPOSED FEDERAL REQUIREMENTS

	Potential ARAR or TBC and Citation	Preliminary Determination	Description and Applicability
CHEMICAL			
1.	Federal Safe Drinking Water Act • 42 USC § 300f, *et seq.* • 40 CFR 141 -- Subpart F– Maximum Contaminant Level Goals (MCLGs)	ARAR Relevant and Appropriate	MCLGs are not federally enforceable drinking water standards, but CERCLA § 121(d) has raised MCLGs to the level of relevant and appropriate.
2.	Federal Safe Drinking Water Act • 42 USC § 300g-1 • 40 CFR 141 -- Subpart G – National Primary Drinking Water Regulations (MCLs)	ARAR Relevant and Appropriate	These MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants (eg. Chromium) in sources (or potential sources) of drinking water. MCLs may be applicable where water at a CERCLA site is delivered through a public water supply system.
3.	Federal Water Pollution Control Act (CWA) • 33 USC §§ 1251-1387 • 40 CFR 131.38	ARAR Applicable	These are federally promulgated Water Quality Standards for surface waters. Such water quality standards include specific criteria for water bodies in California, including standards for Hexavalent Chromium.
4.	Occupational Safety and Health Act • 29 USC § 651, *et seq.* • 29 CFR 1910.1026	TBC	This Act provides standards for workers engaged in field activities associated with remedial actions under the NCP, including occupational exposure to Hexavalent Chromium. Pursuant to the NCP preamble, OSHA standards are not ARARs but may be included as TBCs.

LOCATION			
5.	Federal Land Policy and Management Act (FLPMA) • 43 USC § 1701, *et seq.* • 43 CFR 2800	ARAR Applicable	In managing public lands, BLM is directed to take any action necessary to prevent unnecessary or undue degradation of the lands. Actions taken on the public land (i.e. BLM-managed land) portions of the Topock site should provide the "optimal balance between authorized resource use and the protection and long-term sustainability of sensitive resources."
6.	U.S. Department of Interior, Bureau of Land Management, *Approved Resource Management Plan and Final Environmental Impact Statement*, May 2007	TBC	The Resource Management Plan provides further direction on how FLPMA requirements will be satisfied.
7.	National Wildlife Refuge System Administration Act, as amended • 16 USC §§ 668dd-ee • 50 CFR Part 27	ARAR Applicable	This Act governs the use and management of a National Wildlife Refuge. The Act further requires that the FWS evaluate ongoing and proposed activities and uses to ensure that such activities are appropriate and compatible with both the mission of the overall National Wildlife Refuge System, as well as the specific purposes for which the Havasu Refuge was established. The Topock site includes the Havasu National Wildlife Refuge.
8.	Executive Order 8647; 6 FR 593	TBC	This Executive Order establishes the Havasu National Wildlife Refuge and describes the purposes for which it was created.
9.	Appropriate Use Policy • 603 FW 1	TBC	This policy elaborates on the appropriate uses of a National Wildlife Refuge, ensuring that such uses contribute to fulfilling the specific refuge's purposes and the National Refuge System's mission.
10.	Compatibility Policy • 603 FW 2	TBC	This policy specifies the guidelines for determining the compatibility of proposed uses of a National Wildlife Refuge. This determination is done once a proposed use is deemed appropriate (see number 11 above).
11.	Lower Colorado River National Wildlife Refuges, Comprehensive Management Plan (1994-2014)	TBC	The Comprehensive Management Plan provides further direction on how compliance with the National Wildlife Refuge System Administration Act, as amended, shall be achieved.

12.	Fish and Wildlife Conservation Act • 16 USC §§ 2901-2911	TBC	Federal departments and agencies are encouraged to utilize their authority to conserve nongame fish and wildlife and their habitats and assist States in the development of their conservation plans.
13.	Fish and Wildlife Coordination Act • 16 USC §§ 661-667e • 40 CFR 6.302(g)	ARAR Applicable	This Act requires that any federally-funded or authorized modification of a stream or other water body must provide adequate provisions for conservation, maintenance, and management of wildlife resources and their habitat. Necessary measures should be taken to mitigate, prevent, and compensate for project-related losses of wildlife resources.
14.	National Historic Preservation Act • 16 USC § 470, *et seq.* • 40 CFR 6.301(b) • 36 CFR 800.1, *et seq.*	ARAR Applicable	This statute and the implementing regulations require that remedial actions at or near historic properties must take into account the effects of such undertakings on the historic properties, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. The Topock site includes historic properties.
15.	National Archaeological and Historic Preservation Act • 16 USC § 469, *et seq.* • 36 CFR 65 • 40 CFR 6.301(c)	ARAR Applicable	This statute requires the evaluation and preservation of historical and archaeological data which might otherwise be irreparably lost or destroyed through any alteration of terrain as a result of federal construction projects or a federally-licensed activity. The Topock site includes historical and archaeological data.
16.	Archaeological Resources Protection Act • 16 USC § 470aa-ii, *et seq.* • 43 CFR 7.1, *et seq.*	ARAR Applicable	This statute provides for the protection of archeological resources located on public and tribal lands. The Act establishes criteria which must be met for the land manager's approval of any excavation or removal of archaeological resources if a proposed activity involves soil disturbances.
17.	Historic Sites Act • 16 USC §§ 461-467 • 40 CFR 6.301(a)	ARAR Applicable	Pursuant to this Act, federal agencies are to consider the existence and location of historic sites, buildings, and objects of national significance using information provided by the National Park Service to avoid undesirable impacts upon such landmarks. The Topock site includes areas which are considered historic sites.
18.	Executive Order No. 11593	TBC	This Order directs the Federal Agencies to initiate measures for the protection and enhancement of the cultural environment. These measures include assuring that steps are taken to make records, drawings, and/or maps and have such items deposited in the Library of Congress when, as the result of a Federal action, a property listed on the National Register of Historic Places is to be substantially altered.

19.	Native American Graves Protection and Repatriation Act (NAGPRA) • 25 USC § 3001, *et seq.* • 43 CFR 10.1, *et seq.*	ARAR Applicable	NAGPRA regulates the removal and trafficking of human remains and cultural items, including funerary and sacred objects. If remediation activities result in the discovery of Indian human remains or related objects, these requirements must be met. The Topock site contains archaeological areas which may contain human remains.
20.	American Indian Religious Freedom Act 42 USC § 1996, *et seq.*	ARAR Relevant and Appropriate	The United States shall "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise [their] traditional religions…"
21.	Executive Order No. 13007	TBC	In managing federal lands, the United States "shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and (2) avoid adversely affecting the physical integrity of such sacred sites."
22.	Resource Conservation and Recovery Act • 42 USC § 6901, *et.seq.* • 40 CFR 264.18	ARAR Applicable	These regulations promulgated under RCRA establish Seismic and Floodplain considerations which must be followed for treatment, storage, or disposal facilities constructed, operated, or maintained within certain distances of fault lines and floodplains. Portions of the Topock site are located on or near a 100-year floodplain.
23.	Floodplain Management and Wetlands Protection • 40 CFR § 6.302(a) & (b) • 40 CFR 6, Appendix A	ARAR Applicable	Before undertaking an action, agencies are required to perform certain measures in order to avoid the long and short term impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands. The regulation sets forth requirements as means of carrying out the provisions of Executive Orders 11988 and 11990.
24.	Executive Order 11988 – Floodplain Management	TBC	
25.	Executive Order 11990 -- Responsibilities of Federal Agencies to Protect Wetlands	TBC	

ACTION			
26.	Federal Safe Drinking Water Act • 42 USC §300f, *et seq.* Part C – Protection of Underground Sources of Drinking Water • 40 CFR 144 -148	ARAR Applicable	These Underground Injection Control Regulations assure that any underground injection performed on-site will not endanger drinking water sources. Substantive requirements include, but are not limited to, regulation of well construction and well operation. These requirements will be applicable if underground injection is proposed as a part of a site remedy.
27.	Federal Water Pollution Control Act (Clean Water Act) • 33 USC § 1344 • 40 CFR 230.10	ARAR Applicable	This section of the Clean Water Act prohibits certain activities with respect to on-site wetlands and waterways. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed activity which would have less adverse impact to the aquatic ecosystem.
28.	Federal Water Pollution Control Act (Clean Water Act) • 33 U.S.C. § 1342 • 40 CFR 122 • 40 CFR 125	ARAR Applicable	These National Pollutant Discharge Elimination System (NPDES) requirements regulate discharges of pollutants from any point source into waters of the United States.
29.	Federal Water Pollution Control Act (Clean Water Act) • 40 CFR 122.26	ARAR Applicable	These regulations define the necessary requirements with respect to the discharge of storm water under the NPDES program. These regulations will apply if proposed remedial actions result in storm water runoff which comes in contact with any construction activity from the site remediation.
30.	River and Harbor Act of 1899 33 USC §§ 401 and 403	ARAR Applicable	This Act prohibits the creation of any obstruction in navigable waters, in addition to banning activities such as depositing refuse, excavating, filling, or in any manner altering the course, condition, or capacity of navigable waters. These requirements will apply if proposed activities at the Topock site have the potential of affecting any navigable waters on the site.
31.	Colorado River Front Work and Levee System Act • 44 Stat. 1010 (1927)	TBC	Any proposed remediation activities shall not interfere with the water operations or related water management activities and responsibilities of the Bureau of Reclamation.

32.	Clean Air Act • 42 USC §§ 7401, *et seq.* National Ambient Air Quality Standards (NAAQS) • 40 CFR 50	TBC	These ambient air quality standards define levels of air quality to protect the public health. NAAQSs are not enforceable in and of themselves, but they may be used as guidance if remediation activities create potential air quality impacts.
33.	Clean Air Act • 42 USC §§ 7401, *et seq.* National Emission Standards for Hazardous Air Pollutants (NESHAP) • 40 CFR 61 40 CFR 63	ARAR Applicable	NESHAPs are regulations which establish emissions standards for certain hazardous air pollutants (HAPs) identified in the regulations. NESHAPs will apply if remediation activities on the site produce identified HAP emissions.
34.	Religious Freedom Restoration Act • 42 USC § 2000bb	ARAR Applicable	Pursuant to this Act, the government shall not substantially burden a person's exercise of religion, unless the application of the burden is in furtherance of a compelling government interest, and it is the least restrictive means of furthering that compelling interest. A case by case determination will need to be made to the extent that concerns are raised that a specific remedial activity is alleged to burden a person's exercise of religion.
35.	Endangered Species Act of 1973 • 16 USC §§ 1531-1544 • 50 CFR 402	ARAR Applicable	The ESA makes it unlawful to remove or "take" threatened and endangered plants and animals and protects their habitats by prohibiting certain activities. Examples of such species in or around the Topock site may include, but are not limited to, southwestern willow flycatcher, Mojave Desert tortoise, Yuma clapper rail, Colorado pike minnow, razorback sucker, and bonytail chub. A case by case determination will need to be made to the extent that concerns are raised that a specific remedial activity will result in the take of, or adverse impacts to, threatened and endangered species.

36.	Migratory Bird Treaty Act • 16 USC §§ 703-712	ARAR Applicable	This Act makes it unlawful to "take, capture, kill," or otherwise impact a migratory bird or any nest or egg of a migratory bird. The Havasu National Wildlife Refuge, which is part of the Topock site, was created as a refuge and breeding ground for migratory birds and other wildlife, therefore, there is potential for contact with migratory birds during proposed remediation activities. A case by case determination will need to be made to the extent that concerns are raised that a specific remedial activity will result in the take of, or adverse impacts to, a migratory bird.
37.	Executive Order 13186: Responsibilities of Federal Agencies To Protect Migratory Birds	TBC	This Order directs executive departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act, including supporting the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.
PROPOSED ARIZONA REQUIREMENTS			
	Potential ARAR or TBC and Citation	**Preliminary Determination**	**Description and Applicability**
CHEMICAL			
38.	Narrative Aquifer Water Quality Standards A.A.C. R18-11-405	Not an ARAR	These standards are not more stringent than the equivalent federal standards.
39.	Numeric Aquifer Water Quality Standards for inorganic chemicals (including Chromium) A.A.C. R18-11-406	Not an ARAR	These standards are not more stringent than the equivalent federal standards.
40.	Water quality standards in general and considerations when setting standards. A.R.S. §49-221	Not an ARAR	No substantive requirements.
41.	Considerations in setting numeric water quality standards. A.R.S. §49-222	Not an ARAR	No substantive requirements.

42.	Aquifer identification, classification, and reclassification A.R.S. § 49-224	Not an ARAR	No substantive requirements.
LOCATION			
43.	Archeological Discoveries A.R.S. § 41-841 through 847	ARAR Applicable	This Act restricts the excavation of any archaeological specimen or vertebrate paleontological specimen on Arizona State or State agency owned land.
44.	Historic Preservation A.R.S. § 41-861-866	ARAR Applicable	This Act restricts certain activities on Arizona State or State agency owned Historic properties.
ACTION			
2.	Arizona Endangered Species Protection A.A.C. R12-4-401 - 402	Not an ARAR	These Arizona Endangered Species Protection regulations are not more stringent than federal requirements.
3.	Arizona NPDES requirements A.A.C. R18-9-A901 *et seq.*; A.A.C. R18-9-1001 et seq.; A.R.S. § 49-255 *et seq.*	Not an ARAR	These Arizona NPDES requirements are not more stringent than federal requirements.
4.	Aquifer Protection Permit provisions A.R.S. §49-241, *et seq.*, A.A.C. R18-9-A201; A.A.C. R18-9-A301, A.A.C. R18-9-A701	Not an ARAR	These Arizona Aquifer Protection Permit provisions are not more stringent than federal requirements.
5.	Discharges to Surface Water A.R.S. §49-221; A.A.C. R18-11-101	Not an ARAR	These requirements are not more stringent than federal requirements.
6.	Arizona Well Standards A.A.C. R-12-15-850	ARAR Applicable	These requirements on the placement of wells will apply if the selected remedy includes placement of wells in Arizona.

7.	Design criteria for treatment units A.A.C. R18-5-(501-502)	ARAR Applicable	These minimum design criteria will apply if the selected remedy includes construction of a groundwater treatment plant.
8.	Requirements for wells, groundwater withdrawal, treatment, and reinjection A.R.S. §45-454.01	ARAR Applicable	This statute exempts new well construction, withdrawal, treatment, and reinjection into a groundwater aquifer as a part of a CERCLA Remedial Action from the requirements of the Arizona Groundwater Code, except that they must comply with the substantive requirements of A.R.S. 45-594, 45-595, 45-596, and 45-600. If groundwater that is withdrawn is not reinjected into the aquifer, the groundwater shall be put to reasonable and beneficial use.
9.	Well construction standards A.R.S. §45-594 and 595	ARAR Applicable	These provisions identify the well construction standards and requirements for new well construction in the State of Arizona. These requirements will apply if the selected remedy involves the construction of wells in Arizona.
10.	Notice of intention to drill A.R.S. §45-596	ARAR Applicable	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.
11.	Report by driller A.R.S. §45-600	ARAR Applicable	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.
12.	Arizona Remedial Action Requirements A.R.S. §49-282.06(A)(2)	ARAR Relevant and Appropriate	Any treatment of groundwater must be conducted in a manner to provide for the maximum beneficial use of the waters of the state.

PROPOSED CALIFORNIA REQUIREMENTS			
	Potential ARAR or TBC and Citation	Preliminary Determination	Description and Applicability
CHEMICAL			
45.	California Safe Drinking Water Act • Title 22, CCR, Div 4, Ch 15, §64431, §64444	ARAR Applicable	Maximum Contaminant Levels (MCLs) which shall not be exceeded in the water supplied to the public. California state MCLs for drinking water standards are more stringent than primary federal standards.
46.	Secondary MCLs list for drinking water • Title 22, CCR, Div 4, Ch 15, §64449	ARAR Relevant and Appropriate	State secondary MCLs for drinking water standards are more stringent than federal standards. These secondary MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants in sources (or potential sources) of drinking water. These secondary MCLs would be applicable if water at the site was used as drinking water and delivered through a community water supply system.
47.	Characteristics of Hazardous Waste Title 22, CCR, Div 4.5, Ch 11, Article 3, §66261.20- §66261.24	TBC	These criteria do not establish substantive requirements, but instead describe the analysis by which waste is determined to be hazardous. These regulations outline Toxicity Characteristic Leaching Procedure (TCLP) regulatory levels, persistent and bioaccumulative toxic substances total threshold limit concentrations (TTLC), and soluble threshold limit concentration (STLC).
48.	Groundwater and vadose zone protection standards • Title 22, CCR, Div 4.5, Ch 15, Article 6, §66265.94	ARAR Applicable	RCRA hazardous waste Interim Status TSD facilities shall comply and ensure that hazardous constituents entering the groundwater, surface water, and soil from a regulated unit do not exceed the concentration limit from contaminants of concern in the uppermost aquifer underlying the waste management area beyond the point of compliance.
49.	State Water Quality Control Policy Porter-Cologne Water Quality Control Act (California Water Code Sections 13140, *et seq.*)	TBC	No substantive requirements.

50.	Regional Water Quality Control Plan Objectives Porter-Cologne Water Quality Control Act (California Water Code Sections 13240, 13241)	<u>TBC</u>	No substantive requirements.
51.	Regional Water Quality Control Plan Implementation Porter-Cologne Water Quality Control Act (California Water Code Sections 13242)	<u>TBC</u>	No substantive requirements.
52.	*Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities* DTSC Human and Ecological Risk Division July 1996	<u>TBC</u>	Guidance document
53.	*Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities* DTSC Human and Ecological Risk Division July 1992	<u>TBC</u>	Guidance document
54.	*Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual – Interim Final (EPA/540/1-89/002)* United States Environmental Protection Agency December 1989	<u>TBC</u>	Guidance document
55.	*Selecting Inorganic Constituents As Chemicals Of Potential Concern At Risk Assessments At Hazardous Waste Sites And Permitted Facilities* DTSC Final Policy, February 1997	<u>TBC</u>	Guidance document
56.	*The Designated Level Methodology for Waste Classification and Cleanup Level Determination* Staff Report of the RWQCB, CVR	<u>TBC</u>	Staff Report
57.	*A Compilation of Water Quality Goals* Staff Report of the RWQCB, CVR	<u>TBC</u>	Staff Report

LOCATION			
58.	Seismic and Floodplain standards • Title 22, CCR, Div 4.5, Ch 14, Article 2, §66264.18	ARAR Relevant and Appropriate	These standards are relevant and appropriate for TSD facilities constructed, operated, or maintained within certain distances of fault lines, floodplains, or the maximum high tide.
59.	*Drilling, Coring, Sampling and Logging at Hazardous Substance Release sites* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	Guidance document
60.	*Reporting Hydrogeologic Characterization Data at Hazardous Substance Release sites* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	Guidance document
61.	*Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Sites, Volume 1 & 2,* Cal/EPA, July 1995	TBC	Guidance document
62.	*Aquifer Testing for Hydrogeologic Characterization* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	Guidance document
63.	*Application of Borehole Geophysics at Hazardous Substance Release Sites* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	Guidance document
64.	*Ground Water Modeling for Hydrogeologic Characterization* Guidance Manual for Ground Water Investigations Cal/EPA, July 1995	TBC	Guidance document
65.	*Monitoring Well Design and Construction for Hydrogeologic Characterization* Guidance Manual for Ground Water Investigations, Cal/EPA, July 1995	TBC	Guidance document

66.	*Advisory – Active Soil Gas Investigation* DTSC/CRWQCB-Los Angeles Region, January 2003	TBC	Advisory
67.	*Representative Sampling of Ground Water for Hazardous Substances,* Cal/EPA, July 1995	TBC	Guidance document
68.	*Accumulating Hazardous Waste at Generator Sites,* Cal/EPA, July 1995	TBC	Guidance document
ACTION			
69.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.11	ARAR Applicable	Owners or operators who generate waste shall determine whether waste is a hazardous waste. Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
70.	Hazardous Waste Control Act (HWCA) Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.12	ARAR Applicable	A generator shall not treat, store, dispose of, transport or offer for transportation, hazardous waste without having received an identification number. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.
71.	Hazardous Waste Control Act (HWCA) Standards for owners and operators of hazardous waste transfer and TSD facilities Title 22, CCR, Div 4.5, Ch 14, Article 2	ARAR Applicable	Establish requirements for a hazardous waste treatment facility to have a plan for waste analysis, develop a security system, conduct regular inspections, provide training to facility personnel, and use a quality assurance program during construction. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.
72.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 2, §66262.20, §66262.22	ARAR Applicable	A generator of hazardous waste who transports or offers hazardous waste for transportation shall prepare a manifest. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.

73.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, §66262.33	ARAR Applicable	Before transporting hazardous waste or offering hazardous waste for transportation off-site, the generator must do the following in accordance with DOT regulations: package the waste, label and mark each package of hazardous waste, and ensure that the transport vehicle is correctly placarded.
74.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.34	ARAR Applicable	Requirements with respect to accumulation of waste on-site.
75.	Hazardous Waste Control Act (HWCA) Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 4, §66262.40, §66262.41	ARAR Applicable	Establishes requirements for record keeping of manifests, test results, waste analyses, and Biennial Reports. Any substantive requirements shall be attained.
76.	Corrective Action Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.100 (a) through (d), (f), (g)(1), and (h)	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action under Title 22, CCR, §66264.91 to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
77.	Corrective action for Waste Management Units Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.101	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action to remediate releases from any solid or hazardous waste management unit at the facility to protect public health and the environment. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
78.	Closure and post-closure care Title 22, CCR, Div 4.5, Ch 14, Article 7, §66264.111, §66264.112, §66264.115 through 120	ARAR Relevant and Appropriate	Owners and operators shall close a facility and perform post-closure care when contaminated subsurface soil cannot be practically removed or decontaminated. Contaminated soil, residues, or groundwater from remedial action at a site will achieve clean closure; otherwise, post-closure care requirements will be relevant and appropriate.

79.	Use and management of containers Title 22, CCR, Div 4.5, Ch 14, Article 9	ARAR Applicable	Containers used for the transfer or storage of hazardous waste must be in good condition, compatible with the waste, kept closed except to add or remove materials and be inspected weekly. The area used to store the containers must provide adequate secondary containment and be designed with runoff controls. Also, appropriate closure of the containers must take place.
80.	Tank systems Title 22, CCR, Div 4.5, Ch 14, Article 10	ARAR Applicable	The remedial activities may involve storage and/or treatment in tanks. These tanks are required to have secondary containment, be monitored and inspected, be provided with overfill and spill protection controls, and operated with adequate freeboard. Also, appropriate closure must take place.
81.	Waste piles Title 22, CCR, Div 4.5, Ch 14, Article 12	ARAR Applicable	The waste piles should be placed upon a lined foundation or base with a leachate system, protected from precipitation and wind dispersal, designed to prevent run on and run off. Also, closure and post-closure care requirements. Remedial action may involve soil excavation and the compiling of soil in a temporary waste pile. This requirement is applicable if the excavated waste meets RCRA hazardous waste criteria.
82.	Landfills Title 22, CCR, Div 4.5, Ch 14, Article 14	ARAR Relevant and Appropriate	The requirements for landfills include the design and operation, action leakage rate, monitoring and inspection, response actions, surveying and recordkeeping and closure and post-closure care.
83.	Miscellaneous Units Title 22, CCR, Div 4.5, Ch 14, Article 16	ARAR Applicable	Applies to waste management unit not otherwise regulated under RCRA. It may include pumps, auxiliary equipment, air strippers, etc. The substantive requirements include design, construction, operation, maintenance and closure of the unit that will ensure protection of human health and the environment. The actions include general inspections for safety and operation efficiency, testing and maintenance of the equipment (including testing of warning systems). Applicable if pumps are used for extraction and treatment of leachate that meets RCRA hazardous waste criteria.
84.	Financial Requirements Title 22, CCR, Div 4.5, Ch 14, Article 8	Not an ARAR	Owners or operators of all hazardous waste treatment, storage or disposal facilities must provide sufficient funding through an appropriate mechanism to assume all financial liabilities for the site.

85.	Land Disposal Restrictions (LDR) for RCRA wastes and non-RCRA wastes Title 22, CCR, Div 4.5, Ch 18, Articles 1, 3, 4, 10, 11	<u>ARAR</u> Applicable	Movement of hazardous waste to new locations and placed in or on land will trigger LDR. General applicability, dilution prohibited, waste analysis and record keeping, and special rules apply for wastes that exhibit a characteristic waste. Best Demonstrated Available Technology (BDA) standards for each hazardous constituent in each listed waste, if residual is to be disposed. Utilize treatment standards table when necessary. Where applicable, hazardous waste generated from remedial activities must comply with LDR and meet the treatment standards or notify the disposal facility of the treatment standards before disposal at an appropriate offsite disposal facility.
86.	<u>Hazardous Waste Control Act (HWCA)</u> Standards for owners and operators of hazardous waste transfer and TSD facilities Title 22, CCR, Div 4.5, Ch 14, Articles 3 and 4	<u>ARAR</u> Applicable	Establish requirements for a facility to plan for emergency conditions. In addition, the design and operation of the facility must be done to prevent releases. Other requirements include testing and maintenance of equipment and incorporation of communication and alarm systems and contingency plan. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.
87.	<u>Hazardous Waste Control Act (HWCA)</u> Groundwater monitoring and response Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.91 (a) and (c)	<u>ARAR</u> Relevant and Appropriate	Owners or operators of a RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
88.	<u>Hazardous Waste Control Act (HWCA)</u> Monitoring Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.97 (b), (c), (d) and (e)(1) through (e)(5)	<u>ARAR</u> Relevant and Appropriate	Requirements for monitoring groundwater, surface water, and vadose zone. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
89.	<u>Hazardous Waste Control Act (HWCA)</u> Detection Monitoring Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.98	<u>ARAR</u> Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop a detection monitoring program that will provide reliable indication of a release. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.

90.	Hazardous Waste Control Act (HWCA) Evaluation Monitoring Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.99	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop an evaluation monitoring program that can be used to assess the nature and extent of a release from the unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.
91.	Discharges of Waste to Land Title 23 CCR, Div 3, Ch 15	ARAR Relevant and Appropriate	The regulations in this chapter pertain to water quality aspects of hazardous waste discharge to land, establishing waste and site classifications and waste management requirements for waste treatment, storage, or disposal in landfills, surface impoundments, waste piles, and land treatment facilities. Requirements in this chapter are minimum standards for proper management of each waste category. Pursuant to Section 2511 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.
92.	Consolidated Regulations for Storage, Treatment, Processing, or Disposal of Solid Waste Title 27 CCR, Div 2, Subdivision 1	ARAR Relevant and Appropriate	The regulations in this subdivision (promulgated by the State Water Resources Control Board (SWRCB)) pertain to water quality aspects of discharges of solid waste to land for treatment, storage, or disposal. Pursuant to Section 20090 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.
93.	Requirements for land-use covenants Cal. Code Regs. Title 22, § 67391.1	ARAR Applicable	This regulation requires appropriate restrictions on use of property in the event that a proposed remedial alternative results in hazardous materials remaining at the property at levels which are not suitable for unrestricted use of the land. This is an ARAR with respect to PG&E-owned land at the Topock site.
94.	California Water Code Section 13801(c) California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81)	ARAR Applicable	These standards for water, cathodic, and monitoring wells will be applicable if the remediation requires use of such wells.
95.	State Water Resources Control Board Resolution No. 77-1 Policy with Respect to Water Reclamation in California	TBC	

96.	State Water Resources Control Board Resolution No. 88-63 Adoption of Policy Entitled "Sources of Drinking Water	TBC	
97.	State Water Resources Control Board Resolution No. 68-16 Statement of Policy with respect to Maintaining High Quality of Waters in California	TBC	
98.	State Water Resources Control Board Resolution No. 77-1 Policies and Procedures for investigation and Cleanup and Abatement of Discharges under Water Code Section 13304	TBC	
99.	*Transportation Plan* Preparation Guidance for Site Remediation DTSC, May 1994	TBC	

Appendix H
Groundwater and Surface Water Analytical Data

H1 Summary of Analytical Data Review and Evaluation, 2002-2007 Investigation and Monitoring Programs

APPENDIX H1

Summary of Analytical Data Review and Evaluation

H1.1 Analytical Program

The PG&E Topock analytical program was designed to ensure that field investigation data collected is of the appropriate quality required to support decision-making in the RCRA facility investigation (RFI). The frequency, quantity, and type of analyses required to achieve the data quality objectives are specified in the program-specific work plans, work plan amendments, and additional specific sampling and analysis plans (the list of applicable documents is provided in Table 4-1 of the RFI/RI Report). In addition to the laboratory requirements included in the documents in Table 4-1 of the RFI/RI Report, statements of work (SOW) were prepared detailing the minimum quality assurance/quality control (QA/QC) requirements for laboratory analyses. The *Quality Assurance Project Plan* (QAPP) and the *Quality Assurance Project Plan Addendum* (QAPP Addendum) (CH2M HILL, 2004a-b) document the QA/QC activities that have been used in generating analytical data for the groundwater monitoring program and further define the analytical requirements for the Topock analytical program. These work plans, SOWs, and the QAPP define:

- Sampling and analytical approach.
- Sample container requirements.
- Holding times.
- Sample preservation.
- Analytes or COPCs.
- Analytical methods.
- Method detection limits.
- Reporting limits.

H1.1.1 QA/QC Protocols

The documents referenced in Table 4-1 of the RFI/RI Report and in this appendix describe the QA/QC protocols used to assess the precision, accuracy, representativeness, completeness, and comparability (PARCC) of the data. The frequencies of the data quality indicators, the corrective action requirements, and the performance and system audits are also included in the documents. At a minimum, the QA/QC protocols require laboratories to analyze the following data quality indicators to assess the PARCC of the data:

- Method blanks
- Equipment blanks
- Laboratory control samples
- Matrix spikes
- Laboratory duplicates or matrix spike duplicates

- Field duplicates

The quality of the data is evaluated by the criteria discussed in the following subsections:

H1.1.1.1 Precision

Precision is a measure of reproducibility of analytical results and includes the variability associated with both sampling and analysis. It can be defined as the degree of mutual agreement among individual measurements obtained under similar conditions. Precision for the data for the RFI was required to be evaluated using the relative percent-difference between field duplicate sample results, laboratory sample duplicate results and/or between the matrix spike/matrix spike duplicate results.

H1.1.1.2 Accuracy

Accuracy is the degree of agreement between a measured value and the "true" or expected value and represents the estimate of total error associated with a given data point. Accuracy for the data for the RFI was required to be evaluated using percent recoveries determined from results of matrix spike/matrix spike duplicate and laboratory control sample analyses.

H1.1.1.3 Representativeness

Representativeness is the degree to which sample data accurately reflect the characteristics of a population of samples and is achieved through a well-designed sampling program, using standardized sampling strategies, techniques, and analytical procedures. Factors that can affect representativeness include site homogeneity, sample homogeneity at a single location, and available information around which the sampling program is designed. Representativeness for the RFI was maintained through the use of standardized methods and consistent field procedures.

H1.1.1.4 Completeness

Completeness is the amount of valid measurements compared to the total amount generated for each method, matrix, and analyte combination. The completeness of the data collected by Ecology and Environment, Inc. (E&E) and CH2M HILL are documented by each respective company through reports or data quality evaluation memos.

H1.1.1.5 Comparability

Comparability is the confidence with which one data set can be compared to another and is achieved by maintaining standard techniques and procedures for collecting and analyzing samples and reporting the analytical results in standard units. Results of system audits provide additional information for assessing comparability of data among participating subcontractor laboratories.

H1.1.2 Performance and System Audits

Review of documentation indicates that performance and system audits were performed by E&E and CH2M HILL. E&E's primary performance control was a supplemental SOW (E&E, 1998) for Applied P&Ch Laboratory to continue the analytical services audited by Alisto, in November 1996. CH2M HILL performed an onsite audit of Truesdail Laboratories Inc. in July 2004, April 2005, and October 2007. A continuous paper audit was also systemically performed by CH2M HILL during routine data validation over the course of the project. These audits and data validation indicated that the laboratory was compliant with the SOWs and the QAPP provided by CH2M HILL.

H1.1.3 Data Validation

Data validation was performed to ascertain the quality of the analytical data generated for the RFI. E&E (2000, 2004) documents the evaluation of analytical data collected between 1997 and 2002 in relation to the data quality indicators specified in the RFI work plan (Alisto, 1997), as well as subcontract SOWs and internal laboratory Standard Operating Procedures. Appendix B Data Review Process and Results, Topock RFI from the 2004 E&E RFI/RI is provided as Attachment 1 of this Appendix H1. After 2002 and prior to the QAPP (CH2M HILL, 2004a), data validation was based on the criteria set by the United States Environmental Protection Agency (USEPA) *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 1994) and the *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999).

The QAPP Addendum (CH2M HILL, 2004b) outlines CH2M HILL procedures used to validate data from the groundwater monitoring program beginning in April 2004. Occasionally data required qualifying for some of the following analytical uncertainties:

- The precision and accuracy limits were not achieved.
- The analysis exceeded the sample holding time.
- The field duplicate exceeded relative percent difference criteria.
- Calibration requirements were not met.
- Low-level laboratory or field contamination occurred.
- The reporting limit was not achievable due to matrix interference for some locations by USEPA Method SW7199. The QAPP and QAPP Addendum (CH2M HILL, 2004a-b) addresses additional quality control procedures implemented to evaluate the matrix interference and establish reporting limit criteria for data collected after April 2004.
- A detected peak was not within the laboratory-established retention time window for USEPA Method SW7199.

Data that did not meet quality control requirements were qualified during data validation to alert data users to the uncertainty associated with the result. Data users were provided with guidance on the impact to the data quality either through Data Concern and Resolution Forms or Data Quality Evaluation Reports by E&E and CH2M HILL, respectively. Overall, the data collected were determined to be of acceptable quality, except where noted, and the completeness objectives were accomplished.

H1.1.4 Data Management

A project data management system (DMS) was created to facilitate a systematic approach for managing the data collected from the Topock site. The DMS allows retrieval of data from the project files and database when they are needed, ensures that the required data are collected and are of the highest quality, and ensures that data are not lost during transfer to, or storage in, the central program electronic hardcopy files. The *PG&E Program Data Management Plan* (CH2M HILL 2004c) documents the minimum requirements for the DMS and administration of the DMS. The primary objectives identified for the DMS are listed below:

- **Standardize and facilitate data collection:** Use standard field forms; provide guidance for formatting, reviewing, and transferring data collected in the field to the DMS. The DMS includes hardcopy record files and an electronic DMS such as a database.
- **Minimize the uncertainties associated with the data:** Implement QA/QC measures to provide accurate data representation of data collected and stored in the DMS. QA/QC procedures include restricting data import or entry to specific valid value lists that will not allow incorrect data to be included in the DMS.
- **Provide data that are well-documented:** Retain enough descriptive and source information for technical defensibility and legal admissibility of the data.
- **Provide end users with tools to gain access to the data:** Provide reporting and delivery formats from a single source and allow relatively simple and rapid access to stored data for environmental characterization, report generation, modeling, geographic information system mapping, statistical analyses, and other users.
- **Provide data visualization capabilities:** Allow accurate representation of data used in models, geographic information system, boring log programs, computer-aided design, graphics, and other software used for mapping, graphing, charting, analyzing, and displaying environmental data.
- **Provide the ability to electronically compare data:** Allow electronic comparison of project data to one another or screening criteria.

H1.1.5 Management of Historical Data

Historical data for the RFI are defined as data that were provided from contractors prior to CH2M HILL. To best manage historical data in a manner that addresses the variety of sources and formats, along with concerns regarding data validation, the following procedures were performed:

- Historical data were reviewed to assess whether or not the data should become part of the current project DMS for the RFI. Historical data documentation provided by past contractors were evaluated to ascertain whether laboratory and field data were of sufficient quality to be added to the project database. Historical data deemed unacceptable for RFI decisions remain in files as hardcopy only.
- Acceptable historical data requiring entry into the DMS were organized for data entry or electronic upload.
- An intermediate file was created, and data codes and conventions were created to normalize the historical data with current project in the DMS. The source of the data documented and assigned a quality control level that corresponded to the level of data quality or validation that was discernible. After data entry into the intermediate file, a three-step review was performed to maximize completeness and accuracy. In the first

step, the data in the intermediate files were checked against the original source documents by the person entering the data. Second, another team member reviewed the intermediate data set against the original source documents. Third, after data entry was reviewed, logical queries of the data in the intermediate file against the DMS were performed. The logical queries included checks against previous or current data to identify trends and anomalies on data types such as analytical results, groundwater elevations, coordinates, etc. After the quality control checking process was completed and updates were made, the data were uploaded to the DMS.

References

Alisto Engineering Group (Alisto). 1997. *Current Conditions Report, Bat Cave Wash Project.* Prepared for California Department of Toxic Substances Control. May.

CH2M HILL. 2004a. *PG&E Program Quality Assurance Project Plan.* November.

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Ecology and Environment, Inc. (E&E). 1998*. Supplemental Analytical Services Statement of Work for Applied P&Ch Laboratory, RCRA Facility Investigation, Bat Cave Wash Project, Revised.* March.

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Attachment 1
2004 RFI/RI Appendix B

APPENDIX B
Data Review Process and Results
Topock RFI

1. DATA REVIEW PROCESS

1.1 Basis For Review

The analytical data generated for the Topock RFI was reviewed to ensure accuracy, high quality, and sufficient data usability to support the findings and conclusions. The purpose of the data review was to verify that the quality control indicators met the requirements specified in the following documents:

- RFI Work Plan (Alisto 1997a)
- Subcontract statement of work (SOW) prepared by Alisto (Alisto 1997b) and Ecology and Environment, Inc. (E & E 1998)
- Applied P&Ch Laboratory (APCL's) quality assurance program plan (QAPP) (Alisto 1997a) and standard operating procedures (SOPs)
- Truesdail Laboratories, Inc. (TLI) internal QAPP and SOPs (post March 2002 Groundwater Monitoring Data)
- Subcontract statement of work prepared by CH2M HILL ([CH2M HILL 2001] post March 2002 Groundwater Monitoring Data)
- U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review ([February, 1994], post March 2002 Groundwater Monitoring Data)

A summary of the quality control (QC) criteria is provided in Tables B-1 (soils), B-2a (water), B-2b (water), and B-3 (QC parameters). Corrective actions were documented in Data Concern and Resolution Forms or Data Review Memorandum prepared by E & E and CH2M HILL. The data were reviewed and evaluated for overall precision, accuracy, representativeness, completeness, and comparability. Different levels of review were conducted based on the test performed for constituents of concern (COCs) or other contaminants. The levels and types of reviews that were performed are the following:

- For all the COCs, 100 percent of the raw data packages were reviewed and the results were validated based on criteria defined in the above documents and on the reviewer's professional judgment.

- For the other parameters, 10 percent of the sample data packages were reviewed for obvious discrepancies and compliance with QC criteria, to identify obvious analytical problems.

1.2 Quality Control Measures

An abbreviated review of the data packages (i.e., 10 percent of the samples) was performed for the other parameters. The following QC measures and checks were reviewed to perform for validation of the COCs:

- Chain-of-custody tracking and completeness
- Sample integrity and preservation
- Sample holding time
- RFI Laboratory QC Summary Forms, Part 1 and 2
- Analytical Results Summary and Reports
- Data package completeness
- Appropriate calculations verified and checked
- Analytical method SOP compliance
- Instrument calibration (initial and continuing)
- Laboratory control standards (internal and external standards)
- Blank sample assessment
- Spike sample assessment
- Assessment of sample dilution
- Field and laboratory duplicate assessment
- Practical quantitation limits (PQLs) or reporting limits (RL's) and units
- Annual method detection limits (MDL); i.e., contract required detection limits (CRDL's)
- QC check frequency
- Internal peer review and management approvals
- Evaluate and assess laboratory problems documented in the Case Narrative

1.3 Data Review Results and Conclusions

Overall, the data reported in this RFI are of acceptable quality and the completeness objectives have been accomplished. Data that did not meet all of the established QC criteria were annotated with the qualifier, "J—Estimated." Such qualified data may underestimate the actual environmental concentration (i.e., a negative bias). When the concentrations were below the PQL (or RL) but greater than the MDL (or CRDL), the data are of unknown quality and have greater uncertainty than non-annotated data. The data may be qualified because of the following analytical uncertainties:

- The precision and accuracy limits did not meet the lower limit due to matrix interferences
- The result was below the PQL (or RL), but greater than the MDL (or CRDL)
- The analysis exceeded the sample holding time
- The field duplicate exceeds relative percent difference criteria
- The sample was analyzed prior to continuing calibration verification standard

In summary, data that did not meet every QC criteria were qualified with a "J—Estimated" designation. These data are considered useable, but uncertain, especially at very low concentrations.

2. QUALITY CONTROL RESULTS

2.1 Data Quality Measurement Requirements

Tables B-3a and B-3b present the QC criteria and frequency of testing for precision, accuracy, representativeness, completeness, and comparability. Field and laboratory QC check samples were analyzed with the environmental samples to monitor the overall quality of data generated. Laboratory QA/QC results were tabulated in each data package, which is archived in the project file. All laboratory QC measurements were within the limits listed in Table B-3, except for those samples qualified as "J—Estimated," discussed above.

2.2 Field Duplicate QC Sample Results

The groundwater field duplicate samples collected for the COCs from 1997 to 2002 were reviewed for total chromium and hexavalent chromium. For the data set from 1997 to 1999, two out of 33 samples exceeded the precision limit of 25 relative percent difference (RPD) for total chromium and 3 out of 33 exceeded the RPD limit for hexavalent chromium. For the data set between 1999 to 2002, there are a total of forty-eight groundwater locations for which duplicate samples were obtained and analyzed. Between March 1, 2002 and June 30, 2003 a total of 20 duplicate groundwater samples were collected. Six of the 20 samples exceeded the precision limit of 40% RPD for Zinc and one sample exceeded the 40% RPD limit for orthophosphate. There were no exceedences for either total or hexavalent chromium. Field precision and reproducibility are acceptable to support the data in this RFI report. From 1997 to 1999, all field duplicate samples for surface waters were within the limits; all concentrations were non-detected for the COCs. From 1999 to 2002, no surface water field duplicates were collected. However there were 'false positive' detects in the surface water sampling during June 2002 (6 locations, max Cr+6 = 0.0257 mg/L). The samples are qualified as such because initial sampling occurred June 11, 2002 subsequent resampling occurred in August 2002 with all ND results.

3. PERFORMANCE AND SYSTEM AUDITS

Overview

To monitor and evaluate the performance of field and laboratory personnel conducting sampling and testing activities, both performance and system audits were performed during this investigation during the initial phases of the monitoring program. The objectives of these audits were to monitor compliance with the QA/QC field and laboratory procedures and implement corrective actions, if necessary, and to ensure that procedures comply with the objectives of the project QA plan. Field audits of Alisto field procedures were performed by the Department of Toxic Substances Control (DTSC) and E & E. Field split samples were collected several times and analyzed by DTSC and by a secondary laboratory to monitor the quality of primary lab (APCL) data. Laboratory audits of APCL were also performed to ensure compliance with the QAPP for this project. TLI on-site audits were not performed; only validation of data packages. Intra-laboratory comparisons of APCL and the secondary laboratory were also performed to monitor the overall quality of APCL data by analyzing performance evaluation standards.

3.1 Laboratory Audit Results

The primary laboratory, APCL, was audited by Alisto on November 6, 1996. The audit results indicated that APCL was complying with their internal SOPs and QAPP. The SOW (Alisto 1997b) for APCL, which specified the analytical QC and reporting requirements, was implemented. A supplemental SOW (E & E 1998) for APCL was implemented to continue the contracting services for soil and water sample analysis for the RFI. CH2M HILL audited TLI's performance on a regular basis during routine data validation; this indicated that the Subcontract SOW (CH2M HILL, 2001) was followed.

3.2 Intra-Laboratory Comparisons and Split Sample Results

A secondary laboratory, American Environmental Network (AEN), was directed to perform an intra-laboratory comparison of 20 known standards and field split samples for the COCs in July 1997. The results were within acceptable levels for hexavalent chromium and for total chromium. The average RPD for hexavalent chromium and total chromium was less than 10 percent for all standards and field split samples.

The DTSC also performed an independent check of groundwater samples that were split with APCL; the results were within acceptable levels. Additionally, the DTSC performed a study of holding times for hexavalent chromium in water to determine if there was a significant change in concentration after the 24-hour holding time requirement specified by the U.S. Environmental Protection Agency (EPA). The results indicated that the concentration of hexavalent chromium from the study area did not change significantly, even up to 5 days after sample collection. Nevertheless, all analyses performed for this RFI were carried out within 24 hours, as specified by the analytical method.

Another intra-laboratory comparison of the COCs between APCL and a secondary laboratory (ChromaLabs) was performed in May 1999; the results were within acceptable levels. Each laboratory prepared known standards and exchanged them with the other laboratory for analysis.

Groundwater samples were also split between APCL, ChromaLabs, and the DTSC laboratory in June 1999. The results were within acceptable limits, except for three samples for hexavalent chromium. The anomaly was probably due to the high concentrations of hexavalent chromium and interferences from total dissolved solids (conductivities greater than 5,000 micro mhos per centimeter [S/cm]). Because of this discrepancy, groundwater split samples were collected again in July 1999. The results improved to acceptable limits for hexavalent chromium, except for one sample. This demonstrates that high total dissolved solids may interfere with the reproducibility of hexavalent chromium.

TABLE B-1
Soil Analysis
Topock RFI

Parameter	Analysis	Test Method	CRDL (MDL) (mg/kg)	PQL (mg/kg, dry wt.)
COCs	Total chromium	EPA 200.7/6010	0.054	0.5
	Hexavalent chromium	EPA 7196A	0.027	0.5
	Copper	EPA 200.7/6010	0.16	0.5
	Nickel	EPA 200.7/6010	0.38	2.0
	Zinc	EPA 200.7/6010	0.12	0.2
	pH	EPA 9040	0.01	0.01
Geotechnical	Bulk density	ASTM D2937/D2216	NA	NA
	Sieve analysis	ASTM D422-63 (1990)	NA	NA
	Porosity	ASTM D854 (a)	NA	NA
	Constant head perm.	ASTM D2434-68 (1994)	NA	NA
General Chemistry	Sulfide	EPA 376.2	0.5	4
	Total organic carbon	Walkley/Black	100	100
	Eh	ASTM D1498	1	1
	Extractable Fe (II)	(b)	100	100
	Sulfate	EPA 375.4	4	10
	Phosphorus	EPA 365.2	0.1	0.1
	Cation exchange cap.	EPA 9080/9081	0.02	0.1
	Batch adsorption test	ASTM 4319	na	na
Metals	Manganese	EPA 200.7/6010 and (c)	0.051	0.5
	Total iron	EPA 200.7/6010	0.27	1
	Barium	EPA 200.7/6010	0.13	1
	Lead	EPA 200.7/6010	0.047	0.2
	Vanadium	EPA 200.7/6010	0.092	0.5
	Molybdenum	EPA 200.7/6010	0.027	0.2
Other tests	Chloride	EPA 325.3/9252	1	5
	Carbonate/bicarbonate	SM 2320B	0.01	0.01
	Calcium	EPA 200.7/6010	1	5
	Magnesium	EPA 200.7/6010	1	5
	Potassium	EPA 200.7/6010	1	5
	Sodium	EPA 200.7/6010	1	5
	Nitrogen as nitrate	EPA 353.3	1.4	5
	Phosphorus as ortho-P	EPA 365.2	0.04	0.1
	Percent moisture	ASTM D2216-92	0.12	0.5

ABBREVIATIONS:

a ASTM D854 (Specific Gravity Test) was used to calculate porosity
b Oxalate extraction (Phillips and Lovely 1987) method to be run if total iron is detected
c Hydroxylamine hydrochloride extraction (Palmer & Puls 1994)
COC Constituents of concern
CRDL Contractor Required Detection Limit (i.e., method detection limit)
MDLs Method Detection Limit
mg/kg Milligram per kilogram
NA Not applicable
PQL Practical quantitation limit

TABLE B-2a
Groundwater Analyses
Topock RFI

Parameter	Analysis	Test Method	CRDL (MDL) mg/L	PQL (mg/L)
COCs	Total chromium	EPA 200.7/6010	0.01	0.02
	Hexavalent chromium	EPA 7196A	0.01	0.01
	Copper	EPA 200.7/6010	0.003	0.01
	Nickel	EPA 200.7/6010	0.008	0.025
	Zinc	EPA 200.7/6010	0.003	0.005
	pH	EPA 9040	0.01	0.01
	Electrical conductivity	EPA 120.1/9050	1	1
General Chemistry	Ammonia	EPA 350.2	0.07	0.2
	Carbonate/bicarbonate	SM 2320B	0.6	2
	Chloride	EPA 325.3/9252	0.8	1
	Eh	ASTM D1498	1	1
	Fluoride	EPA 340.2	0.046	0.1
	Nitrogen as nitrate	EPA 353.3	0.48	1
	Nitrogen as nitrite	EPA 353.3	0.004	0.02
	Phosphorus	EPA 365.2	0.018	0.1
	Sulfide	EPA 376.2	0.11	0.2
	Sulfate	EPA 375.4	0.7	2
Metals	Barium	EPA 200.7/6010	0.003	0.01
	Calcium	EPA 200.7/6010	0.11	0.2
	Total iron	EPA 200.7/6010	0.007	0.05
	Ferrous iron	ASTM 3500FeD	0.01	0.01
	Total lead	EPA 200.7/6010	0.001	0.005
	Magnesium	EPA 200.7/6010	0.051	0.1
	Manganese	EPA 200.7/6010	0.005	0.005
	Molybdenum	EPA 200.7/6010	0.005	0.005
	Potassium	EPA 200.7/6010	0.19	0.4
	Sodium	EPA 200.7/6010	0.82	2
	Vanadium	EPA 200.7/6010	0.005	0.01
Other tests	Dissolved oxygen	EPA 360.1	0.05	0.2
	Total dissolved solids	EPA 160.1	3	10
	Total organic carbon	EPA 415.1	0.4	1

ABBREVIATIONS:
COC Constituents of concern
CRDL Contractor Required Detection Limit (i.e., MDL)
MDL Method detection limit
mg/L Milligram per liter
PQL Practical quantitation limit (i.e. RL)

TABLE B-2b
Routine Groundwater Analyses Post March 2002
Topock RFI

Parameter	Analysis	Test Method	PQL (mg/L)
COCs	Total chromium Hexavalent chromium Copper Nickel Zinc pH Electrical conductivity	EPA 6020/6010B EPA 7196A/7199 EPA 6010/6020 EPA 6010/6020 EPA 6010/6020 EPA 150.0 EPA 120.1	0.02/0.001 0.01/0.0002 0.01 0.025 (0.005*) 0.005 (0.010*) 0.1 units 1 umhos/cm
General Chemistry	Ammonia Carbonate/bicarbonate Chloride Fluoride Nitrogen as nitrate Phosphorus Sulfate	EPA 350.2 SM 2320B EPA 300 EPA 300 EPA 300 EPA 365.2 EPA 300	0.2 2 1 0.1 1 0.1 2
Metals	Barium Calcium Total iron Ferrous iron Total lead Magnesium Manganese Molybdenum Potassium Sodium Vanadium	EPA 200.7/6010 EPA 200.7/6010 EPA 200.7/6010 ASTM 3500FeD EPA 200.7/6010 EPA 200.7/6010 EPA 200.7/6010 EPA 200.7/6010 EPA 200.7/6010 EPA 200.7/6010 EPA 200.7/6010	0.01 0.2 0.05 0.01 0.005 0.1 0.005 0.005 0.4 2 0.01
Other tests	Total dissolved solids Total organic carbon Alkalinity	EPA 160.1 EPA 415.1 EPA 310.1	10 1

ABBREVIATIONS:
COC Constituents of concern
mg/L Milligram per liter
umhos/cm Micro ohms per centimeter
PQL Practical quantitation limit (i.e. RL)
Note: Routine Groundwater Analyses Post March 2002 performed by Truesdail Laboratories, Inc.
Metals results are dissolved concentrations

TABLE B-3a
Summary of Data Quality Indicator Objectives
Topock RFI

ANALYTE	% R	RPD	FIELD/ TRIP BLANKS	FIELD/TRIP BLANKS FREQUENCY	MS/MSD FREQUENCY	METHOD BLANK AND FIELD DUPLICATE FREQUENCY
SOIL						
Total chromium	75-125	25	NA	NA	NA	1 per 10
Hexavalent chromium	85-115	15	NA	NA	NA	1 per 10
Copper	75-125	25	NA	NA	NA	1 per 10
Nickel	75-125	25	NA	NA	NA	1 per 10
Zinc	75-125	25	NA	NA	NA	1 per 10
PH	NA	NA	NA	NA	NA	1 per 10
WATER						
Total chromium	75-125	25	<PQL	1 each per day	1 per 20	1 per 10
Hexavalent chromium	85-115	15	<PQL	1 each per day	1 per 10	1 per 10
Copper	75-125	25	<PQL	1 each per day	1 per 20	1 per 10
Nickel	75-125	25	<PQL	1 each per day	1 per 20	1 per 10
Zinc	75-125	25	<PQL	1 each per day	1 per 20	1 per 10
PH	NA	NA	<PQL	1 each per day	1 per 20	1 per 10
Electrical conductivity	NA	NA	<PQL	1 each per day	1 per 20	1 per 10

ABBREVIATIONS:

PQL Practical quantitation limit
MS/MSD Matrix spike/matrix spike duplicate in the laboratory
% R Percent recovery for LCS and MS/MSD
RPD Relative percent difference for MS/MSD, LCS/LCSD, laboratory replicate of samples, and all field duplicate samples
NA Not applicable
LCS Laboratory control standard

TABLE B-3b
Summary of Data Quality Indicator Objectives – Routine Groundwater Monitoring Program post-March 2002
Topock RFI

ANALYTE	MS % R	LCS %R	MRCCS AND CCV %R	LAB DUPLICATE RPD	FD RPD	METHOD BLANK	METHOD BLANK, LAB DUPLICATE	MS AND LCS FREQUENCY	FIELD DUPLICATE FREQUENCY
WATER									
Total Chromium	75-125%	90-110%	90-110%	20%	40%	<PQL	1 per 20	1 per 20	1 per 10
Hexavalent chromium	75-125%	90-110%	90-110%	20%	40%	<PQL	1 per 20	1 per 20	1 per 10
Copper	75-125%	90-110%	90-110%	20%	40%	<PQL	1 per 20	1 per 20	1 per 10
Nickel	75-125%	90-110%	90-110%	20%	40%	<PQL	1 per 20	1 per 20	1 per 10
Zinc	75-125%	90-110%	90-110%	20%	40%	<PQL	1 per 20	1 per 20	1 per 10
PH	NA	NA	NA	20%	40%	<PQL	1 per 20	NA	1 per 10
Electrical Conductivity	NA	NA	NA	20%	40%	<PQL	1 per 20	NA	1 per 10

ABBREVIATIONS:
MS Matrix spike
LCS Laboratory control standard
MRCCS Midrange calibration check standard
CCV Continuing calibration verification standard
FD Field Duplicate
RPD Relative percent difference
MS Matrix spike
% R Percent recovery
NA Not applicable
PQL Practical quantitation limit

Note:
Field blanks are not collected because dedicated sampling equipment is used .
Trip blanks are not collected because VOCs are not site COCs.

H2 Data Quality Review for June 2002

Review of June, 2002 Analytical Data for Samples Collected from Groundwater Monitoring of Topock PG&E Site

TO:	Paul Bertucci/SFO
FROM:	Misty Price/RDD
DATE:	August 5, 2002

Introduction

This report summarizes the results of the review of analytical data generated from Groundwater Monitoring of the PG&E Topock compressor station near Needles, California between June 11 and June 13, 2002. The purpose of this review was to determine if any quality control deviations affected the certainty of analytical results. Individual method requirements and internal laboratory control limits were used in this assessment. Summaries of calibration information and the results for method blanks, field duplicates, laboratory duplicates, and laboratory control samples were reviewed for all analytes. Data qualifications resulting from the review are summarized at the end of this report.

All analyses were performed at Truesdail Laboratories, Inc. (TLI) in Tustin, CA. There were 32 normal and three field duplicate environmental water samples submitted as three Sample Delivery Groups (SDGs) and analyzed by four methods.

Parameter	Method
Dissolved Chromium, Copper, Nickel and Zinc	SW6020A
Hexavalent Chromium	SW7196A
pH	SW9040
Electrical Conductivity	SW9050

Data Analysis

The quality control data reviewed included calibration information, method blanks, laboratory and field precision indicators, and laboratory accuracy information. Blank contamination impacts were assessed by comparison of the relative concentration levels in method blanks and samples. Laboratory precision was assessed using the relative percent differences (RPD) between the results of duplicate sample analyses. Field precision related to either sampling protocols or matrix homogeneity was assessed using the field duplicate RPDs. Overall analytical accuracy was evaluated using LCS percent recoveries. Sample accuracy was evaluated using the LCS recoveries.

Sample Preparation

Samples submitted for SW6020A analysis were filtered upon arrival at the laboratory through a 0.45 micron filter prior to preservation and analysis.

Holding Times

All samples were analyzed within method-required holding time.

Method Blanks

Method blanks were analyzed at the required frequencies. No target analytes were detected at or above the reporting limits, indicating that laboratory contamination was not an issue when the samples were analyzed.

Quantitation

The percent difference for Zinc exceeded the upper control limit slightly in one of the continuing calibration verification standards. Three results associated with that standard have been flagged "J".

Results for Dissolved Chromium were significantly lower than those for Hexavalent Chromium reported using method SW7196A in the samples collected on June 11, 2002. All of the analytical quality indicators for both methods were in control and the samples were analyzed within holding time. Since the difference between the hexavalent and total chromium results was greater than the margin of error expected for comparing two analytical techniques, the laboratory analyzed the samples for the documented SW 7196A interferences. The interferences were not detected in the samples at concentrations that are documented to interfere with the accuracy of method SW 7196A. However, the likelihood that the hexavalent chromium results are still biased high remains due to the fact that the methodology utilized to determine the total chromium concentrations is documented to be less prone to both positive and negative interferences than method SW7196A.

Sensitivity

The project reporting limit for pH by method SW9040 is listed in the SOW as 0.01 units. The laboratory reporting limit is 0.1. Since the pHs of the samples are in the 7.0-9.0 range, this discrepancy has no negative impact on the quality of the data.

The project reporting limit for Electrical Conductivity by SW9050 is listed in the SOW as 1 umhos/cm. The laboratory reporting limit is 2 umhos/cm. Because all of the sample results are greater than 1000 umhos/cm, this discrepancy has no negative impact on the quality of the data.

The laboratory reporting limits for all other analytes meet the project requirements. All results less than the project reporting limit have been presented as not detected at the reporting limit.

Matrix Spike Samples

Matrix spikes were performed by the laboratory at the required frequencies, and the acceptance criteria were met for all methods.

Field Duplicates

Three sets of field duplicates were collected and analyzed. With the exception of Zinc in two of these field duplicate pairs, all relative percent differences (RPDs) were either acceptable or the concentrations of detected analytes were not high enough to evaluate precision. The results in the aforementioned field duplicate pairs have been qualified "J" to reflect the imprecision between them.

Laboratory Duplicates

Analyses of duplicate aliquots of field samples were performed by the laboratory at the required frequencies. The acceptance criteria were met for all methods.

Laboratory Control Samples

LCSs were analyzed at the required frequency. All results met acceptance criteria.

Chain-of-Custody

No discrepancies were noted.

Completeness

No data have been rejected, therefore the completeness goal for the project has been met.

Summary and Conclusions

The following conclusions can be drawn from the data quality evaluation process:

- There was no indication of contamination problems in the laboratory.
- Laboratory accuracy was acceptable for all analytes.
- Laboratory precision was acceptable.
- Precision between the field duplicate results was acceptable with the exception of Zinc in two of the three field duplicate pairs.

- There is an indication of false positive results caused by unidentified interference in the Hexavalent Chromium results reported for the samples collected on June 11, 2002 and analyzed by SW7196A. In the professional opinion of the data validator, no action should be taken or project decisions made based on the results from these sites, and they should be reevaluated following the next sampling event. In future events, the laboratory should be instructed to analyze the samples collected from these sites within holding time using method SW7199 if Hexavalent Chromium is found above the reporting limit using method SW7196A.

H3 Groundwater Analytical Data

(Provided only on CD ROM)

H4 Surface Water Analytical Data

(Provided only on CD ROM)

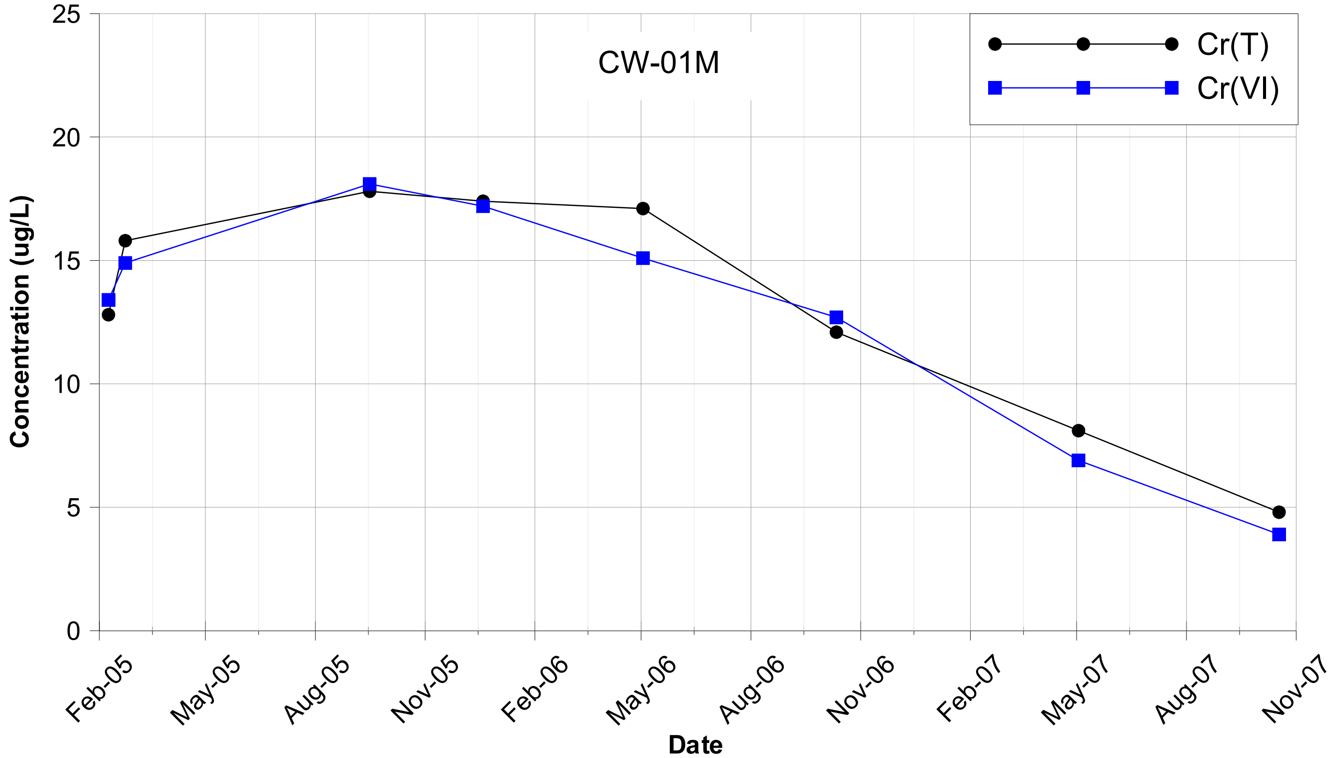
H5 Pore Water Analytical Data

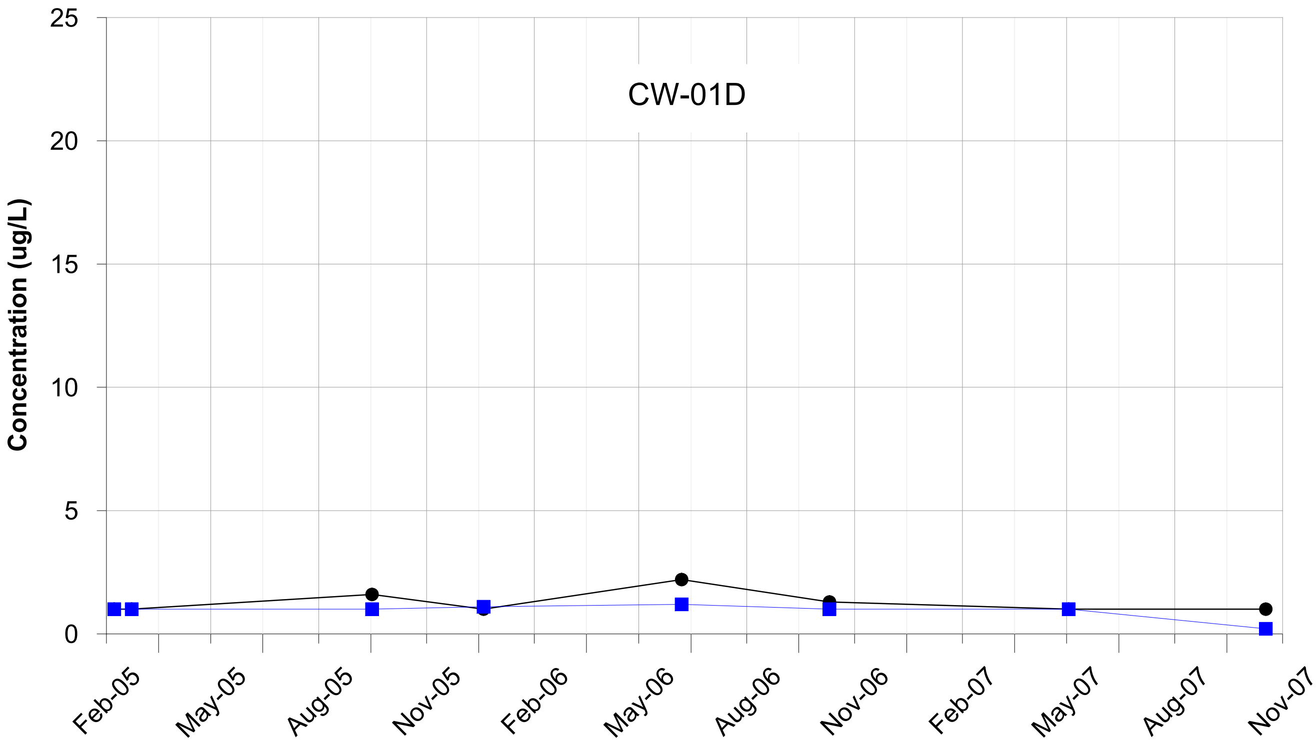
(Provided only on CD ROM)

H6 River Sediment Analytical Data

(Provided only on CD ROM)

Appendix I
Chromium Trend Plots for Selected Wells





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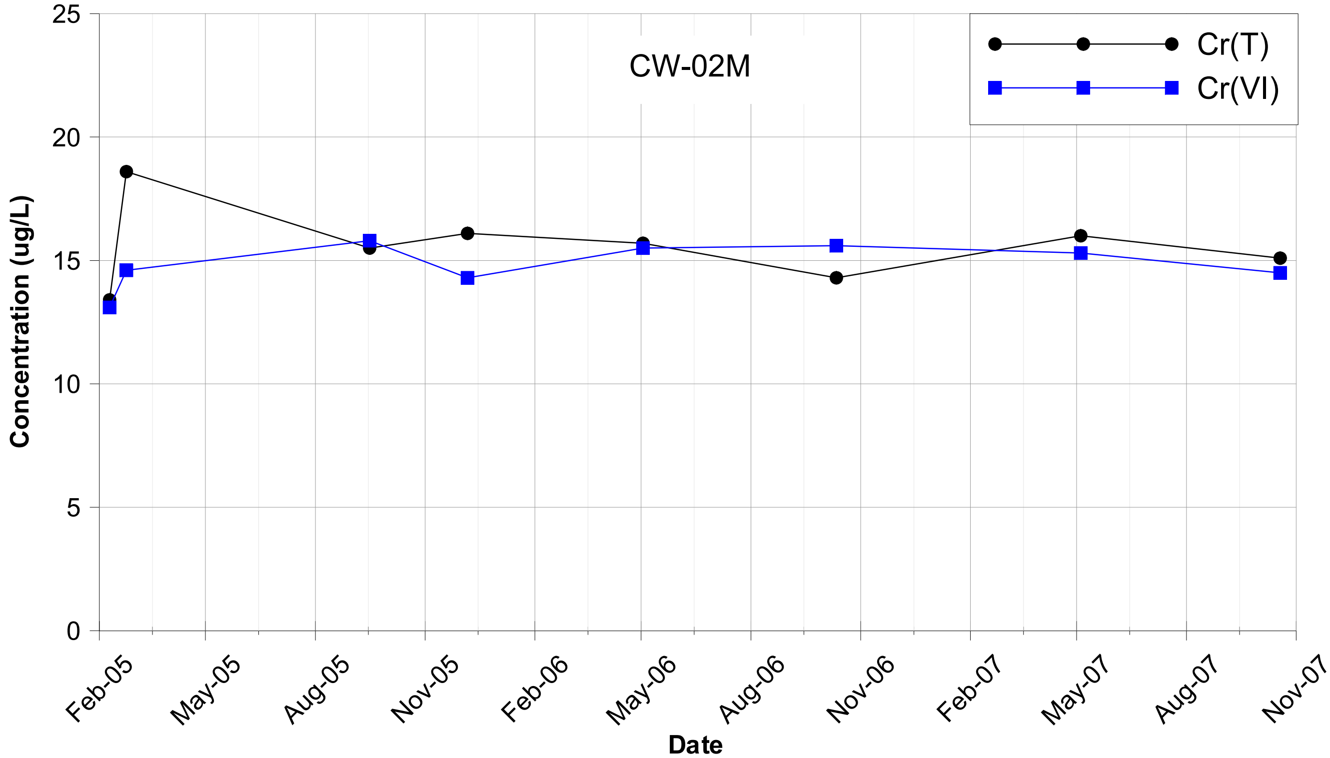
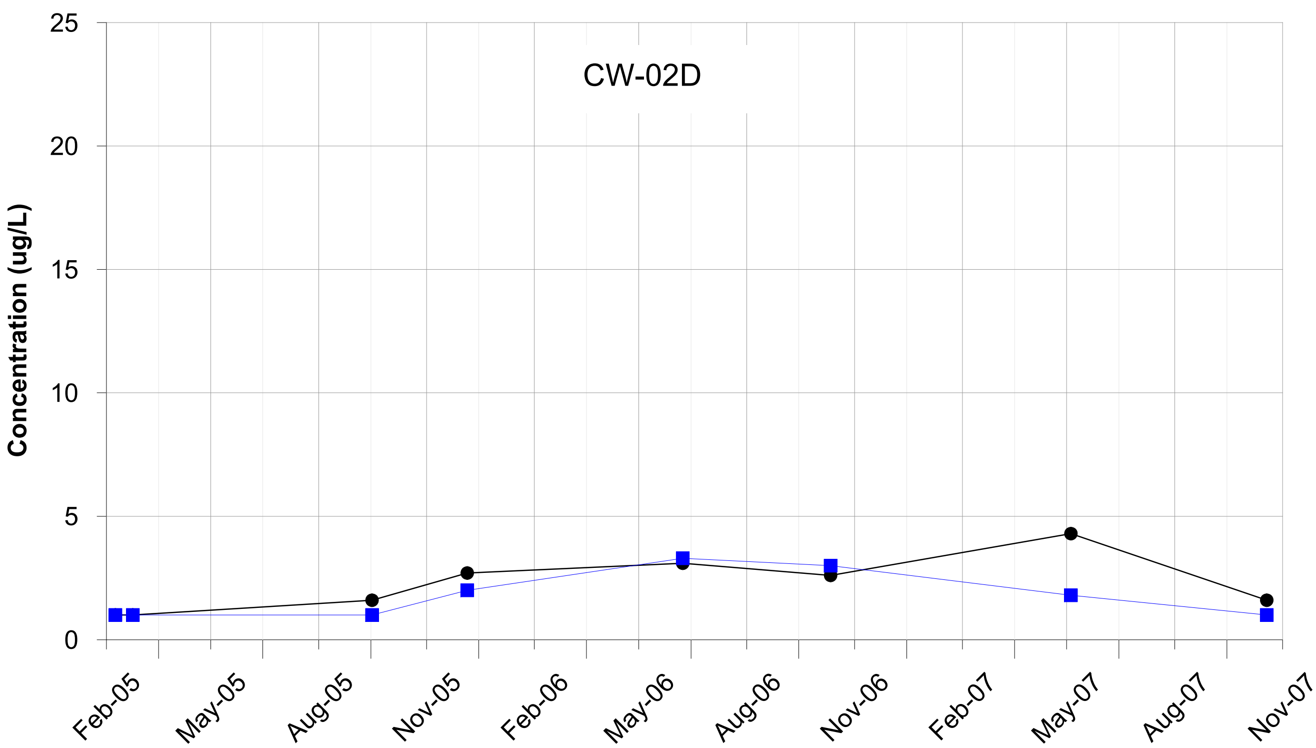
CHROMIUM CONCENTRATION TRENDS,
CW-01 WELL CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL





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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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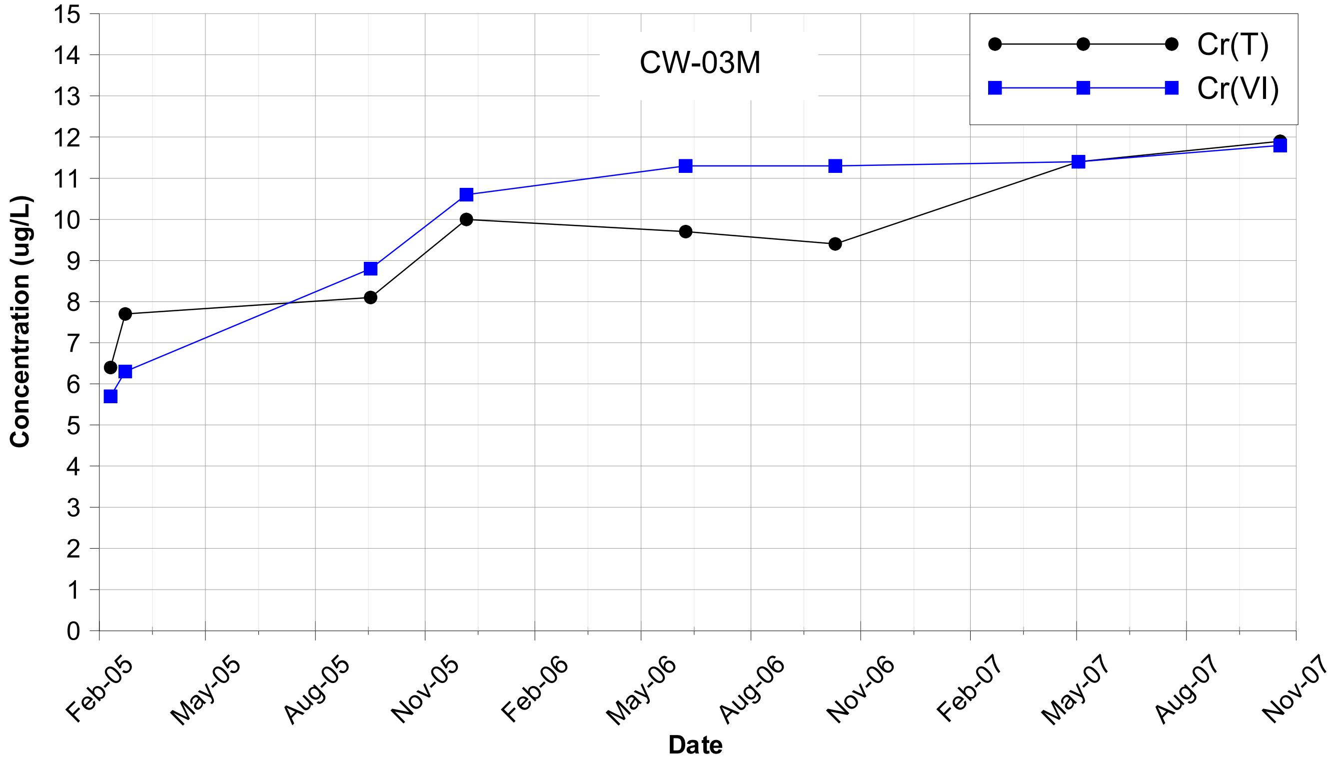

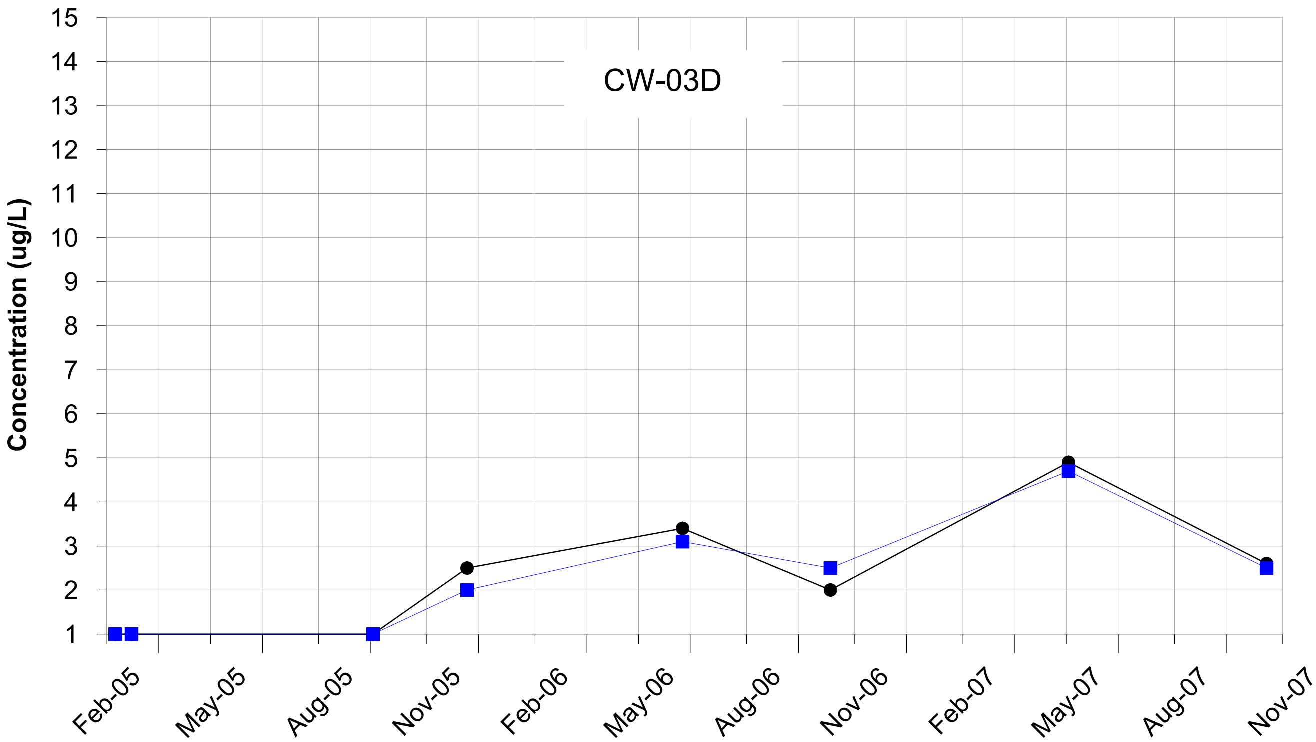

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CHROMIUM CONCENTRATION TRENDS,
CW-03 WELL CLUSTER

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NEEDLES, CALIFORNIA

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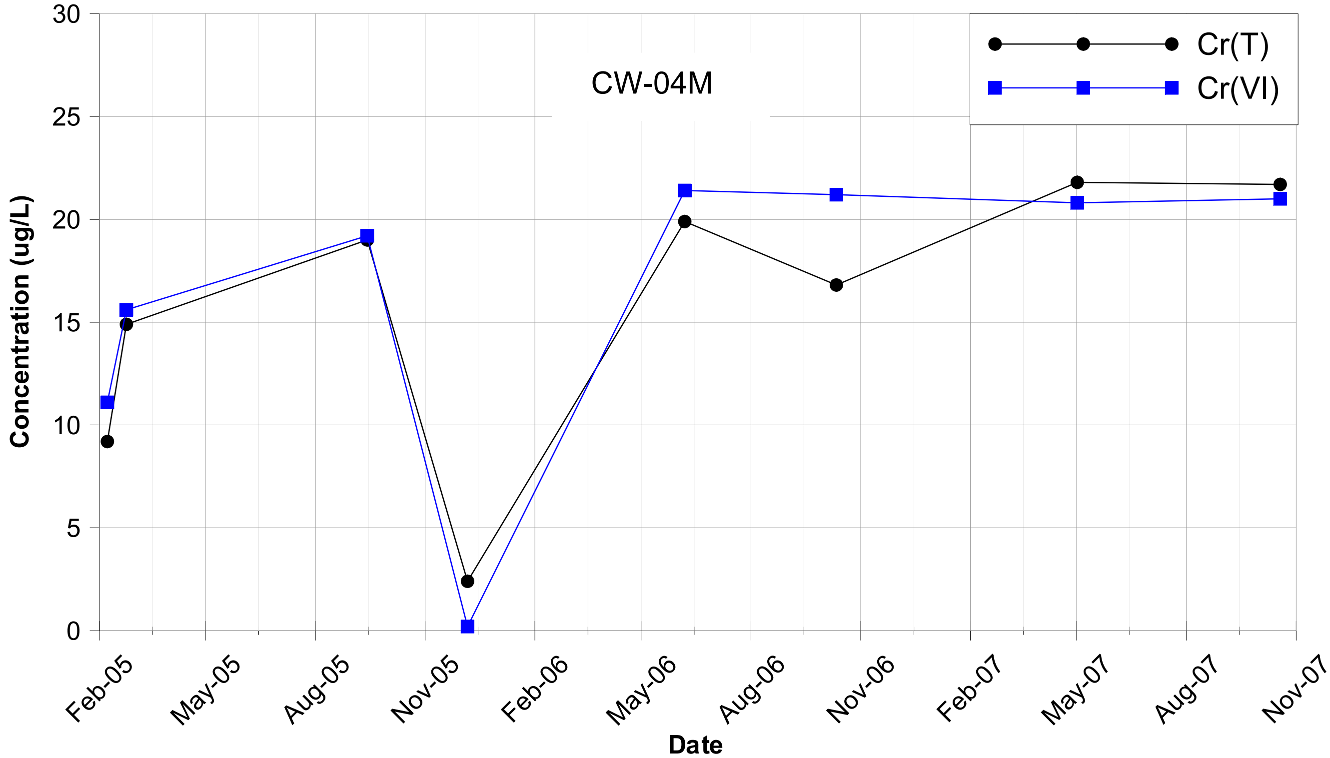

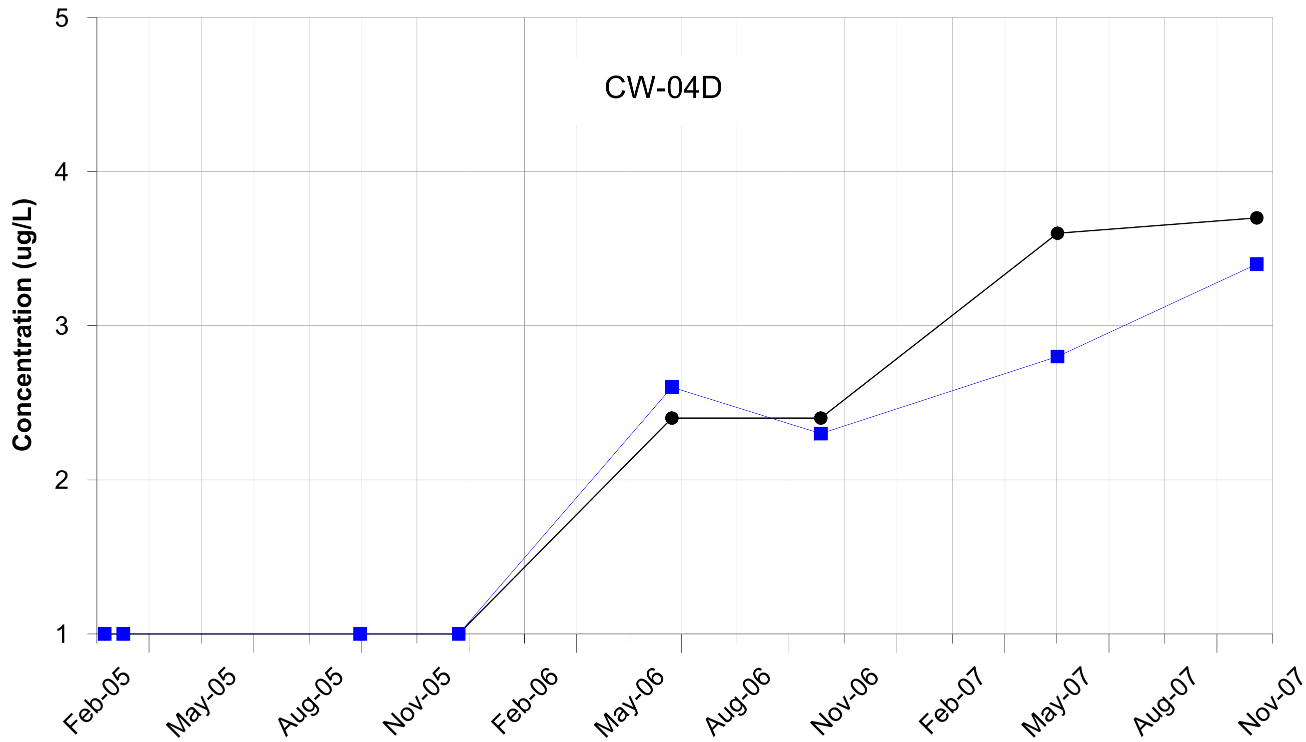

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CHROMIUM CONCENTRATION TRENDS,
CW-04 WELL CLUSTER

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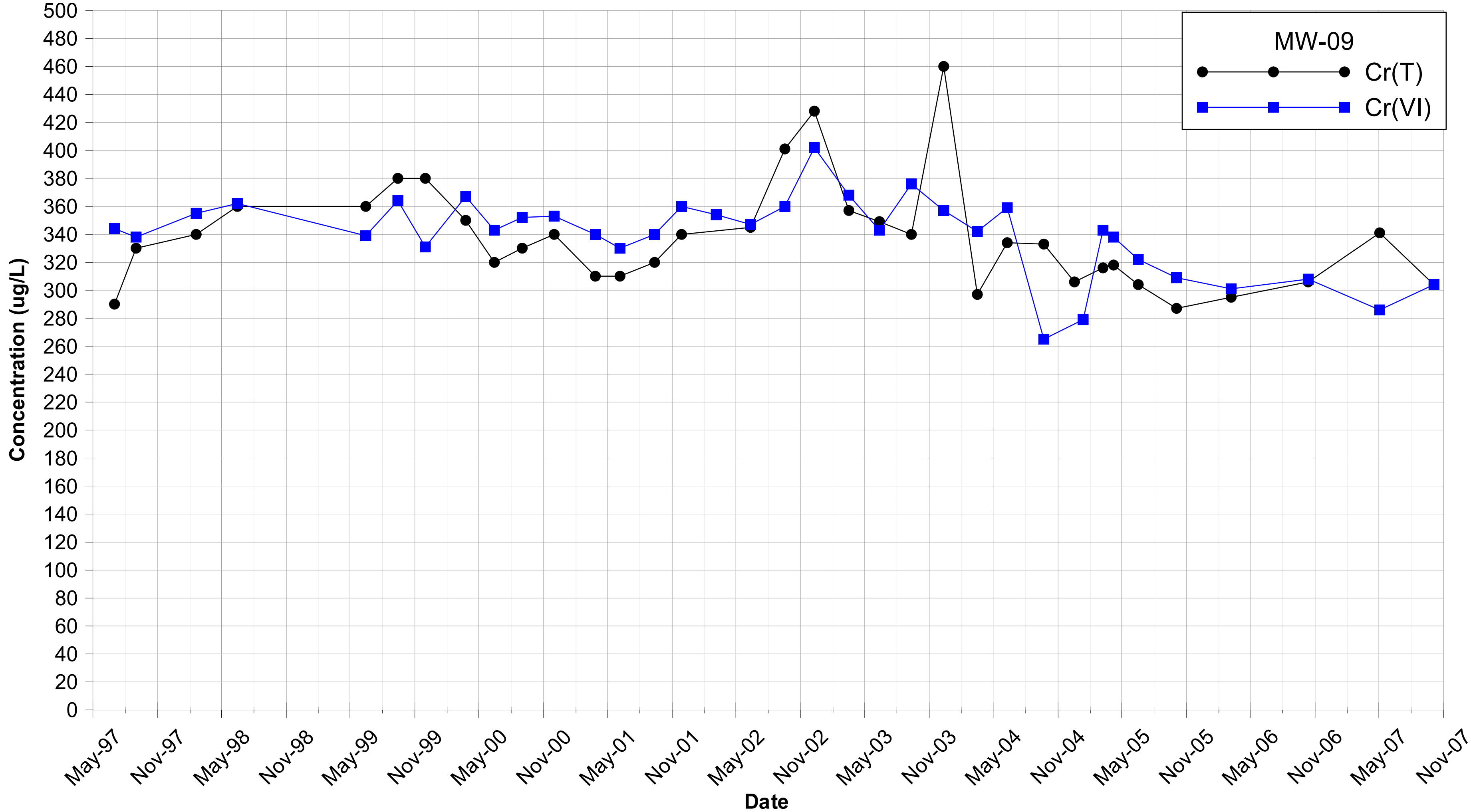

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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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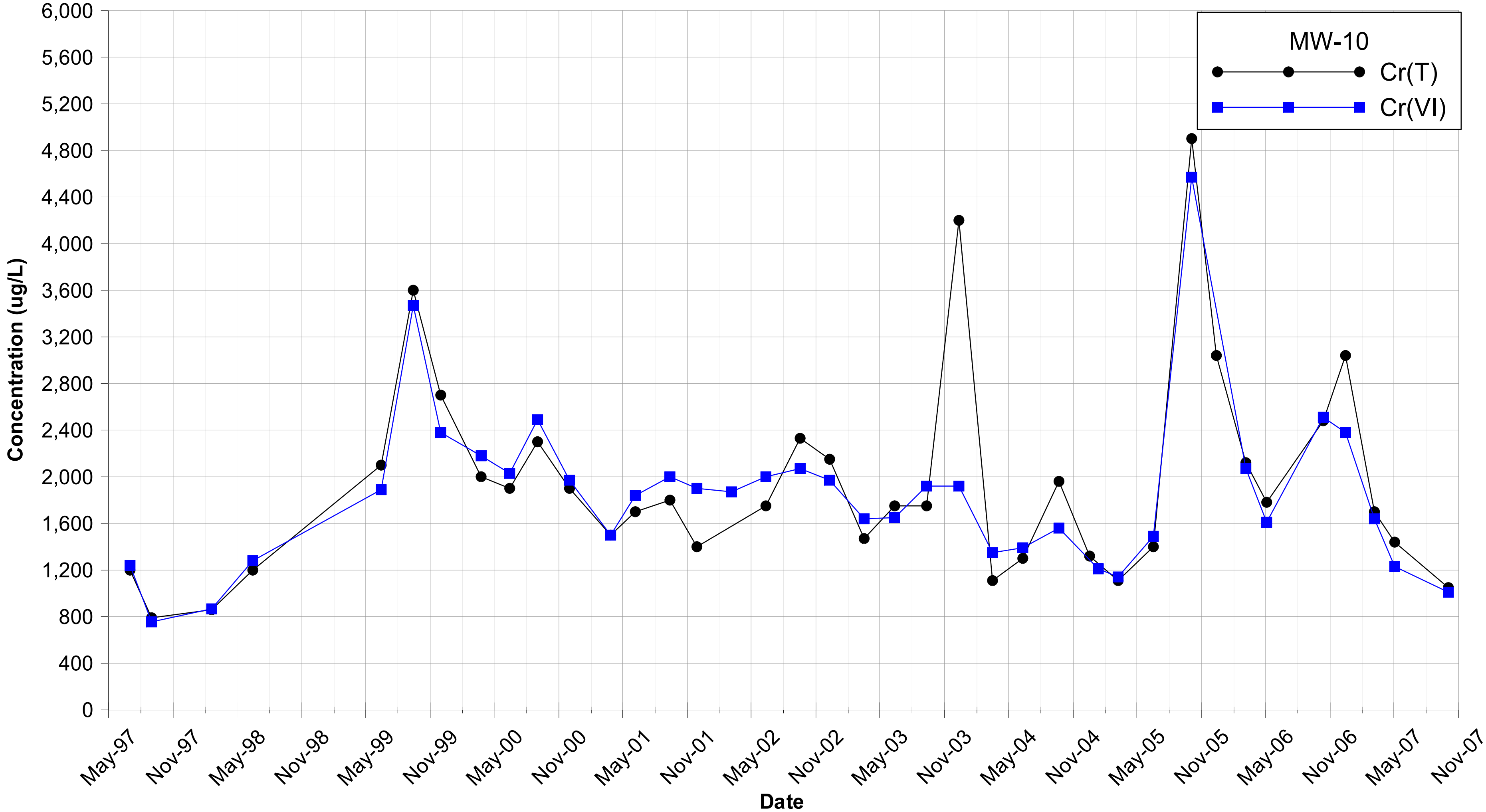

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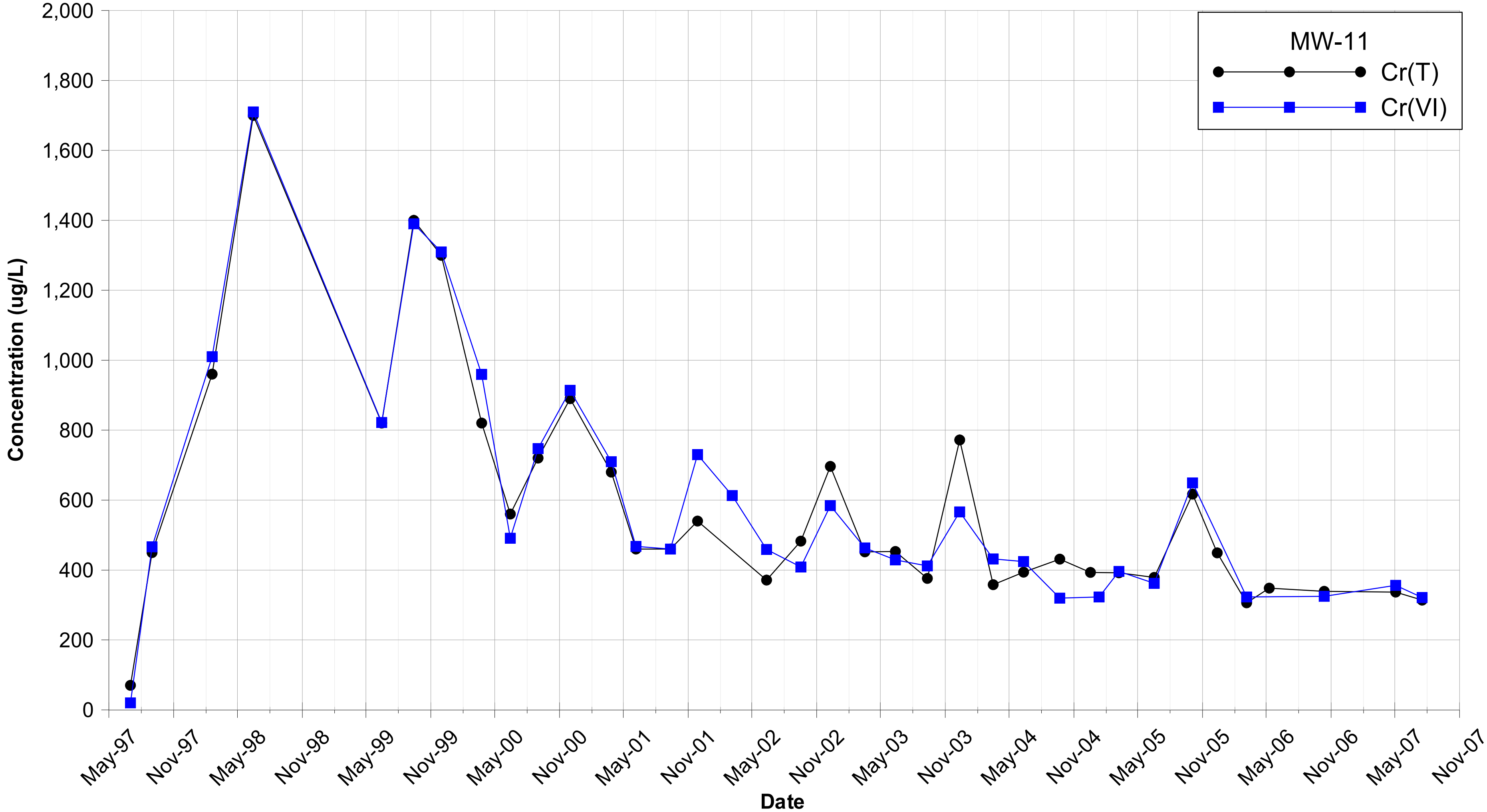

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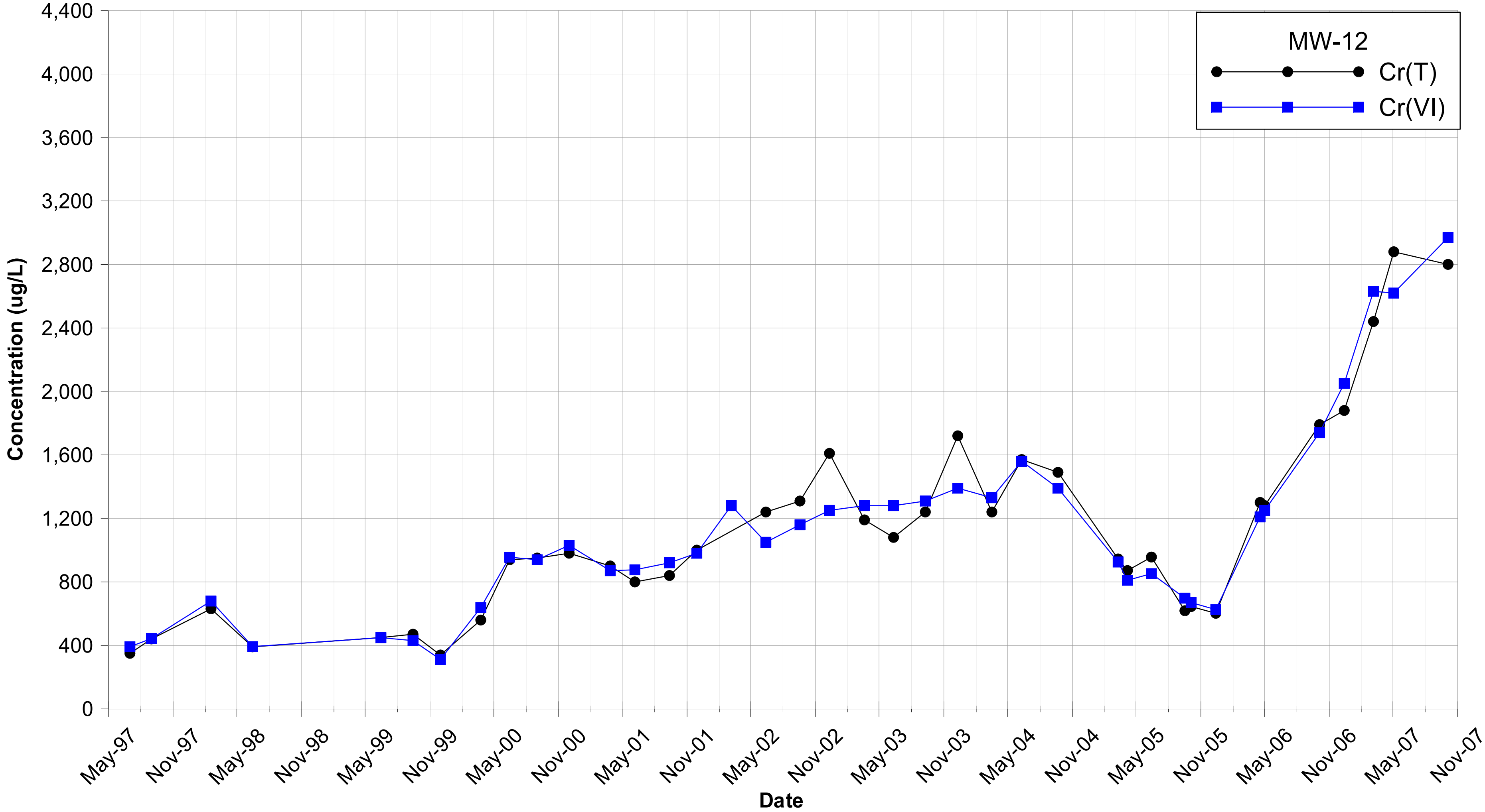

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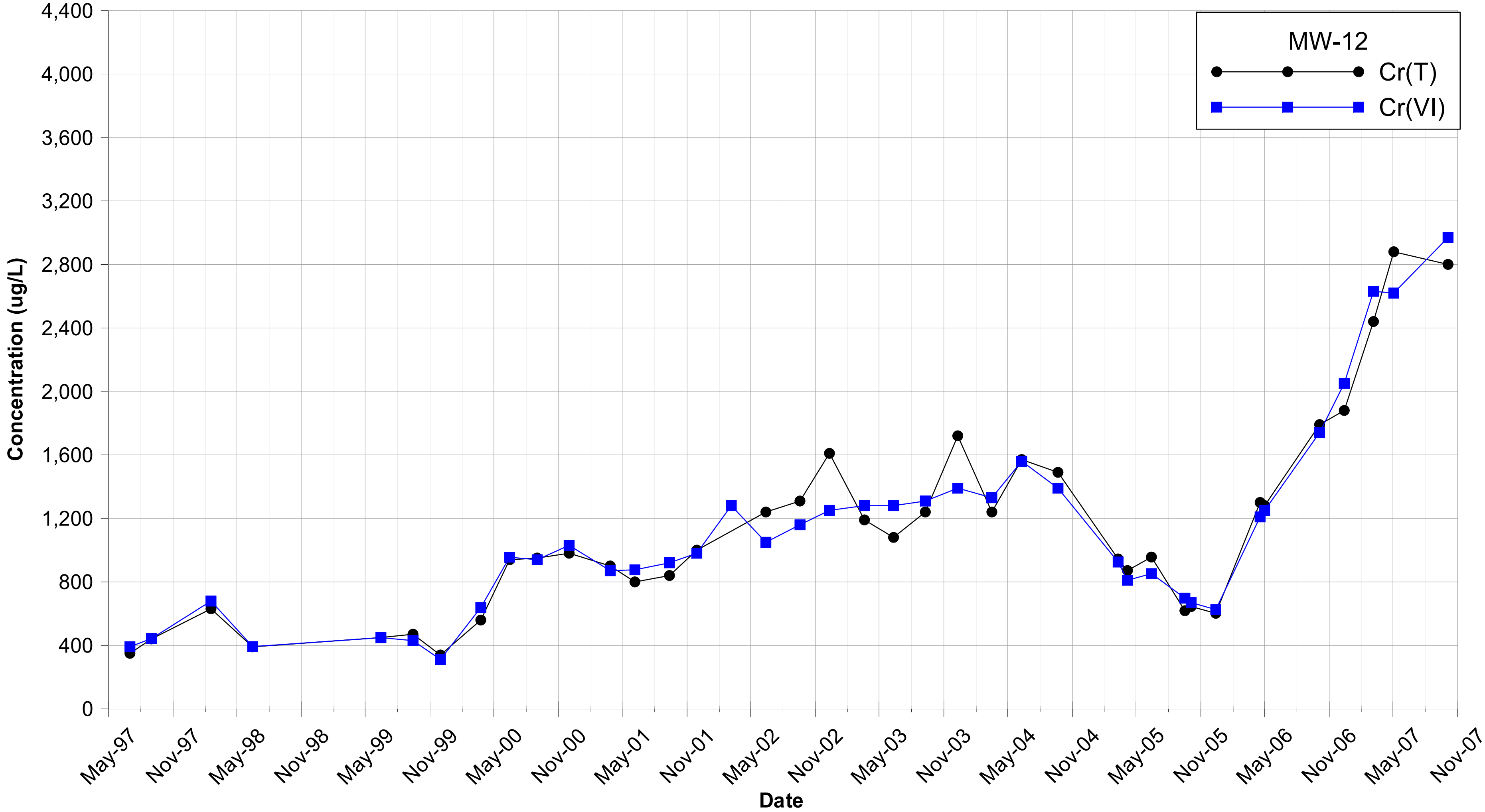

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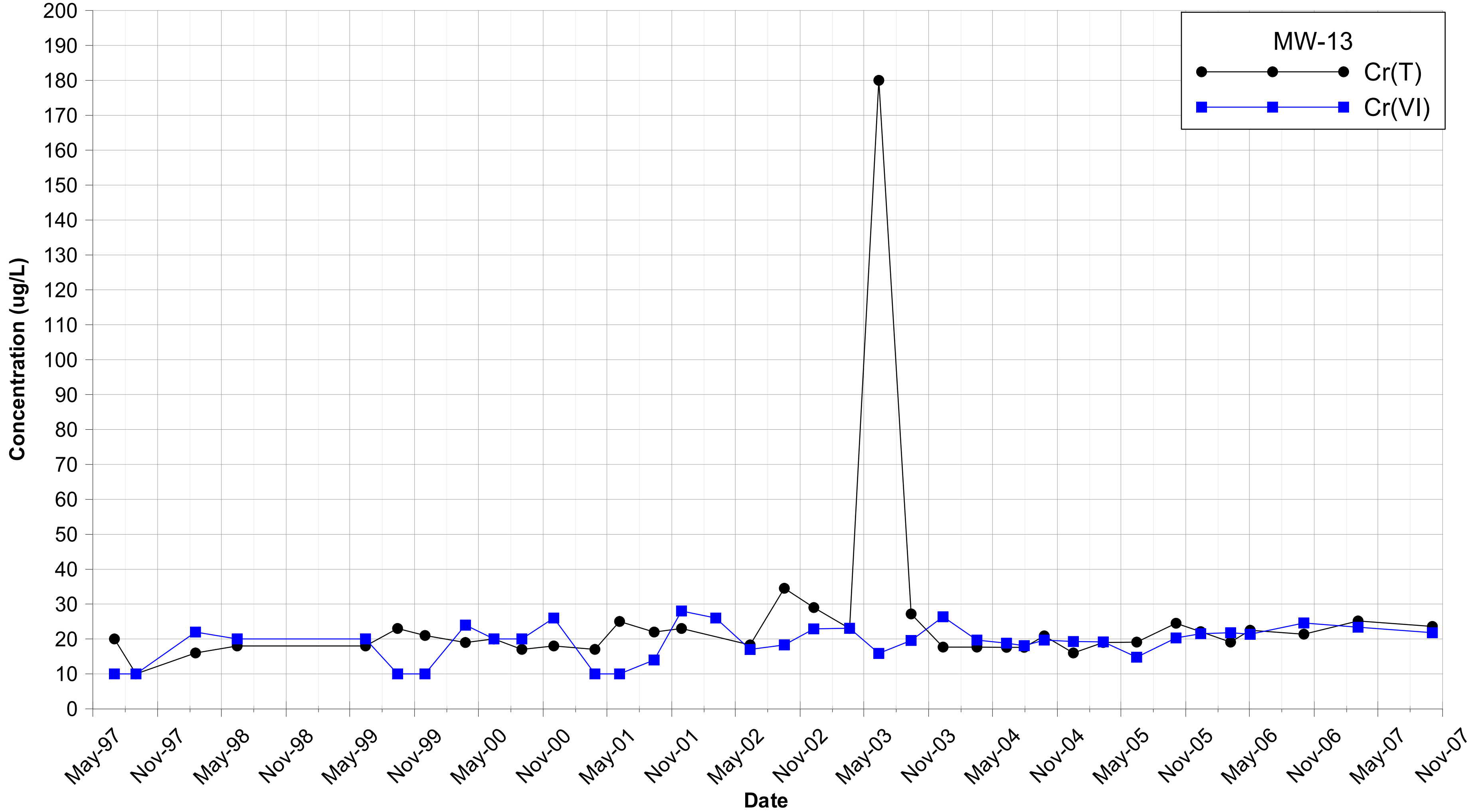

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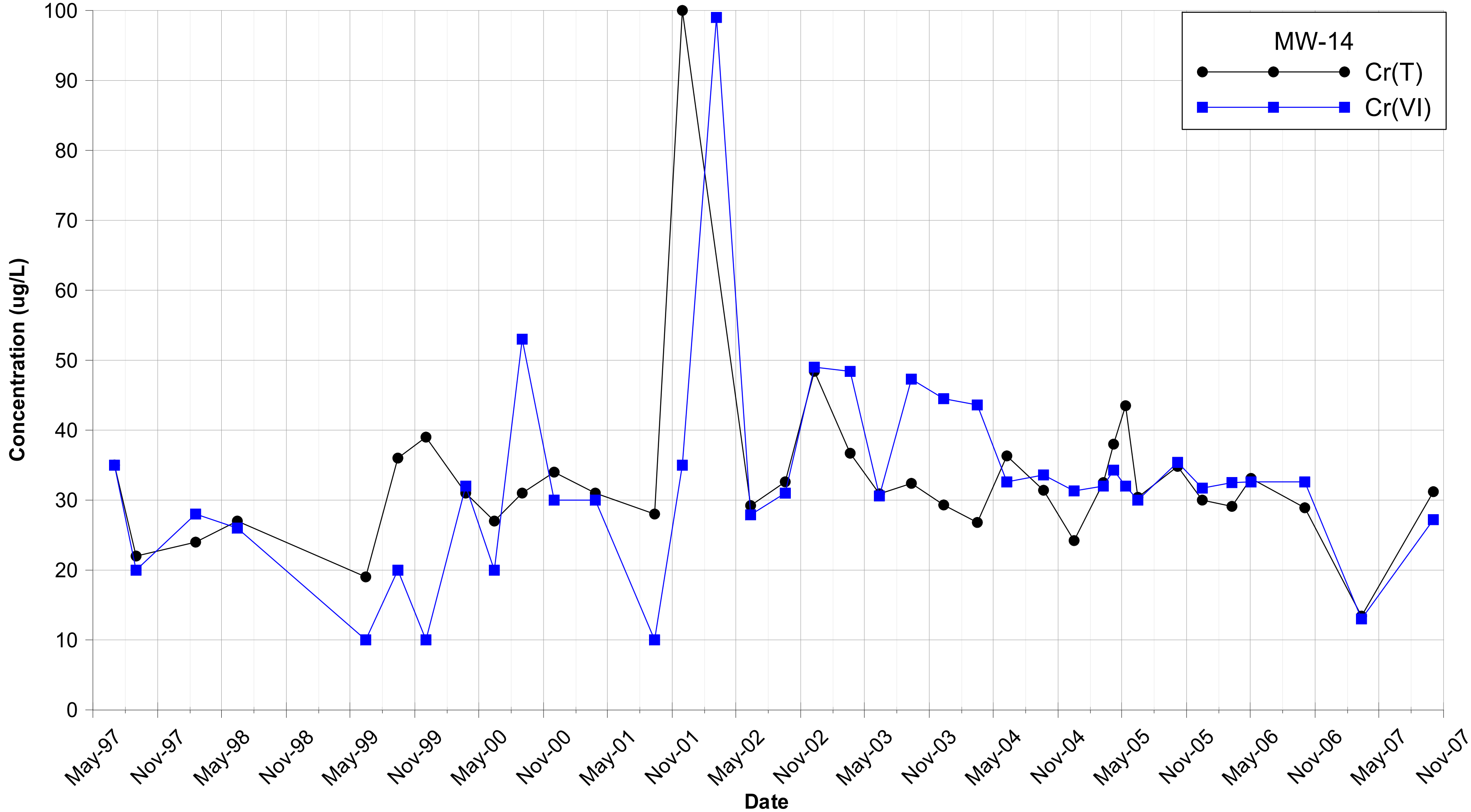

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CHROMIUM CONCENTRATION TRENDS, MW-14, MAY 1997 TO OCTOBER 2007

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
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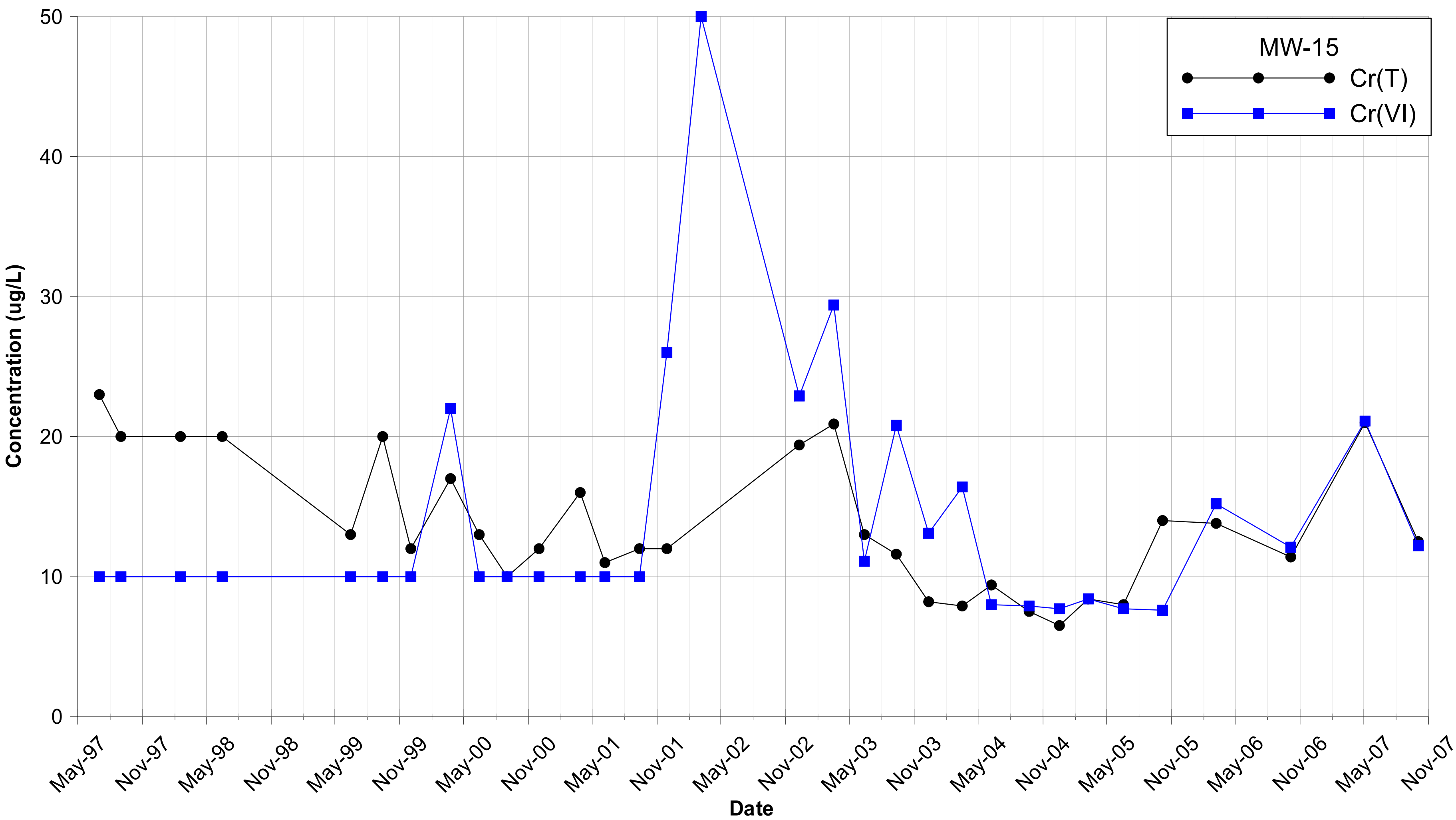

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PG&E TOPOCK COMPRESSOR STATION
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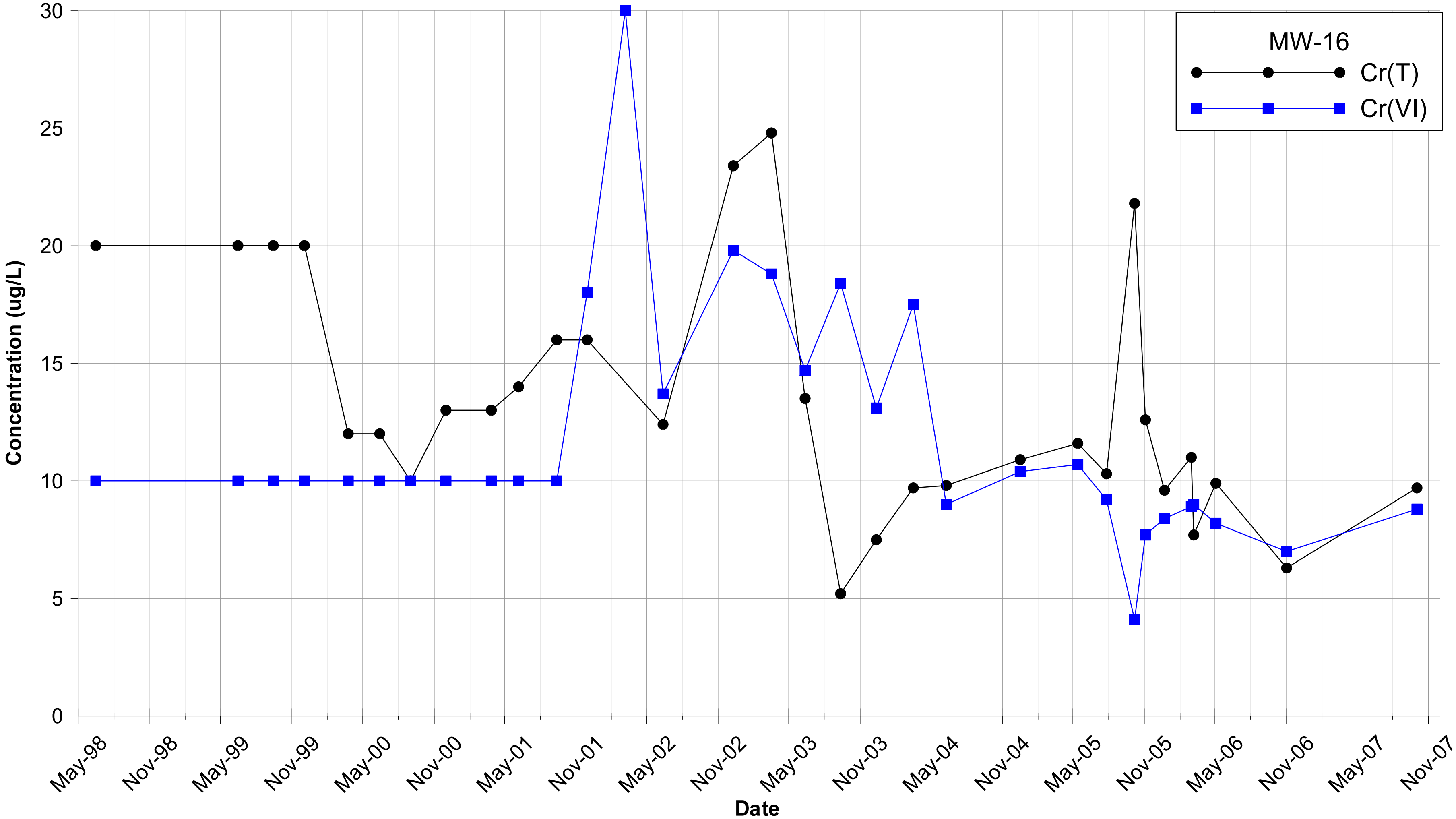

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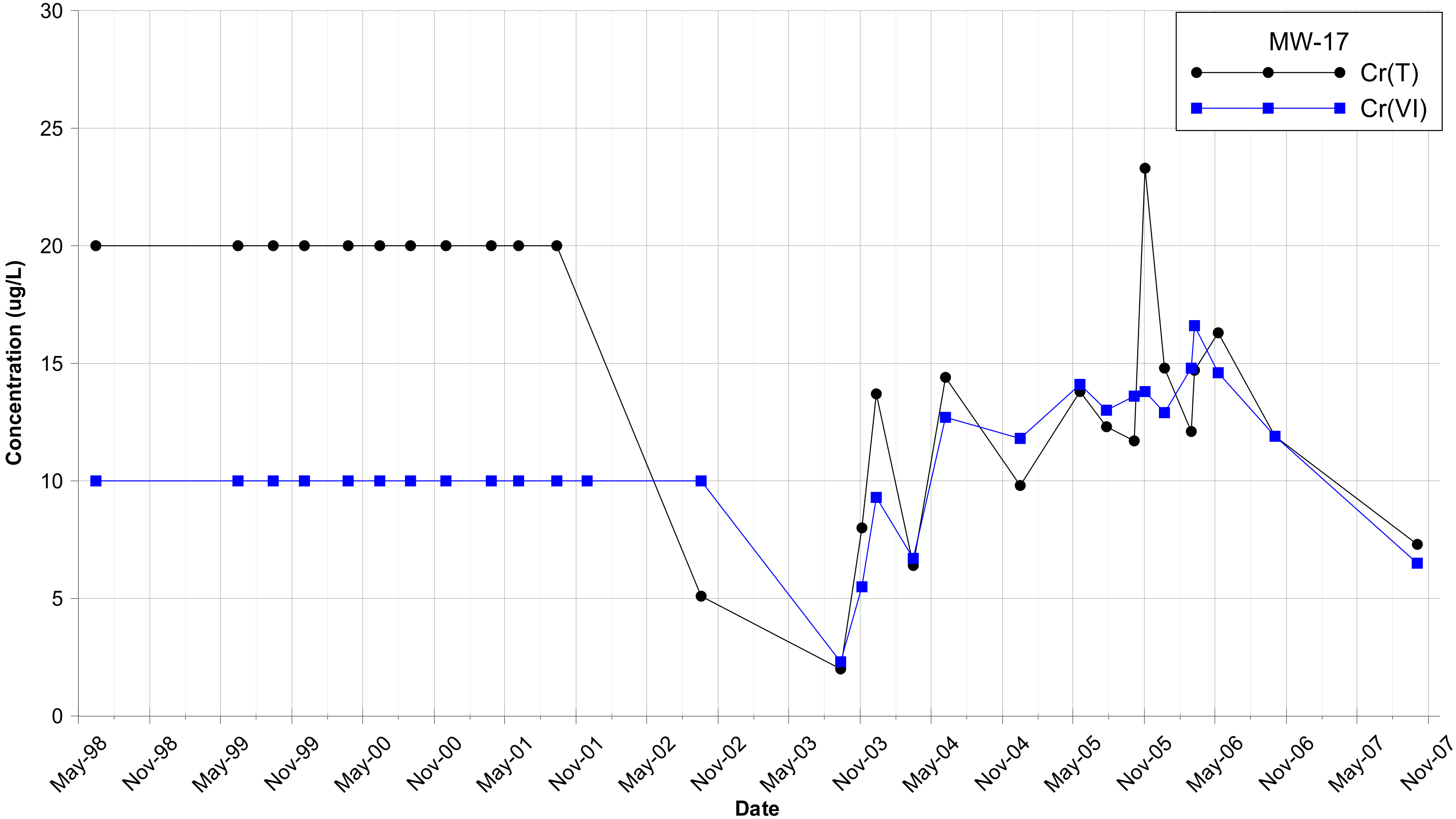

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CHROMIUM CONCENTRATION TRENDS, MW-17, MAY 1998 TO OCTOBER 2007

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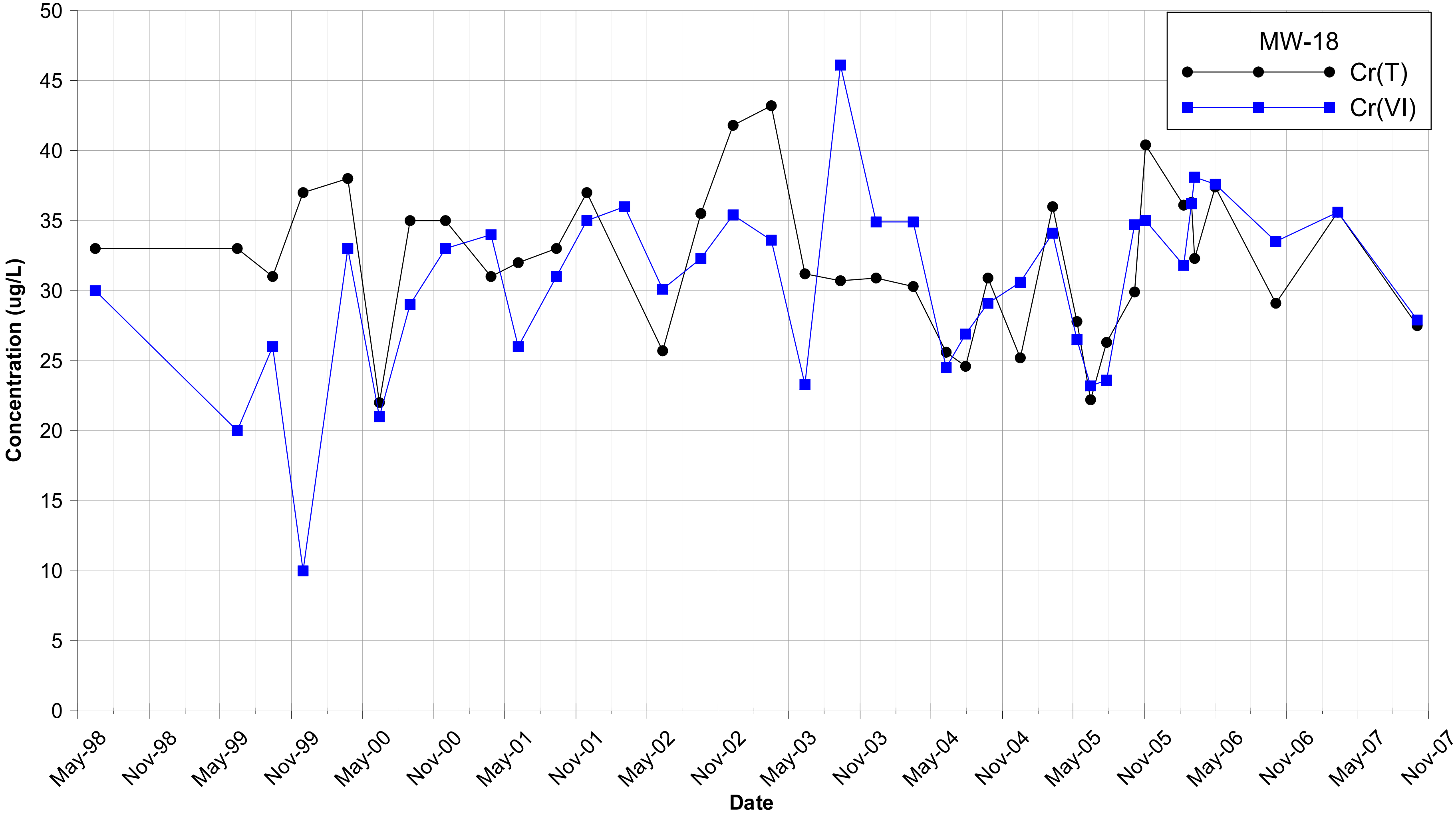

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CHROMIUM CONCENTRATION TRENDS,
MW-18, JUNE 1998 TO OCTOBER 2007

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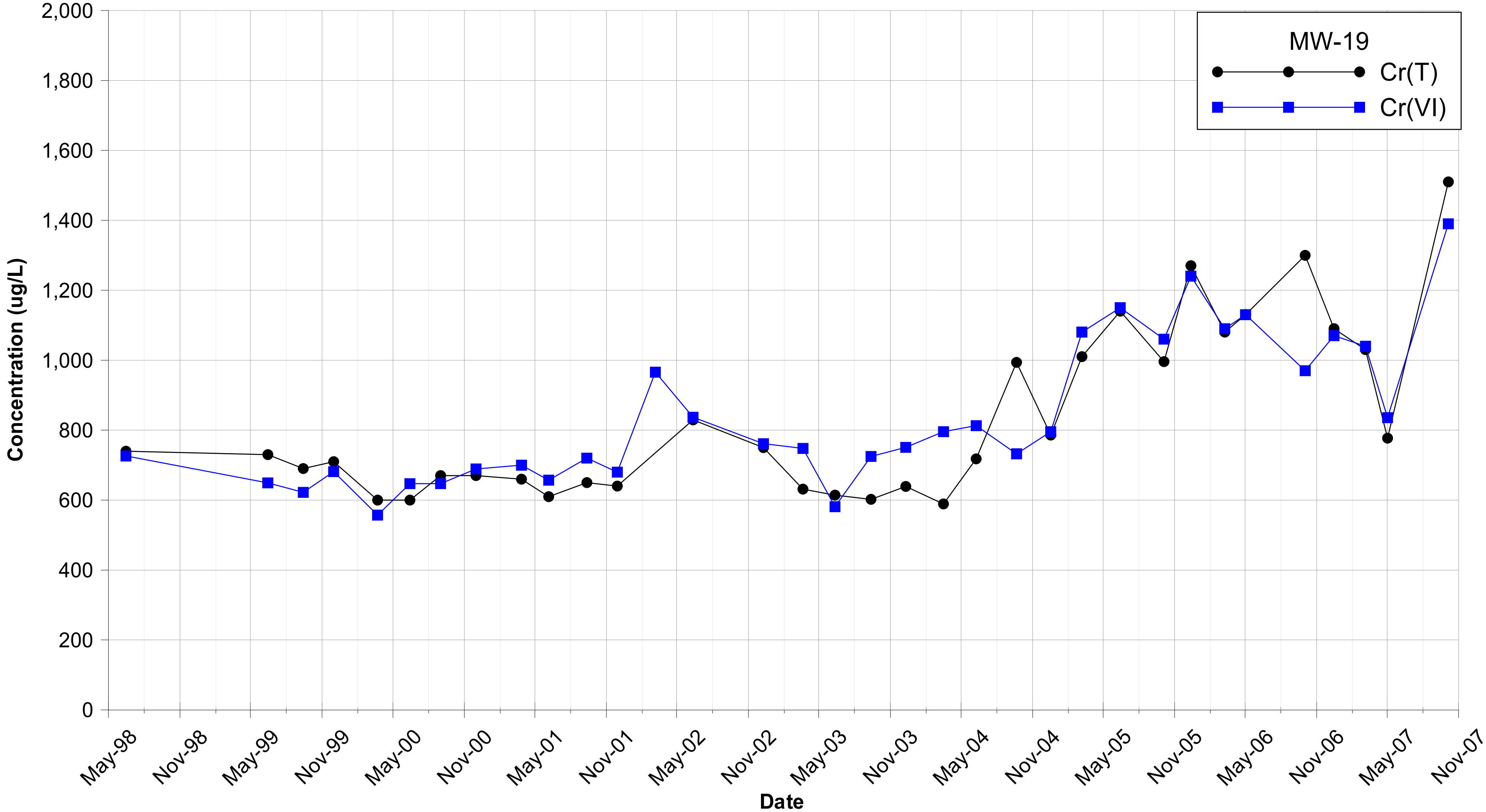

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CHROMIUM CONCENTRATION TRENDS,
MW-19, JUNE 1998 TO OCTOBER 2007

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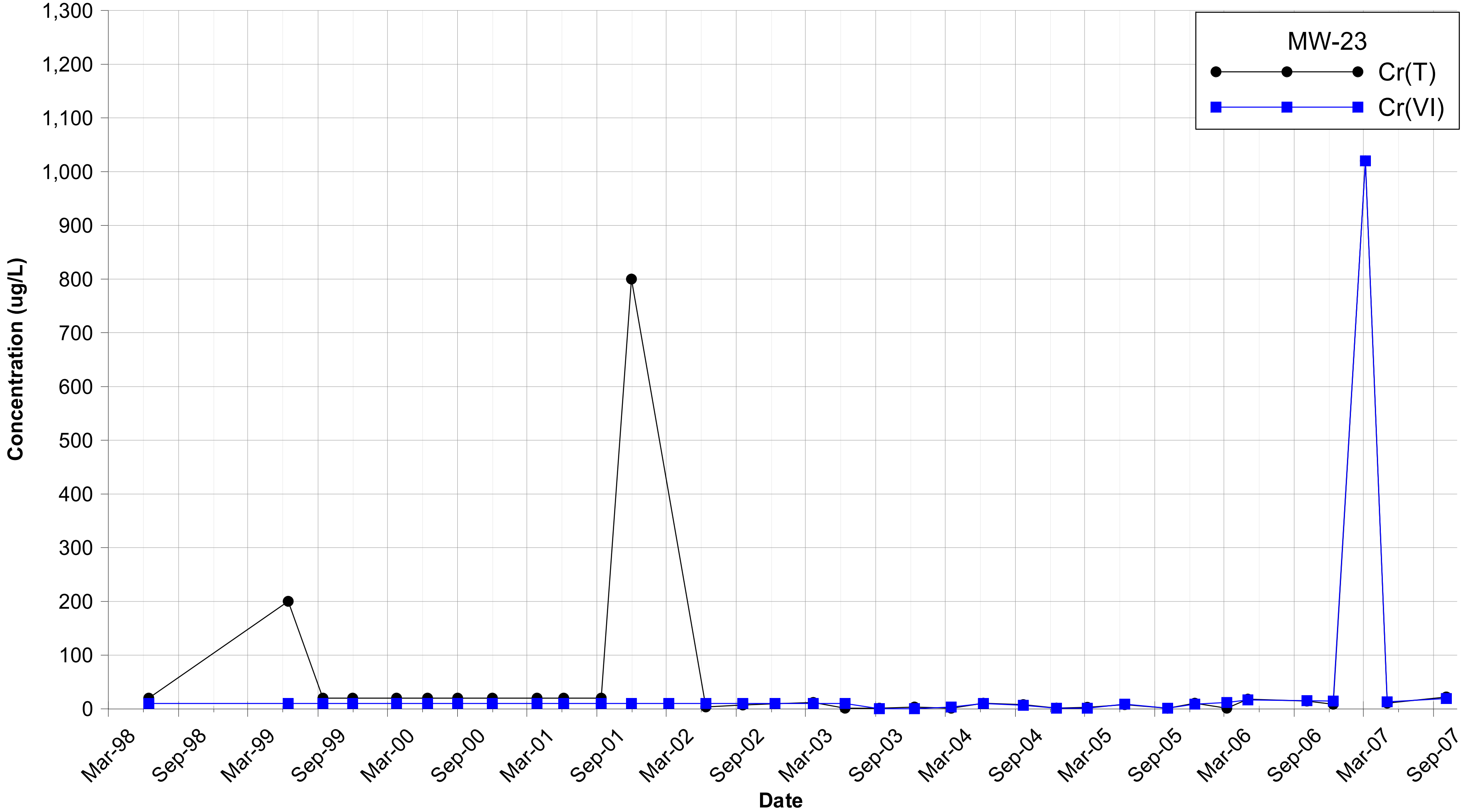

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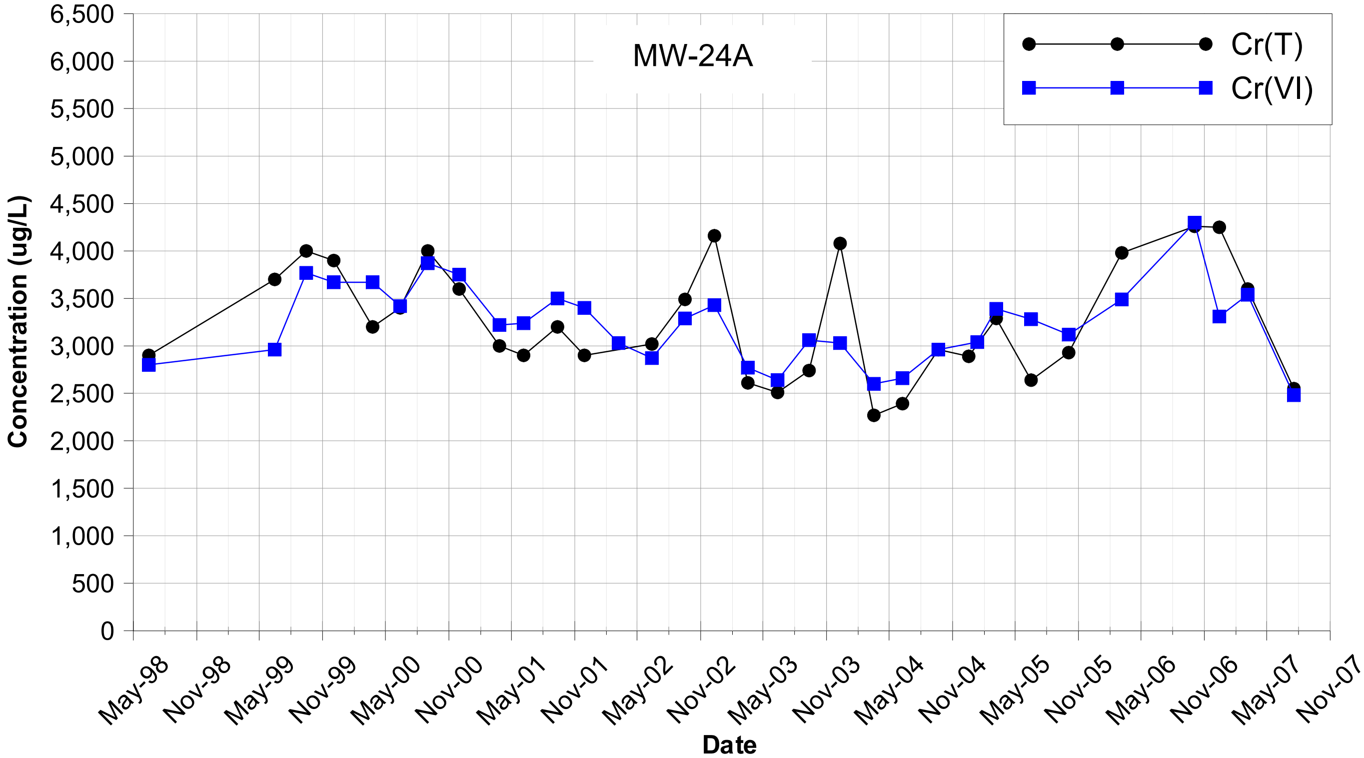

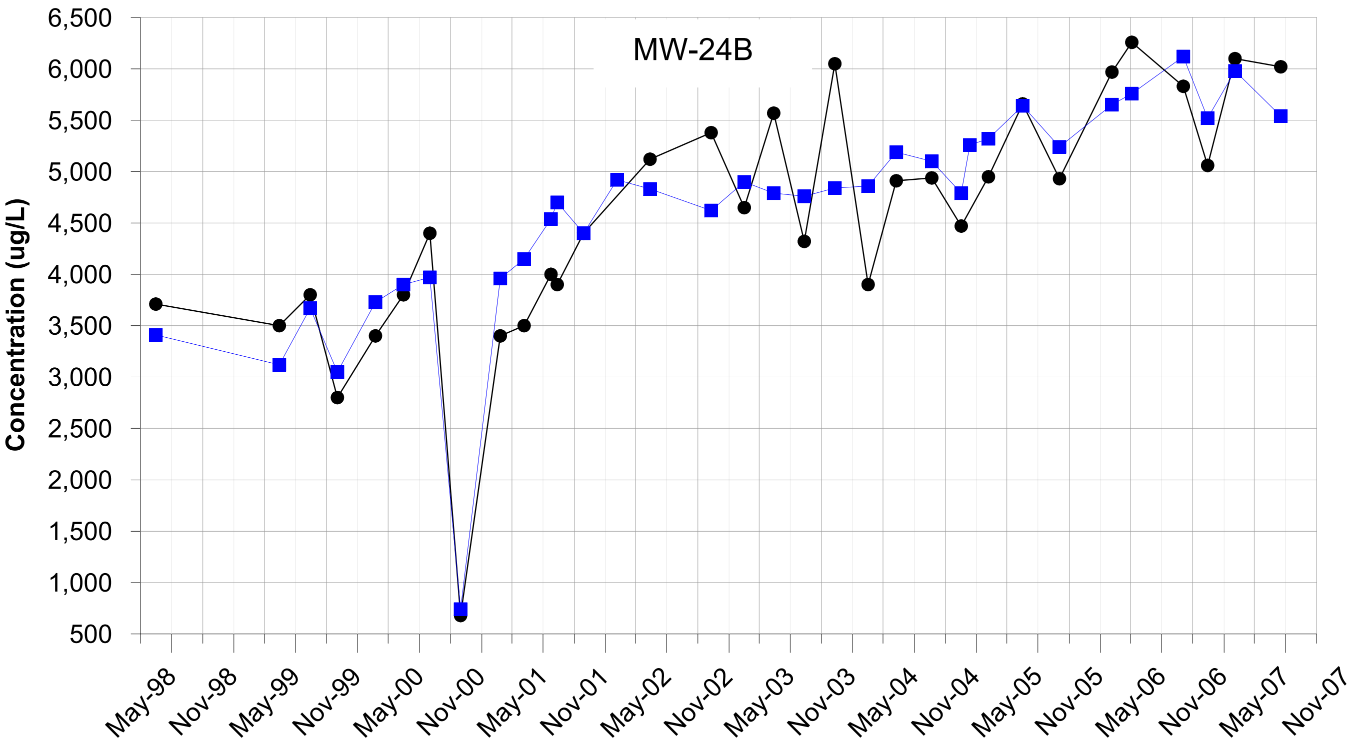

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CHROMIUM CONCENTRATION TRENDS, MW-24A and MW-24B

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NEEDLES, CALIFORNIA

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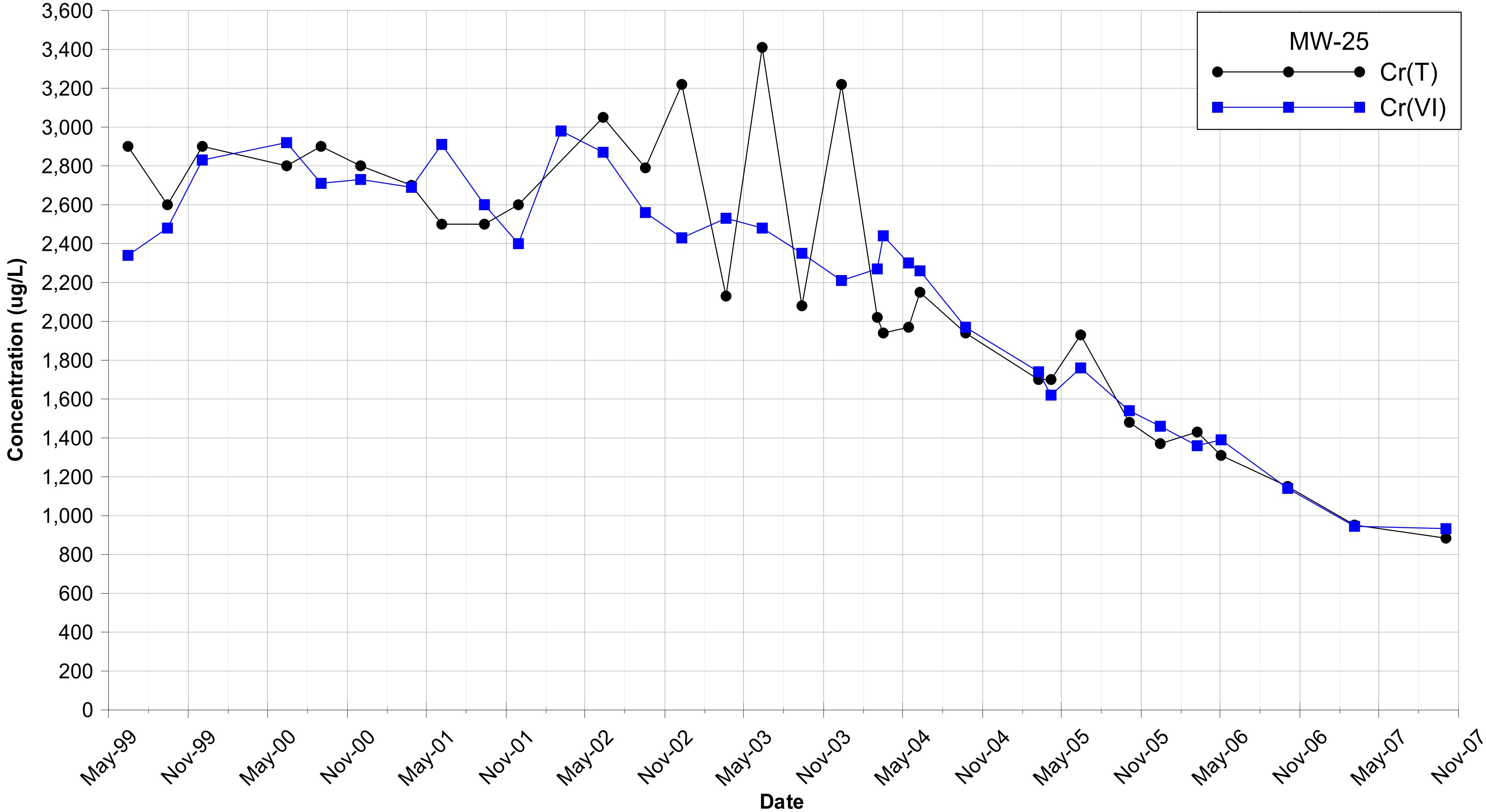

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CHROMIUM CONCENTRATION TRENDS,
MW-25, JUNE 1999 TO OCTOBER 2007

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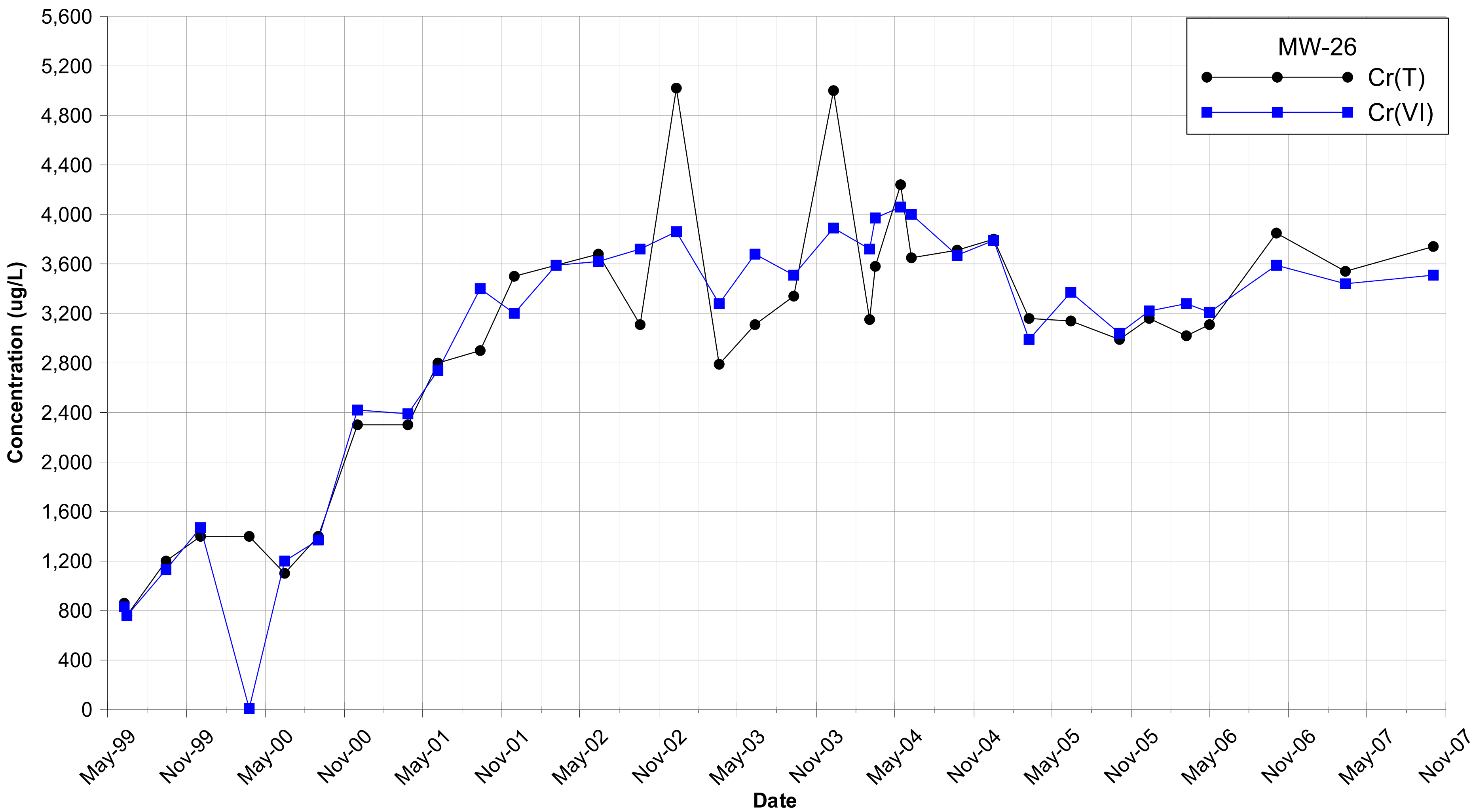

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NEEDLES, CALIFORNIA

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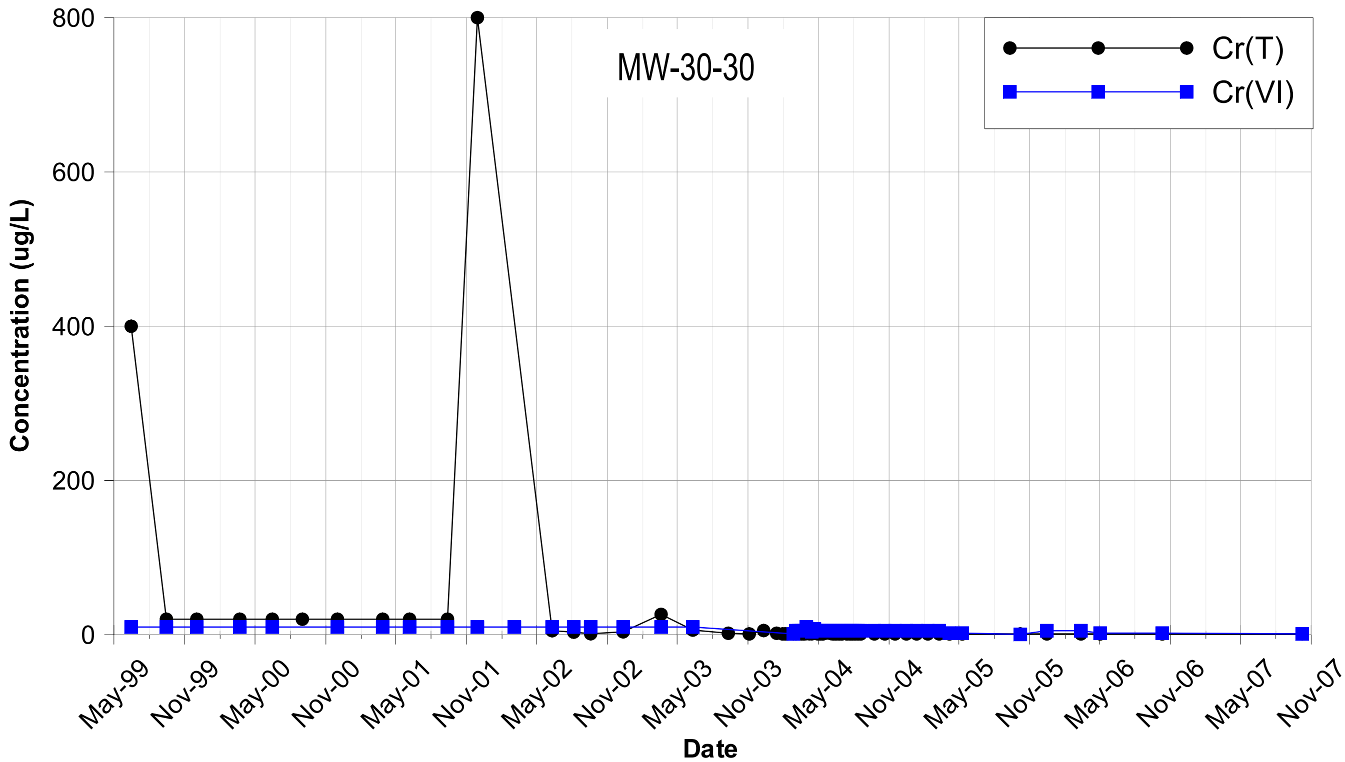

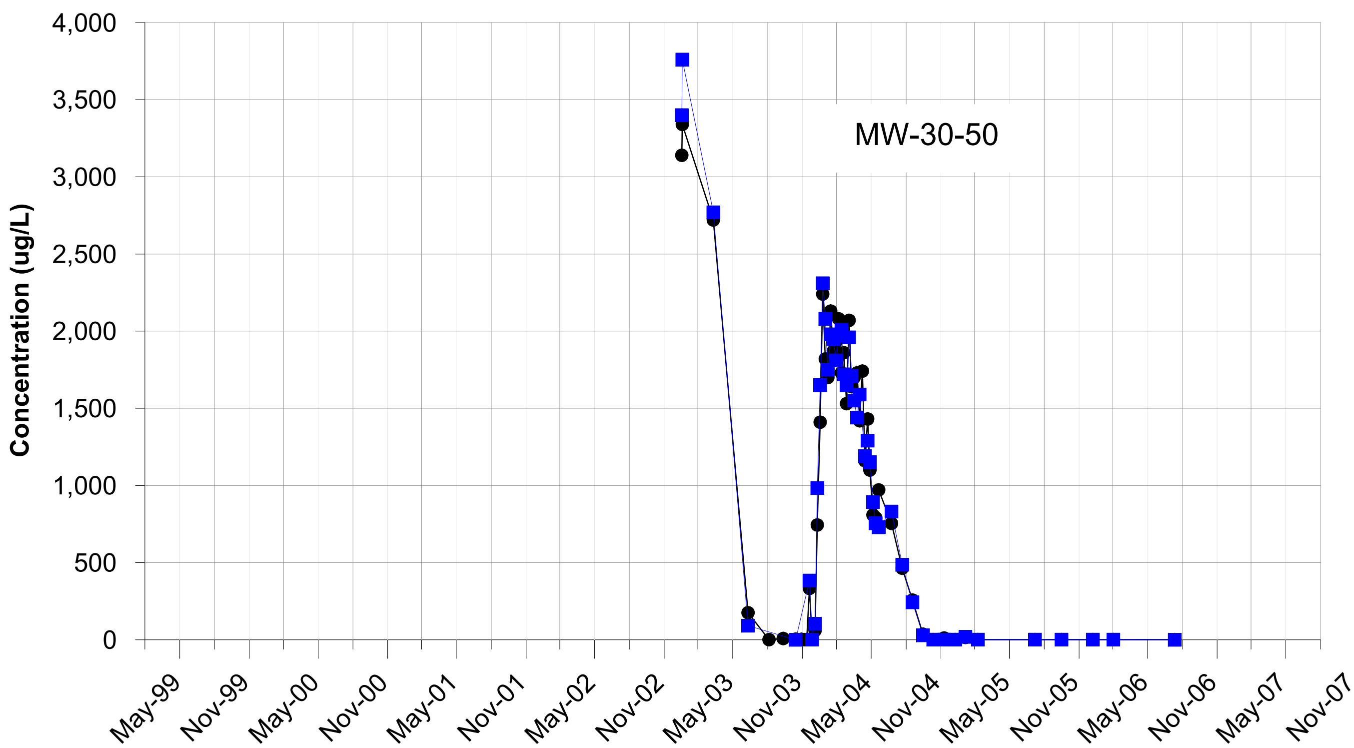

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CHROMIUM CONCENTRATION TRENDS,
MW-30 WELL CLUSTER

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INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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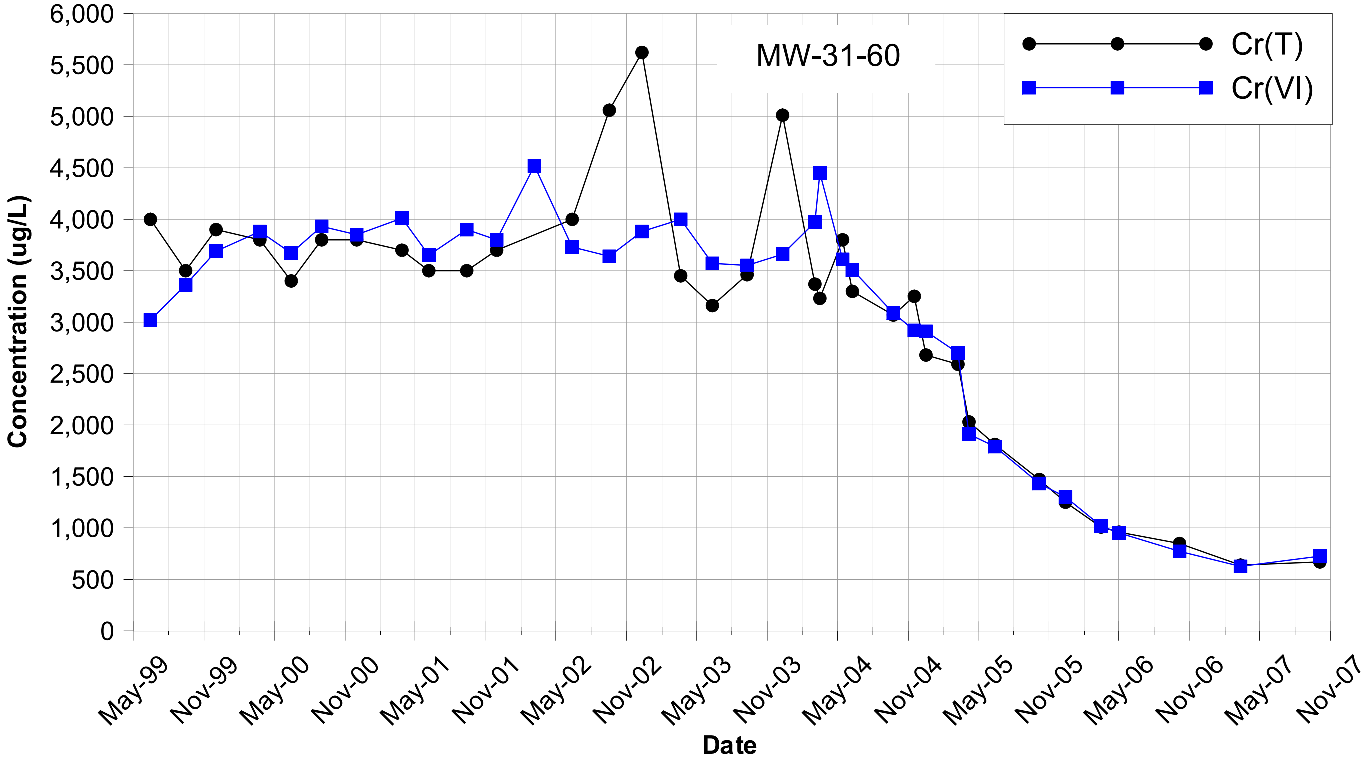

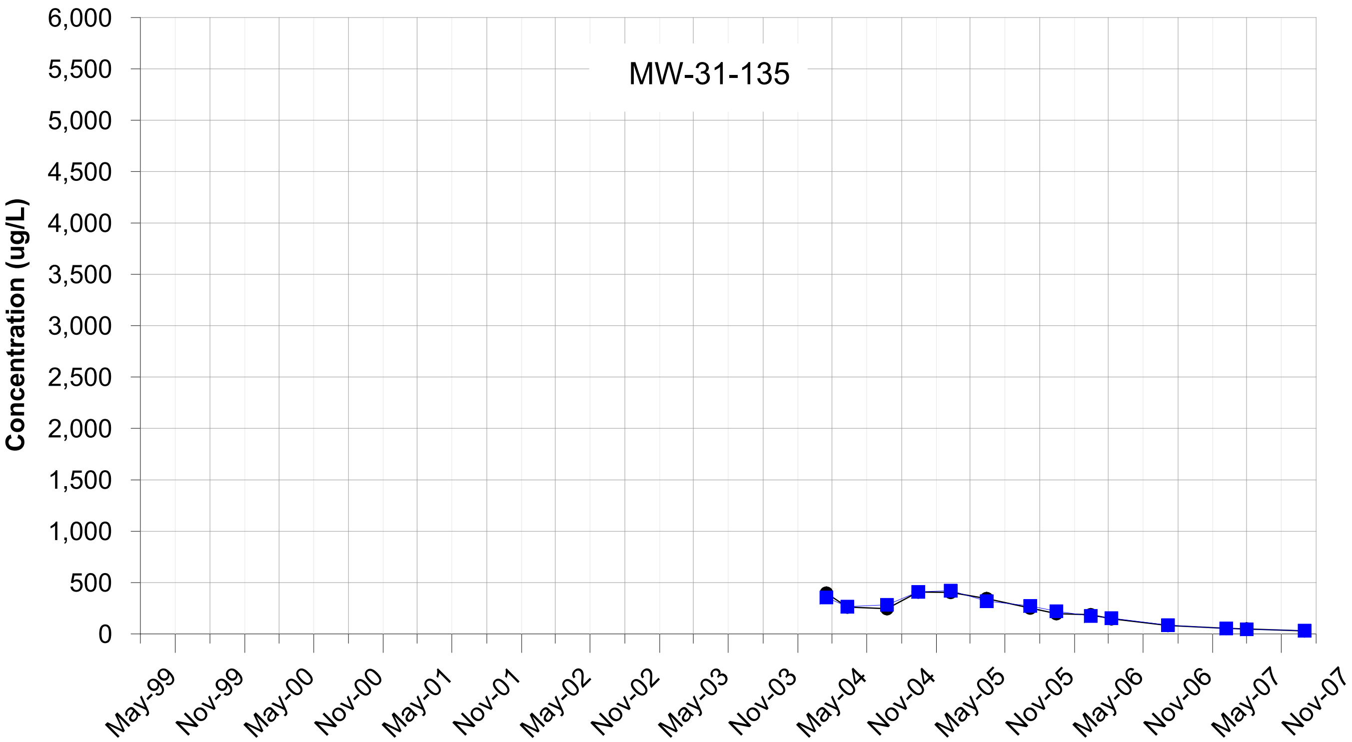

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CHROMIUM CONCENTRATION TRENDS,
MW-31 WELL CLUSTER

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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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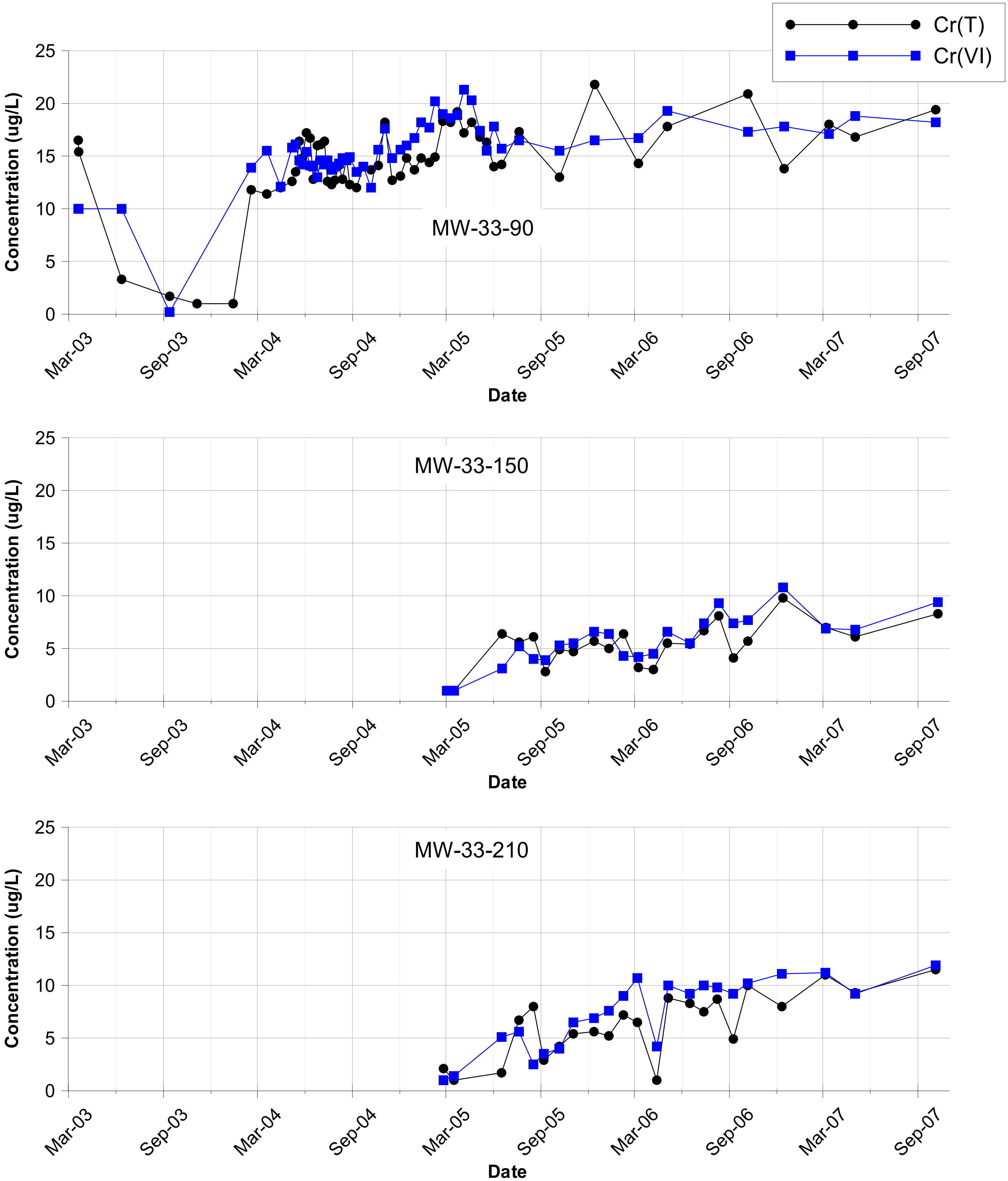

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CHROMIUM CONCENTRATION TRENDS, MW-33 CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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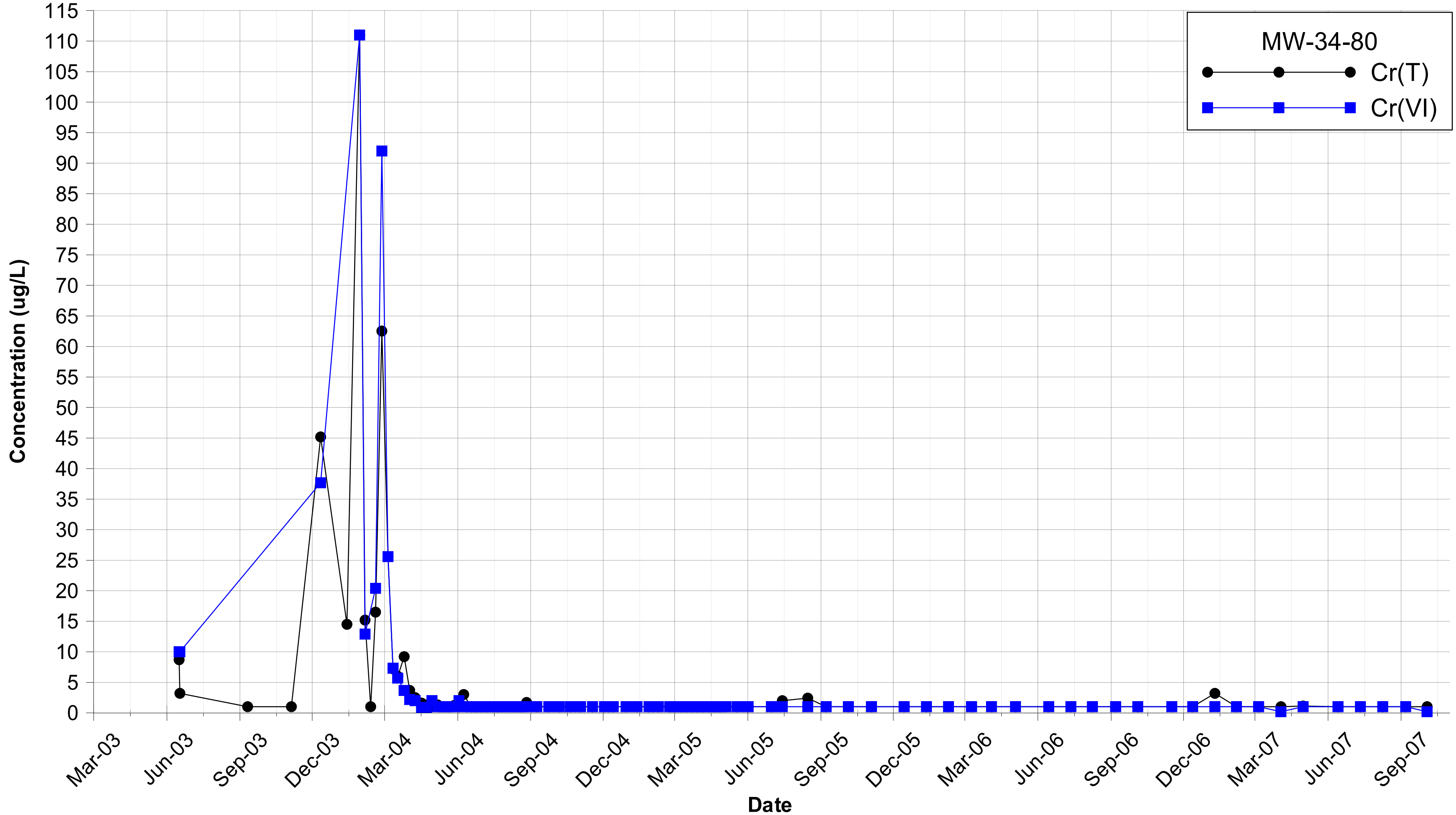

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CHROMIUM CONCENTRATION TRENDS, MW-34-80, JUNE 2003 TO OCTOBER 2007

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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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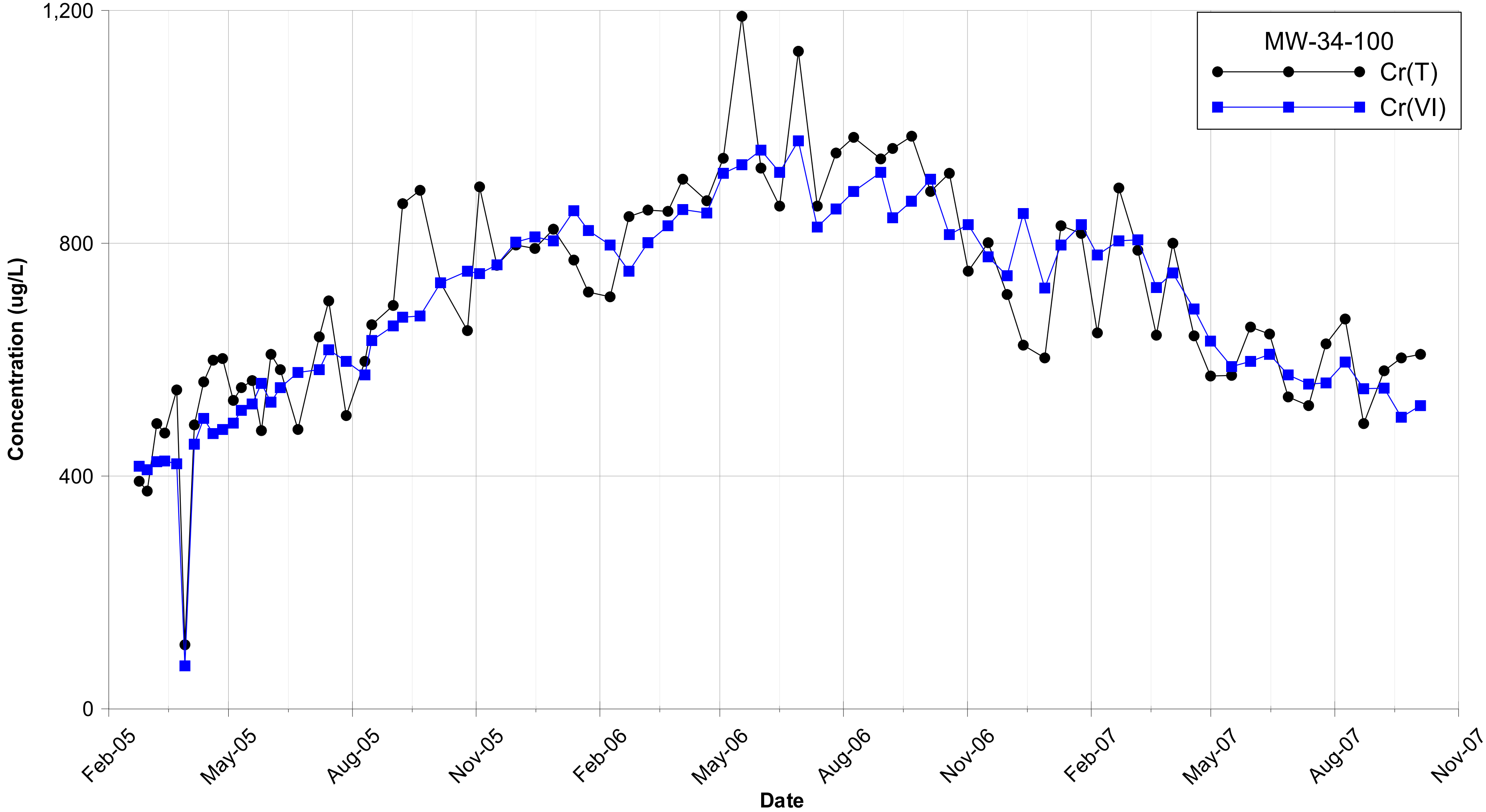

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CHROMIUM CONCENTRATION TRENDS,
MW-34-100, MARCH 2005 TO OCTOBER 2007

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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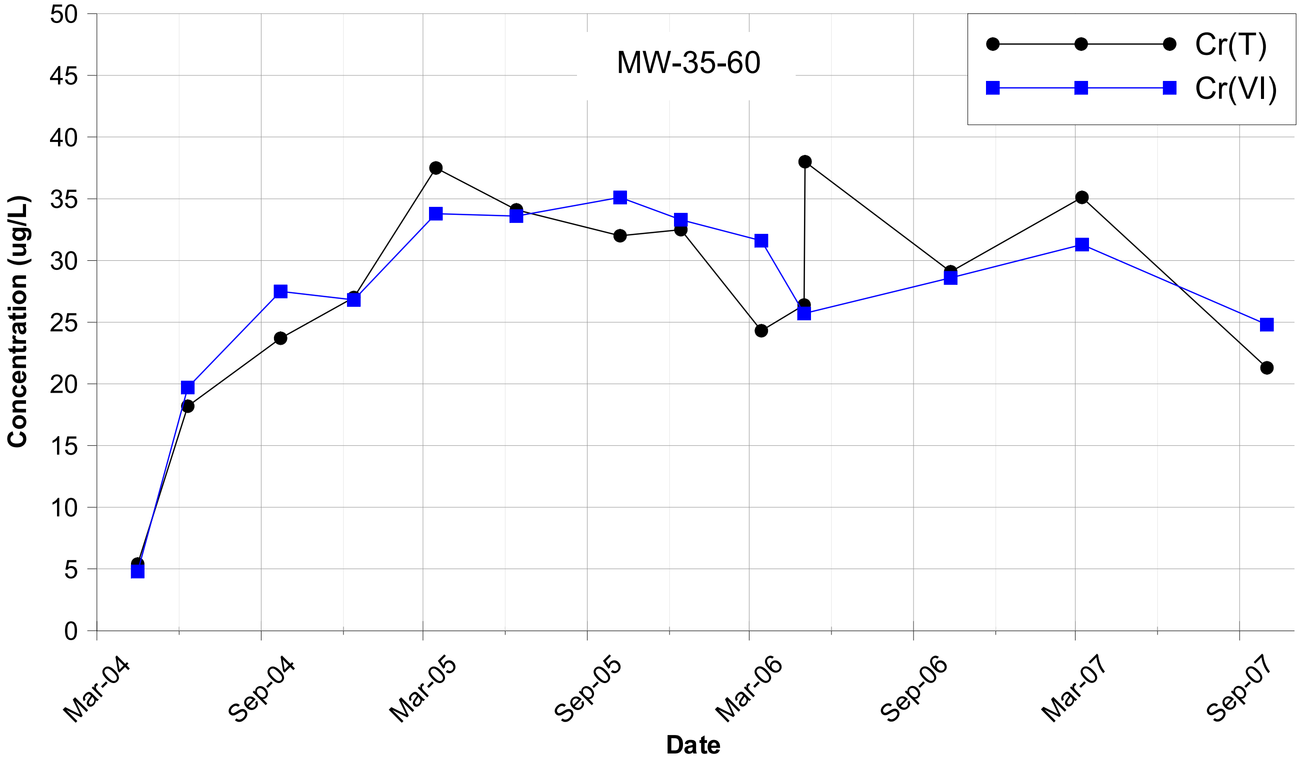

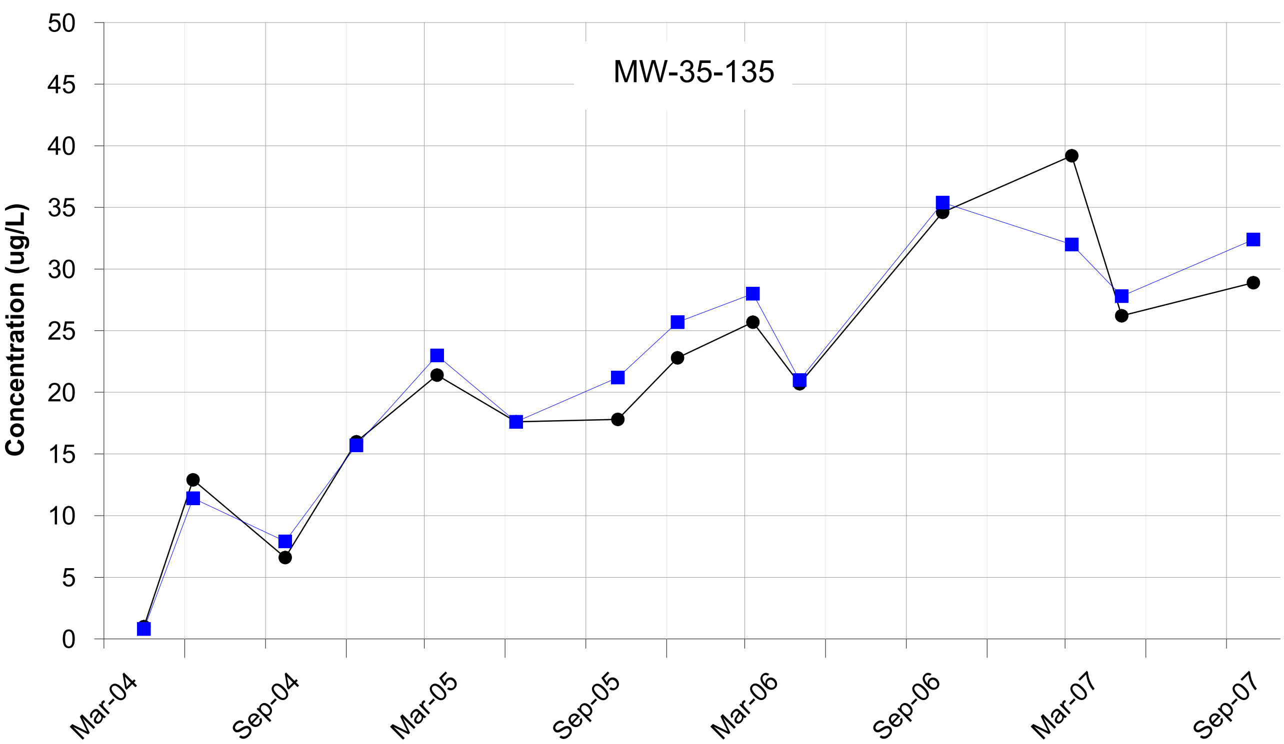

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CHROMIUM CONCENTRATION TRENDS, MW-35 WELL CLUSTER

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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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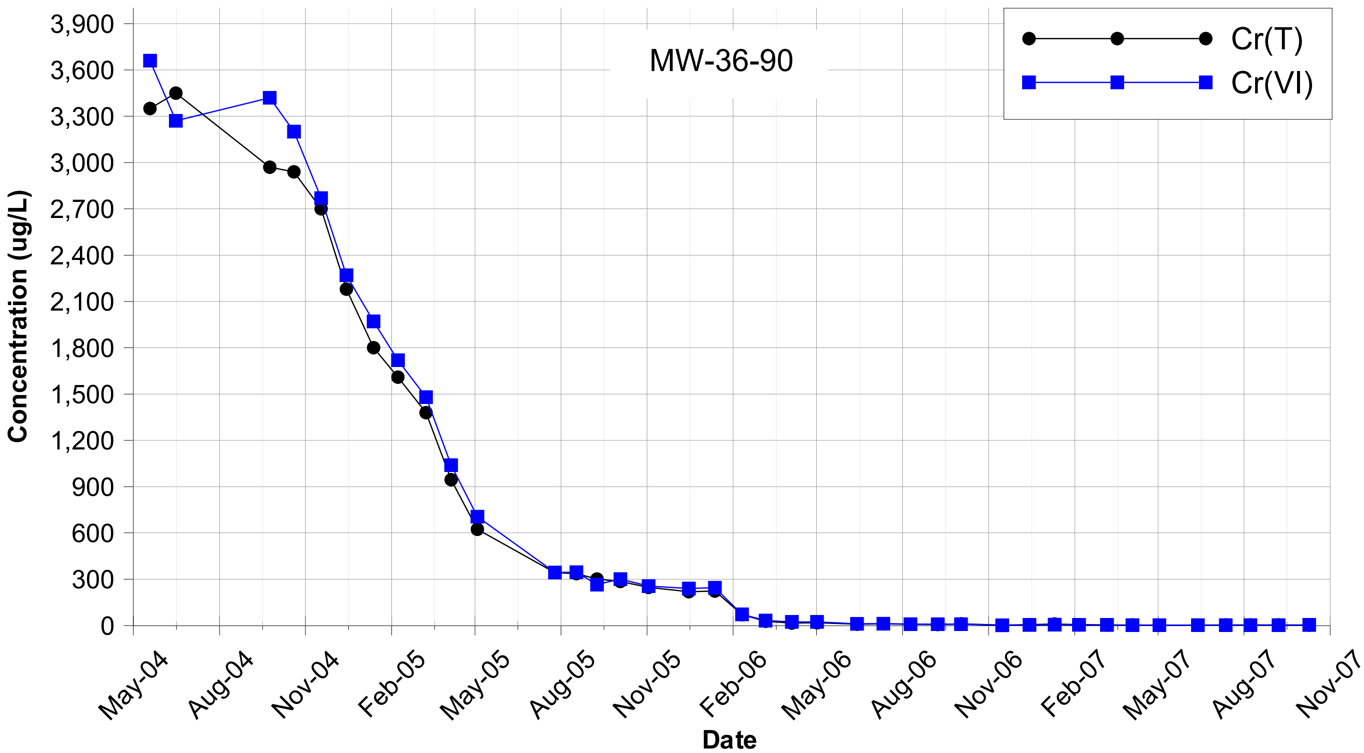

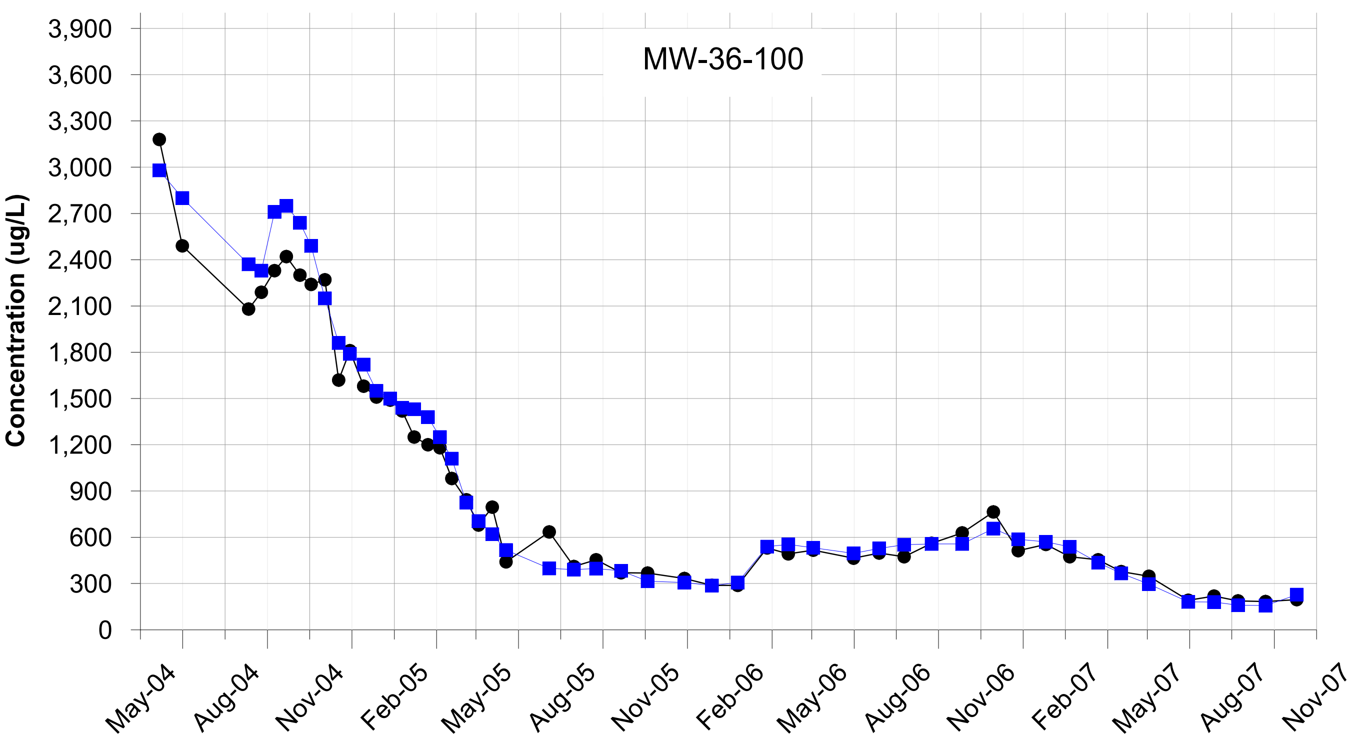

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CHROMIUM CONCENTRATION TRENDS,
MW-36-90 AND MW-36-100

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
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NEEDLES, CALIFORNIA

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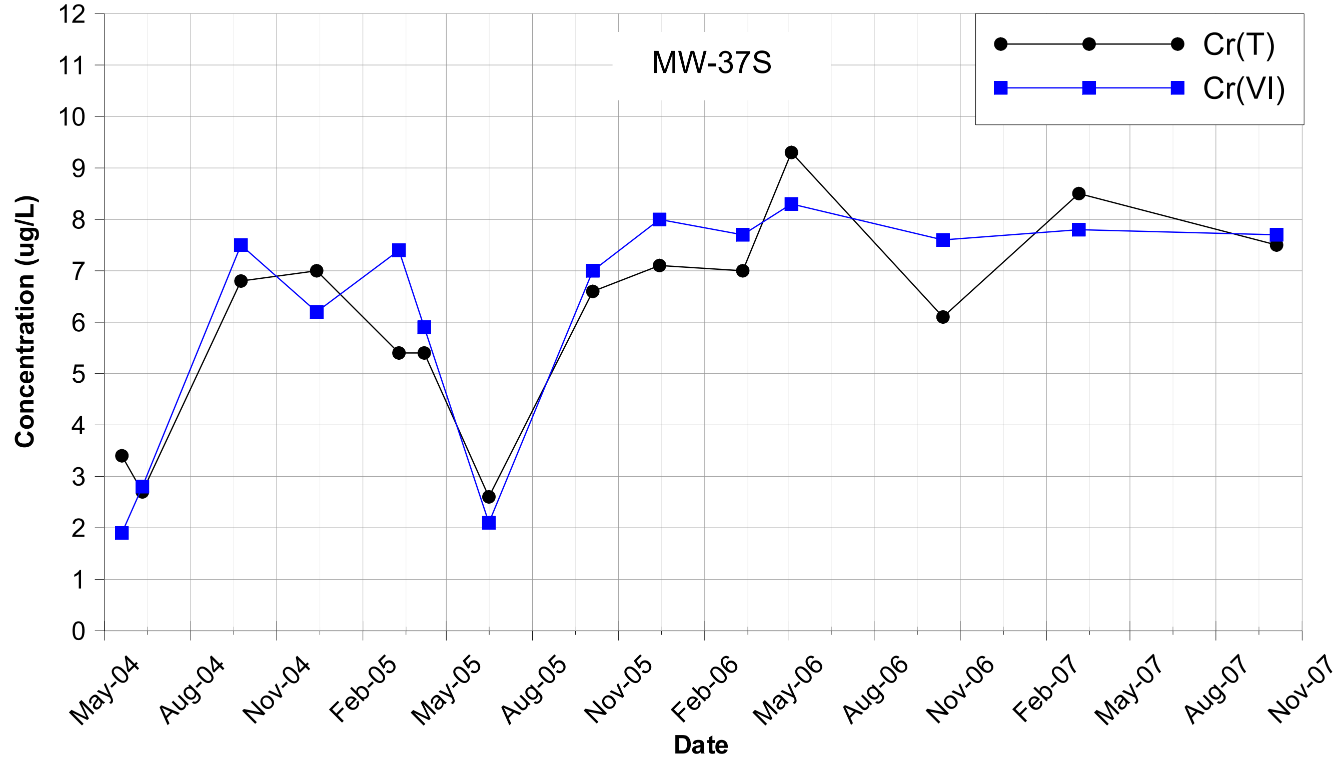

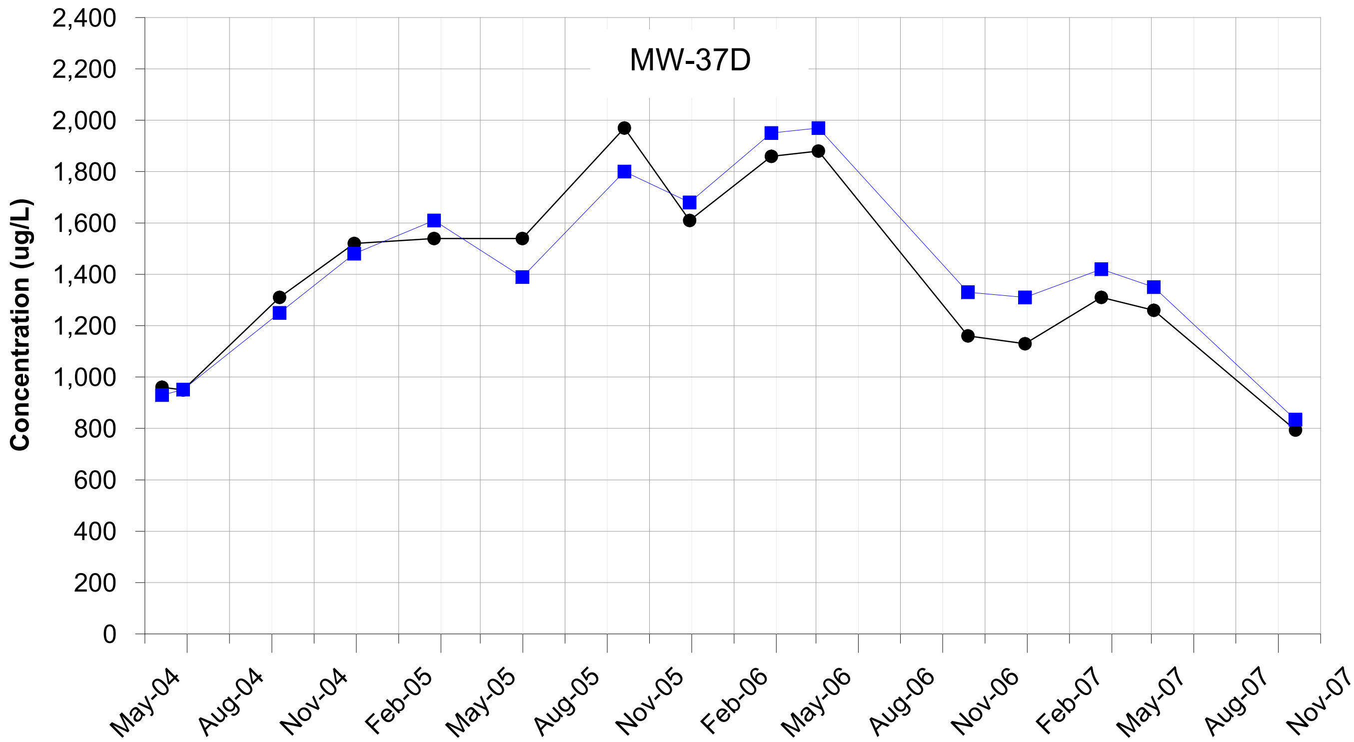

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CHROMIUM CONCENTRATION TRENDS, MW-37 WELL CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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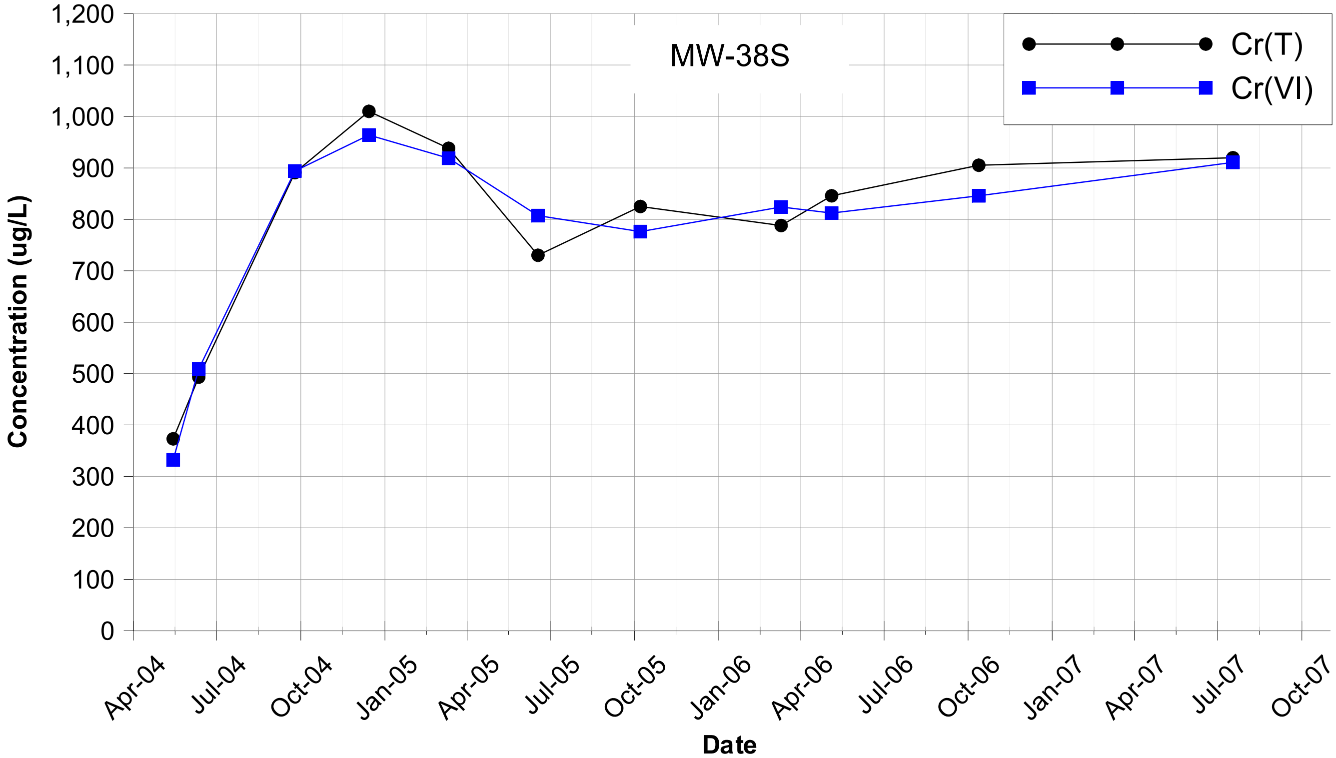

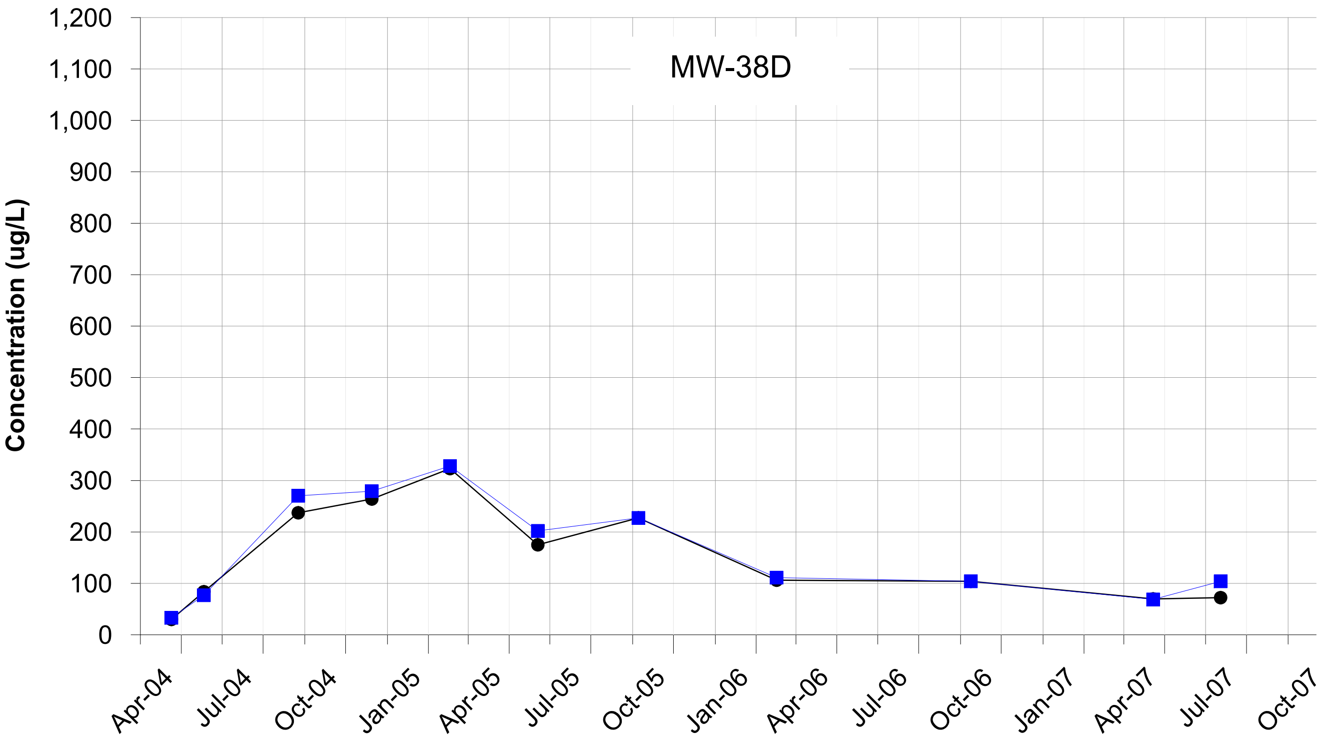

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CHROMIUM CONCENTRATION TRENDS,
MW-38 WELL CLUSTER

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INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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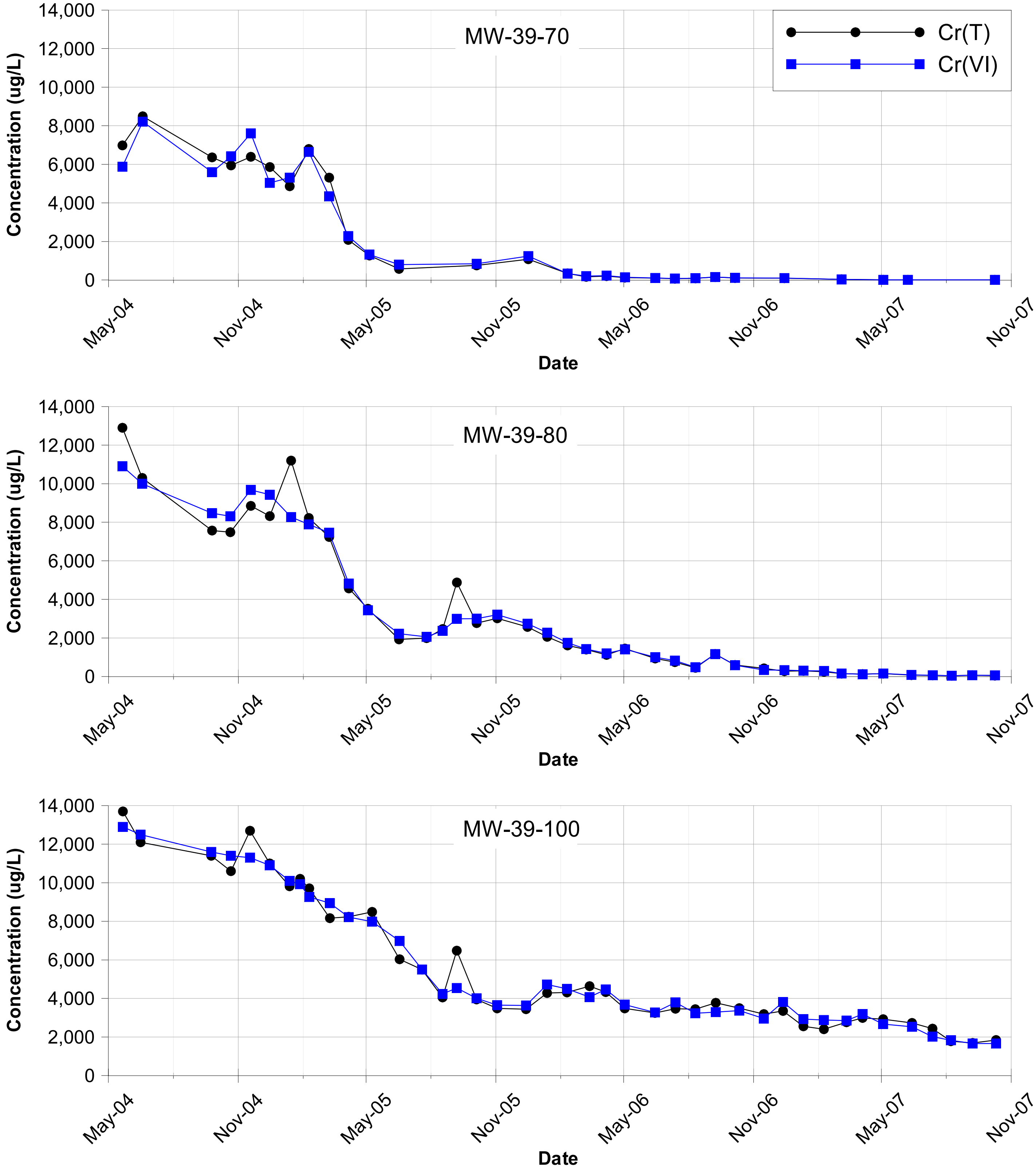

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CHROMIUM CONCENTRATION TRENDS, MW-39 CLUSTER

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NEEDLES, CALIFORNIA

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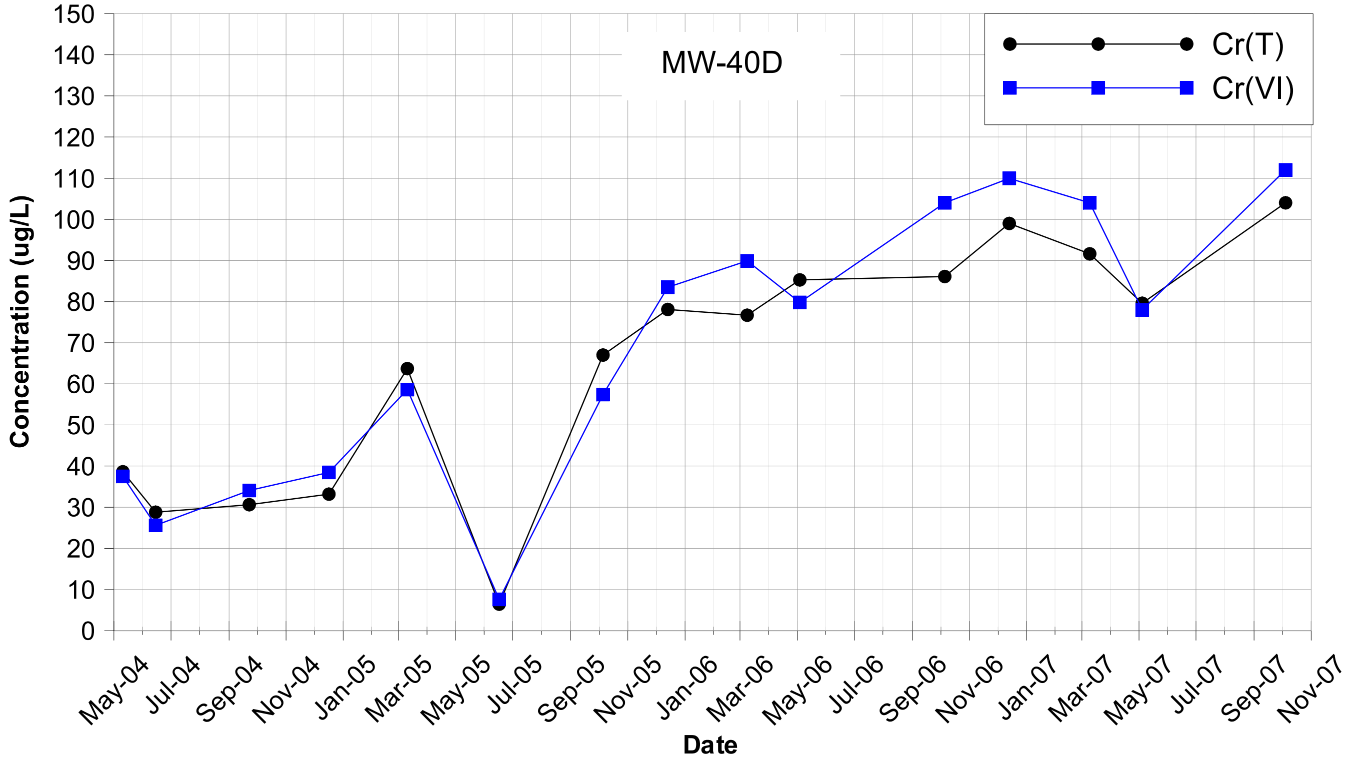

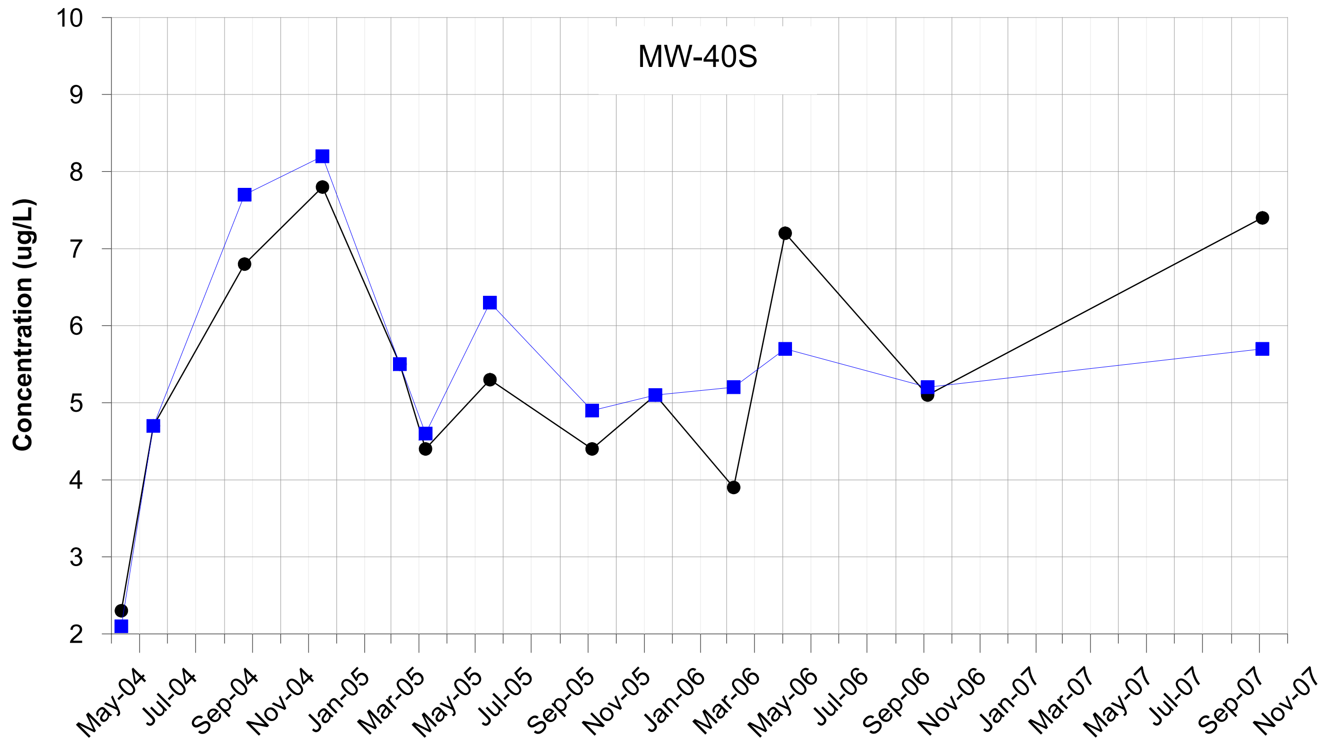

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CHROMIUM CONCENTRATION TRENDS,
MW-40 WELL CLUSTER

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PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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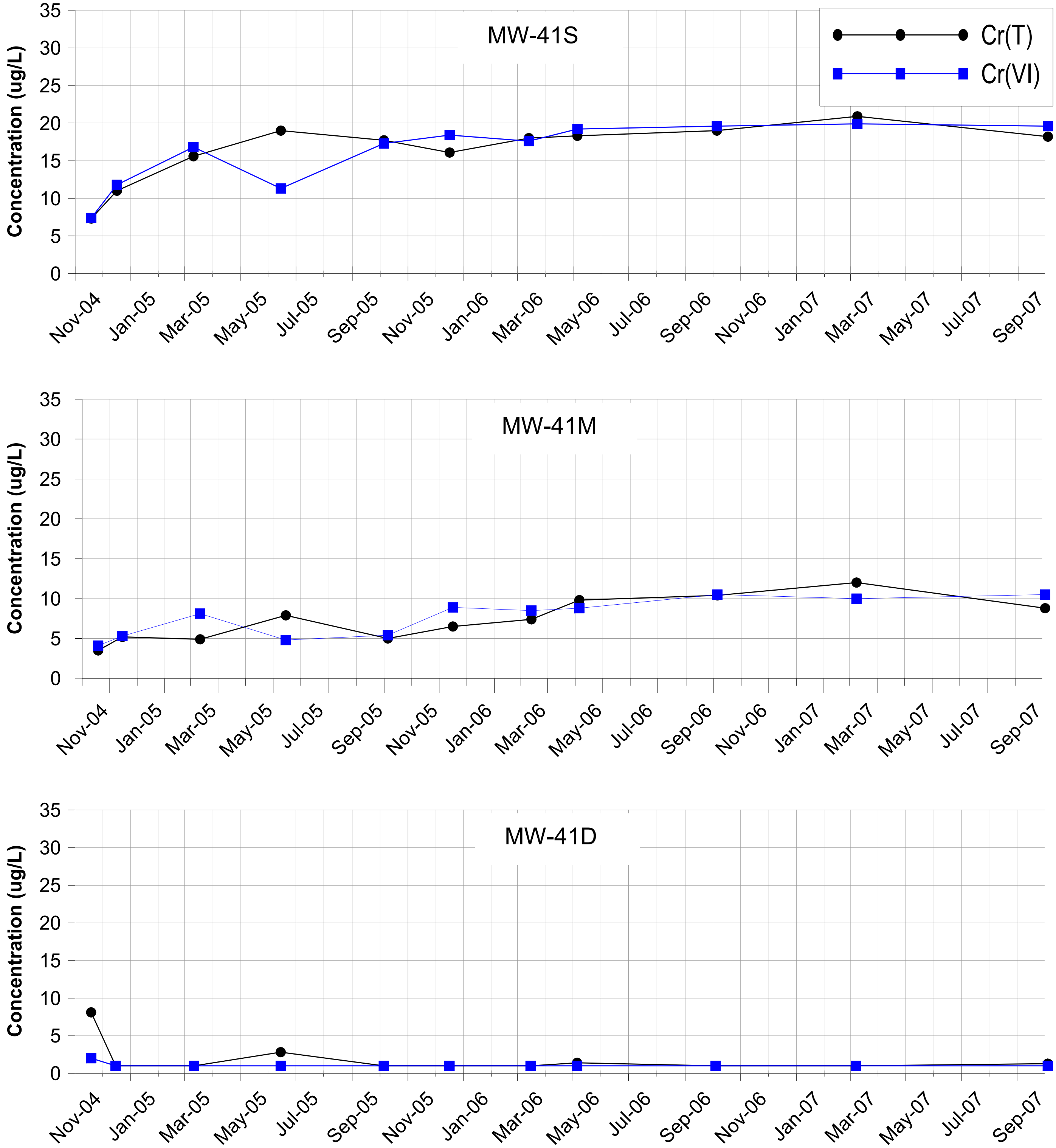

CHROMIUM CONCENTRATION TRENDS, MW-41 WELL CLUSTER

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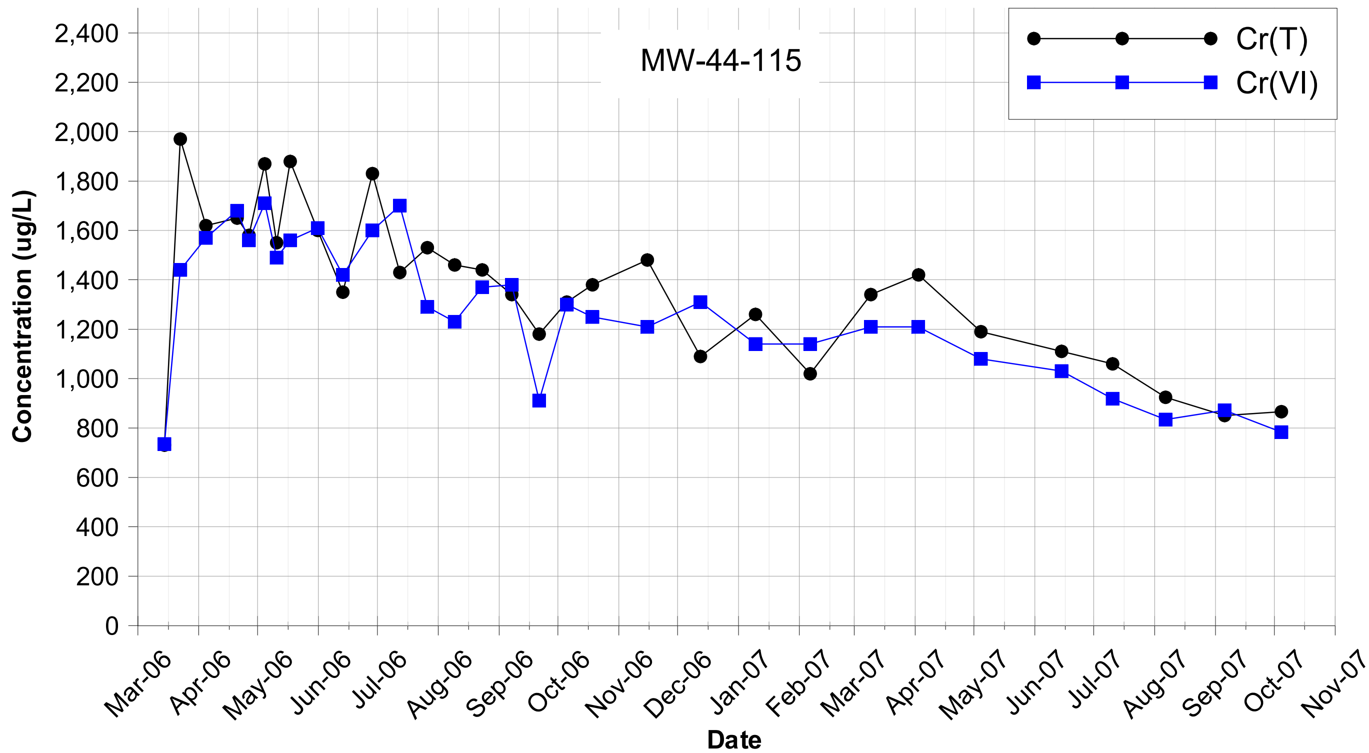

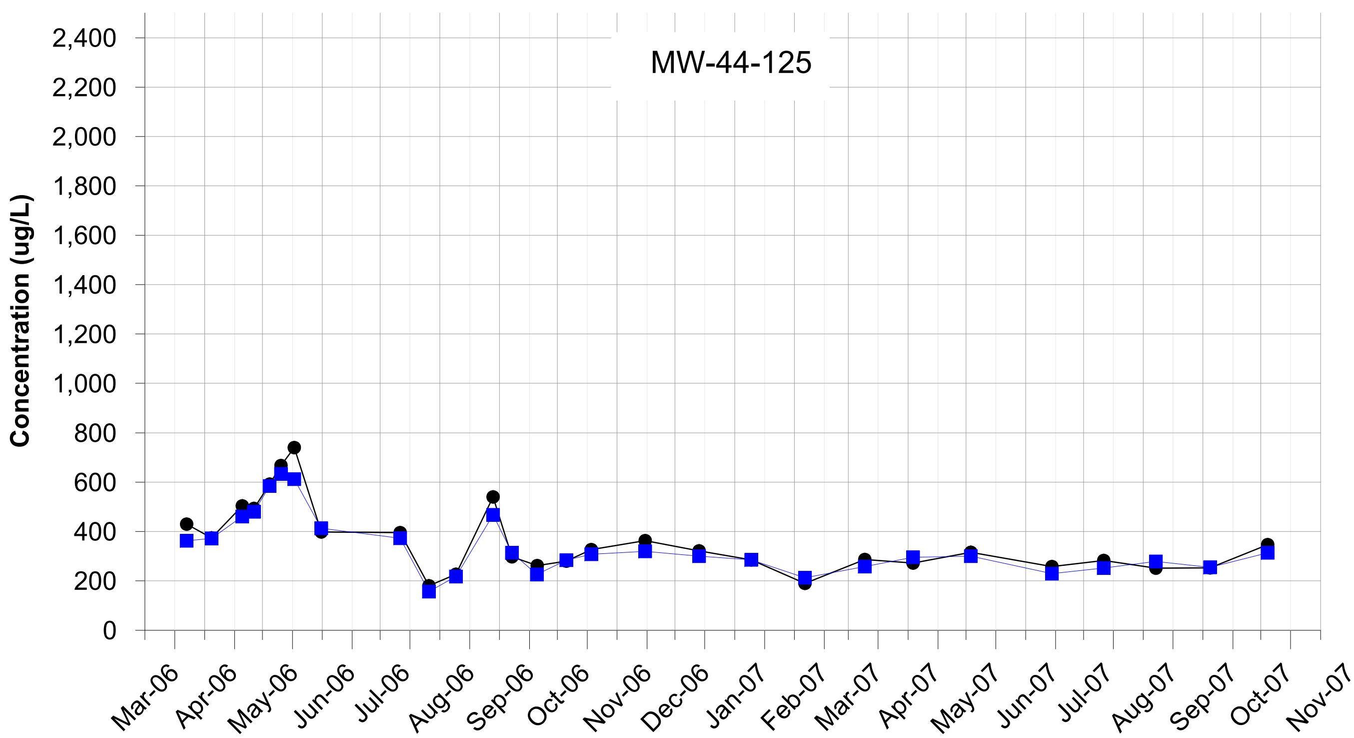

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CHROMIUM CONCENTRATION TRENDS,
MW-44 WELL CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
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NEEDLES, CALIFORNIA

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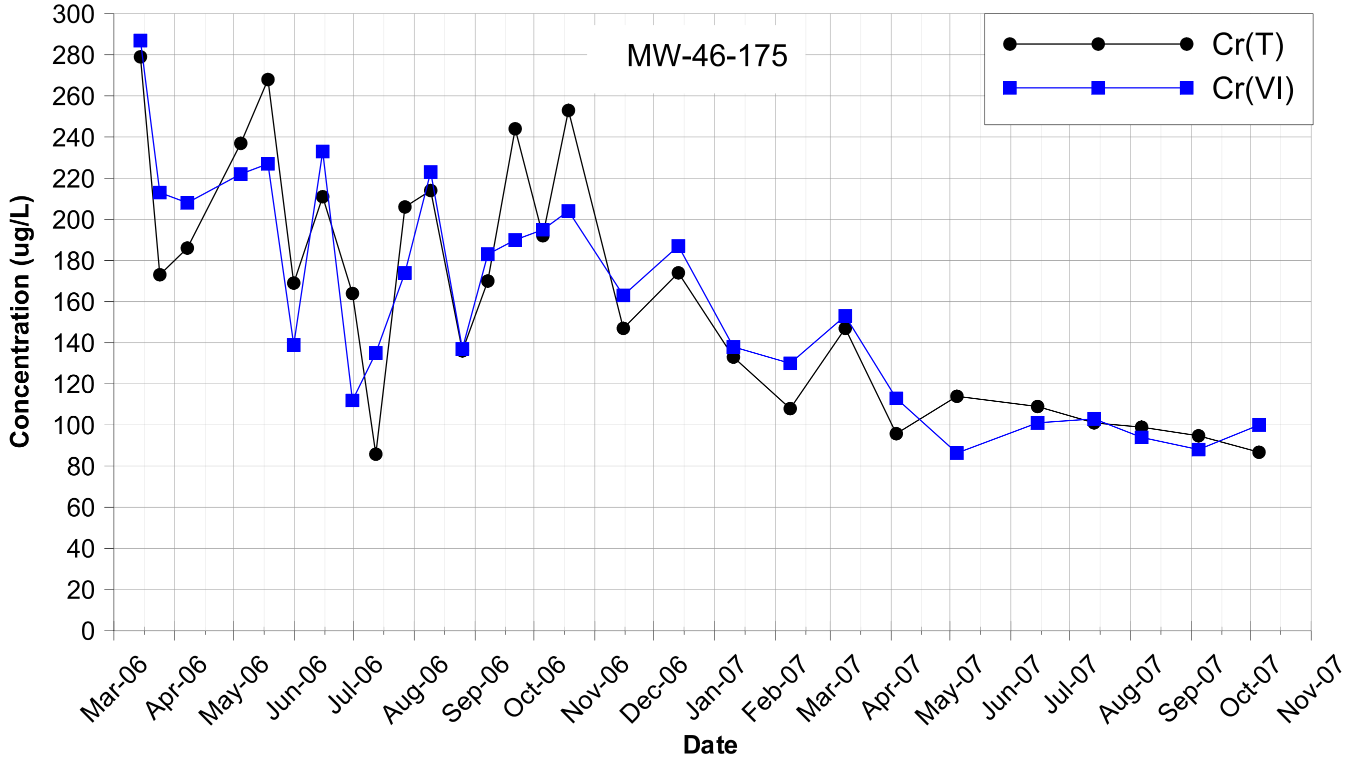

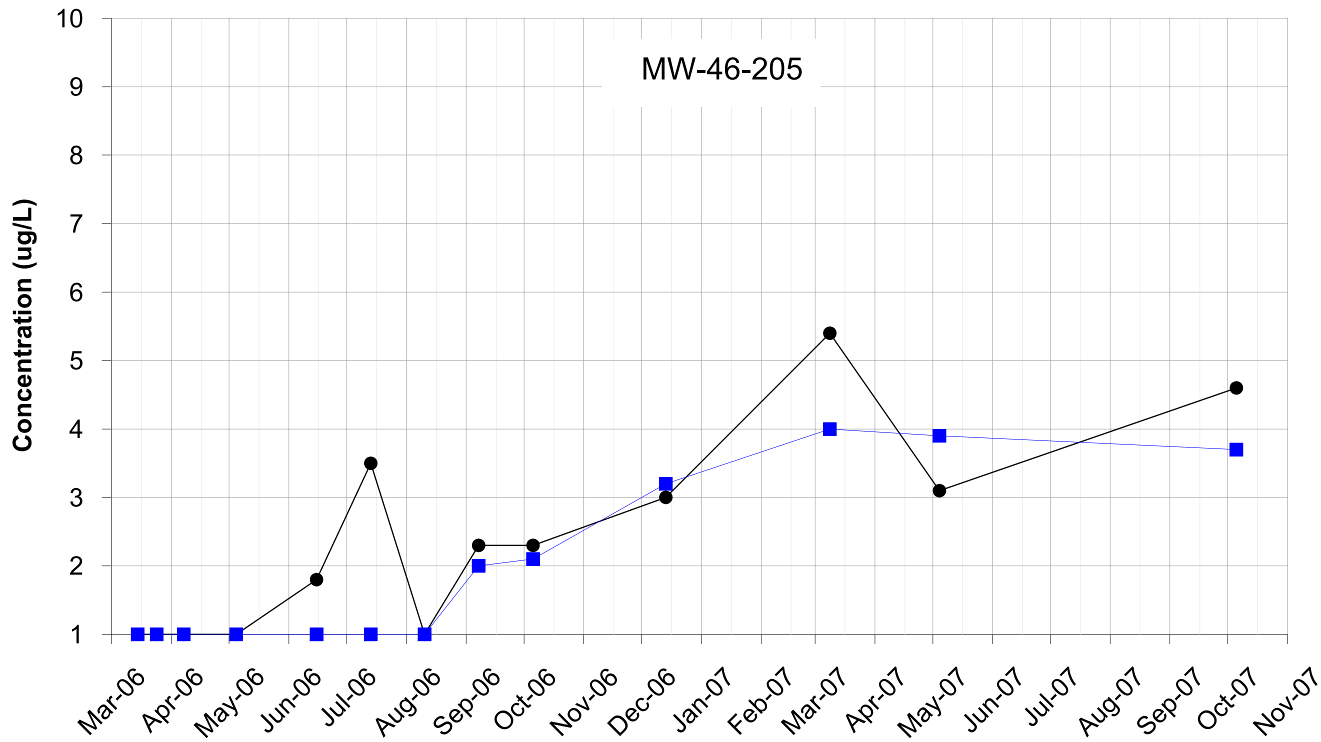

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CHROMIUM CONCENTRATION TRENDS,
MW-46 WELL CLUSTER

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INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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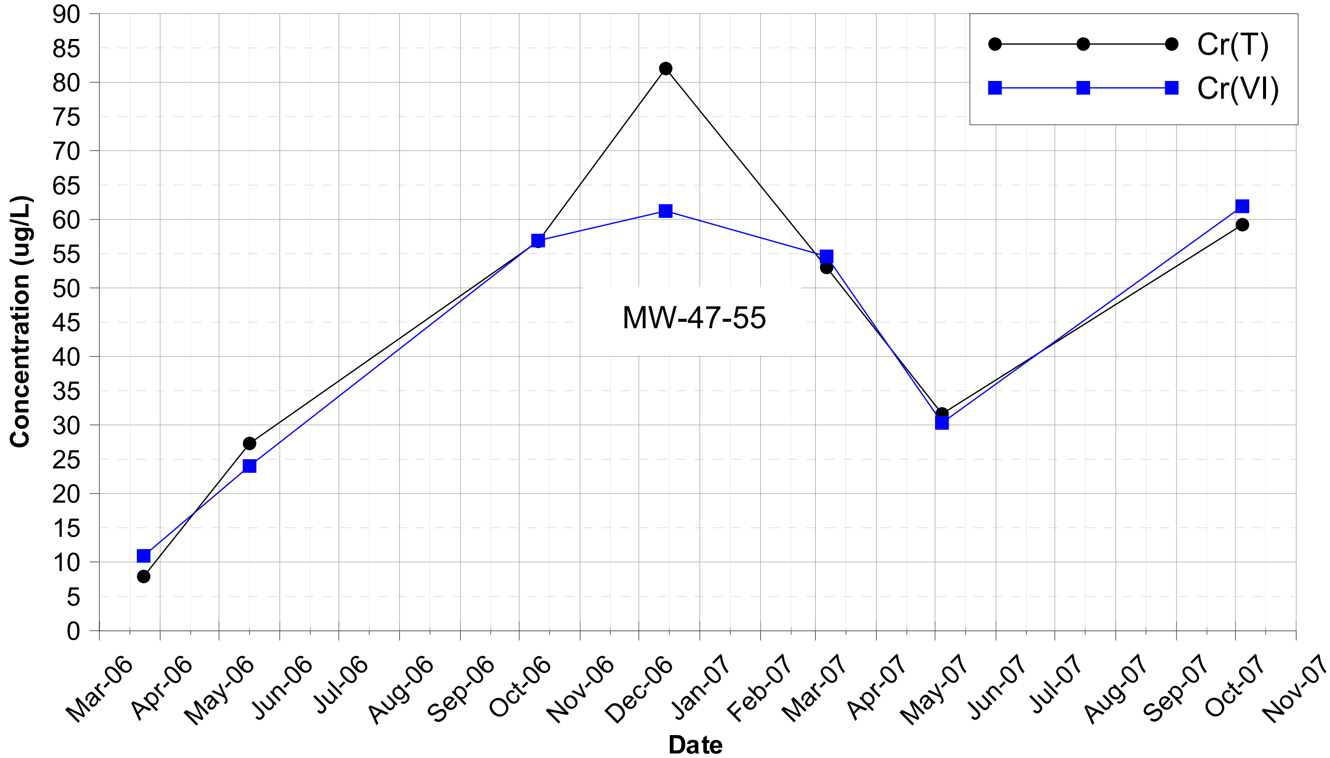

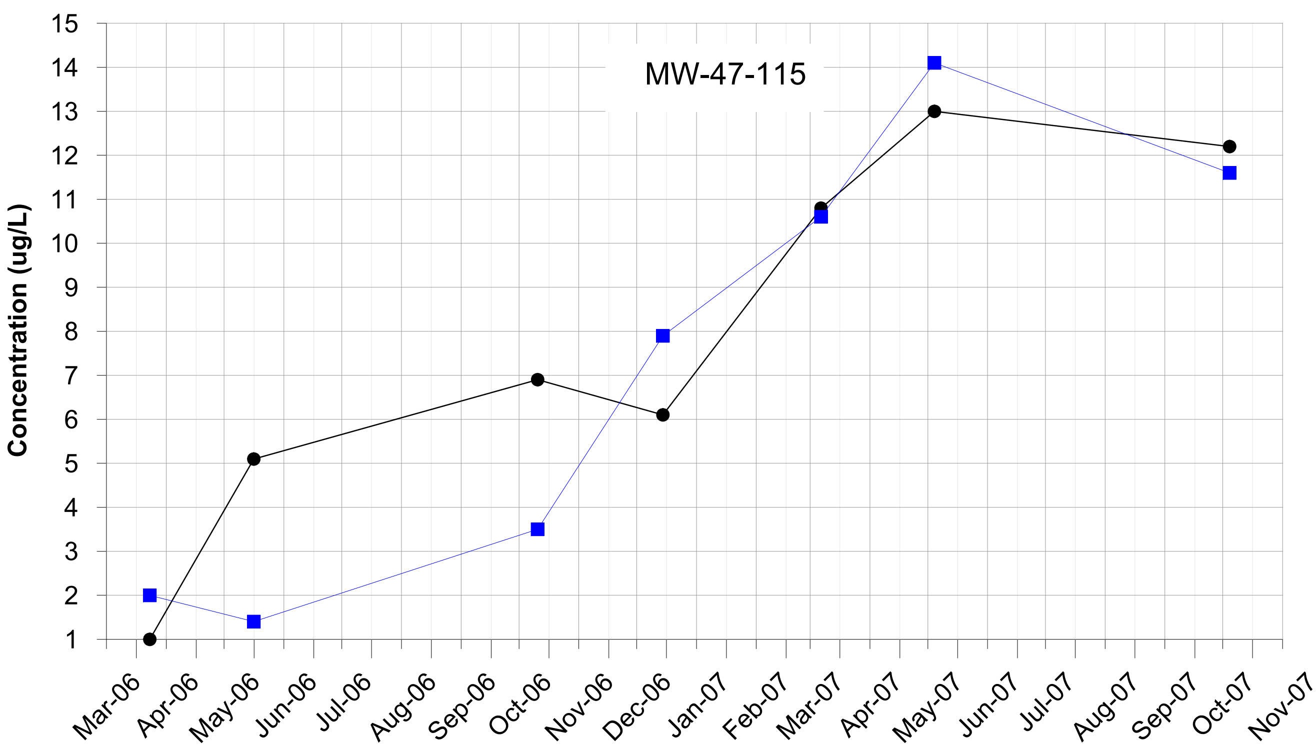

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CHROMIUM CONCENTRATION TRENDS,
MW-47 WELL CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
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NEEDLES, CALIFORNIA

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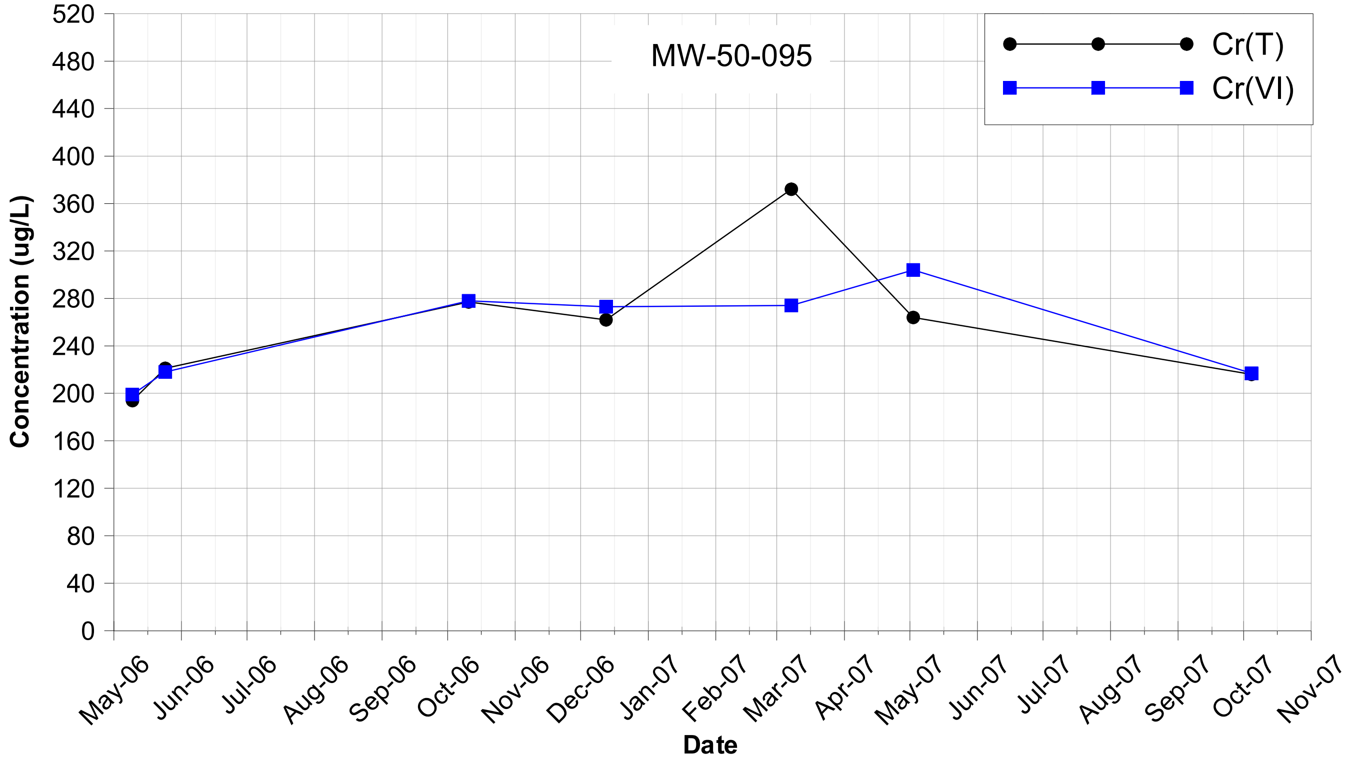

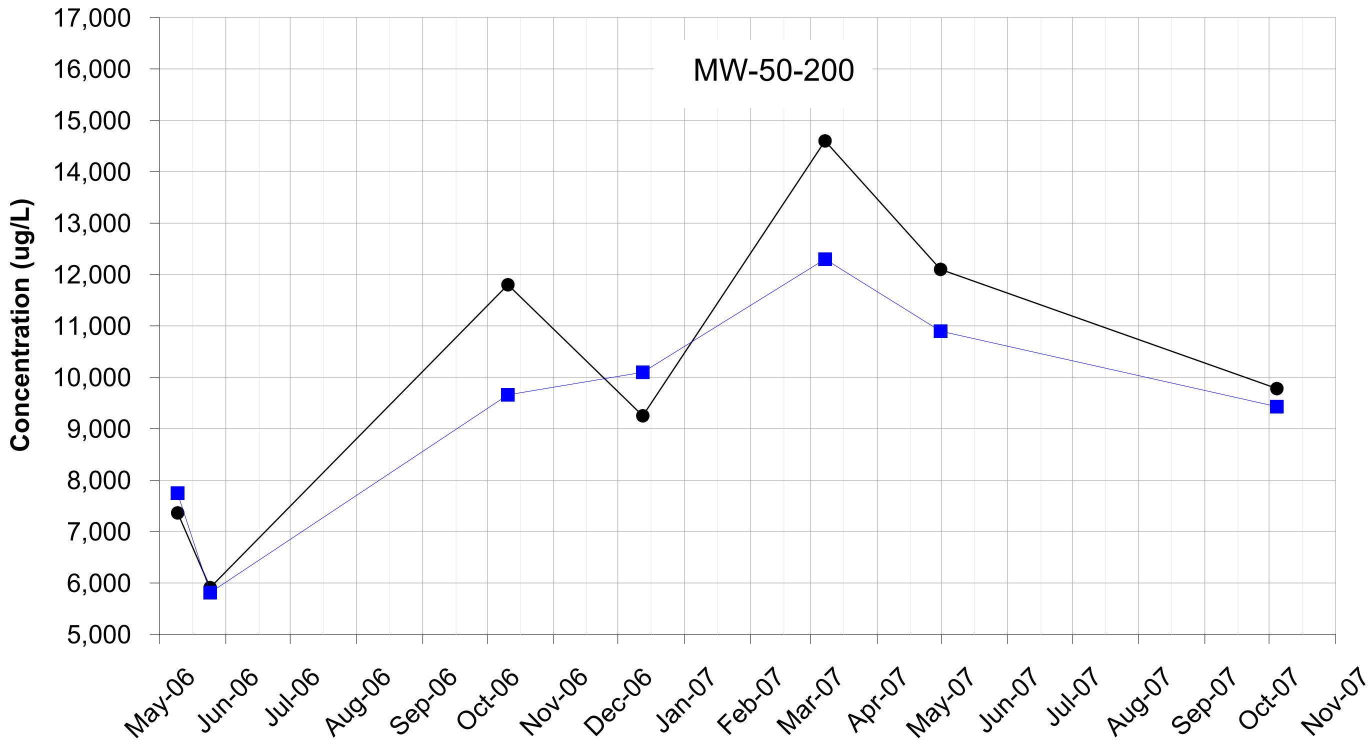

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CHROMIUM CONCENTRATION TRENDS,
MW-50 WELL CLUSTER

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INVESTIGATION REPORT (VOLUME 2)
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NEEDLES, CALIFORNIA

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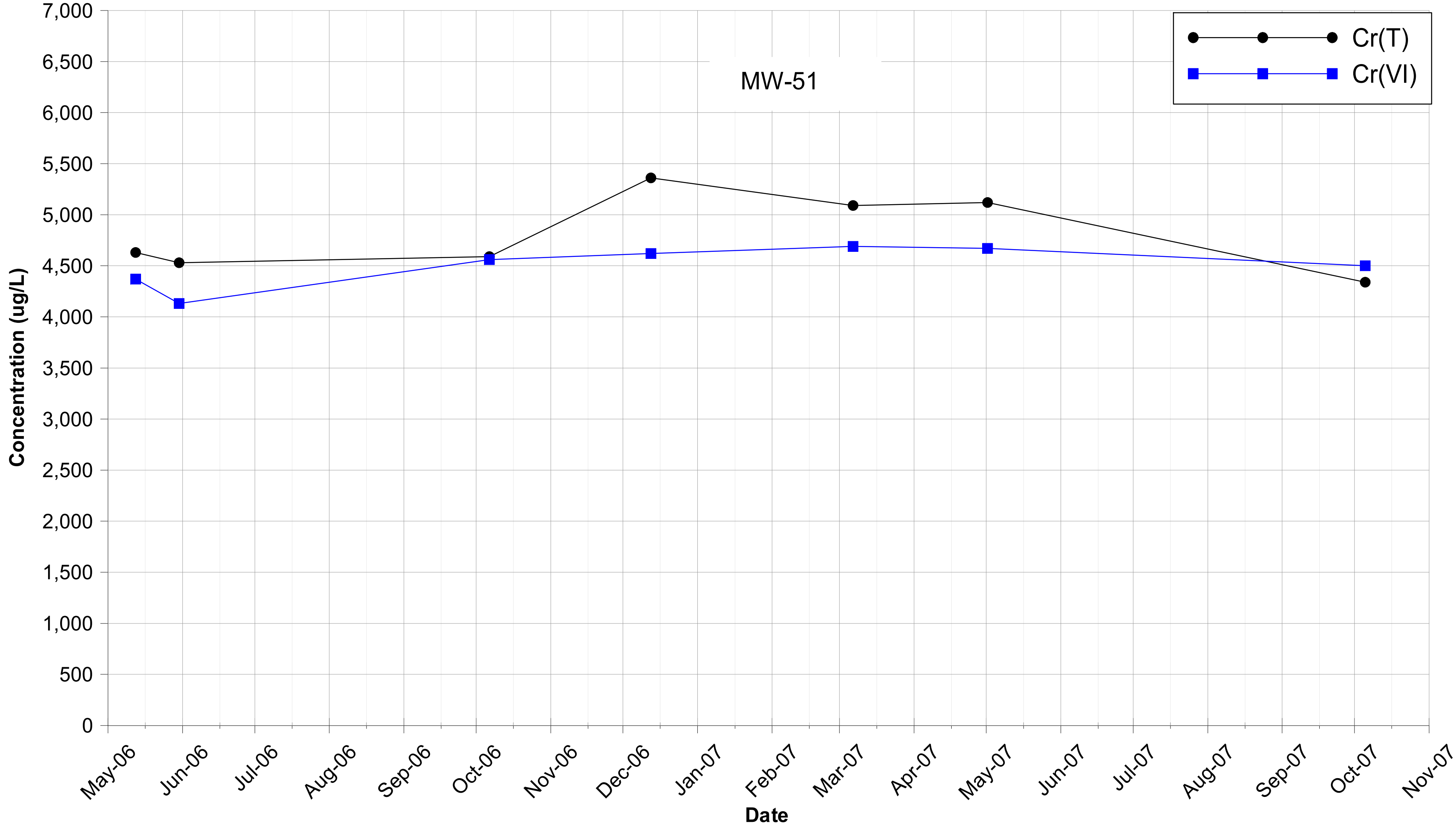

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CHROMIUM CONCENTRATION TRENDS, MW-51, MAY 2006 TO OCTOBER 2007

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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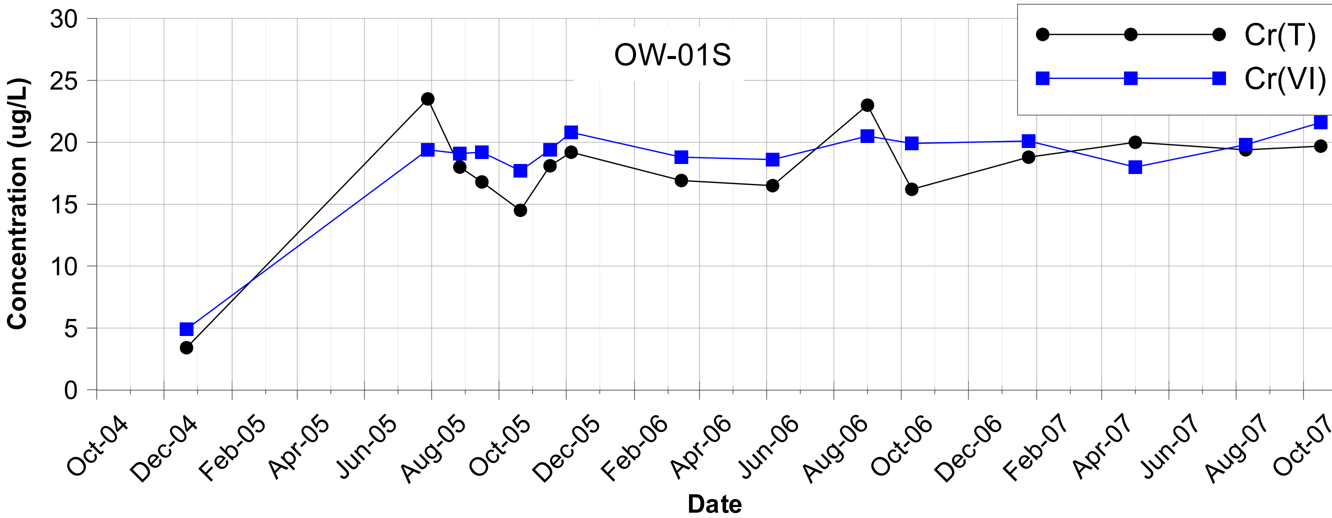

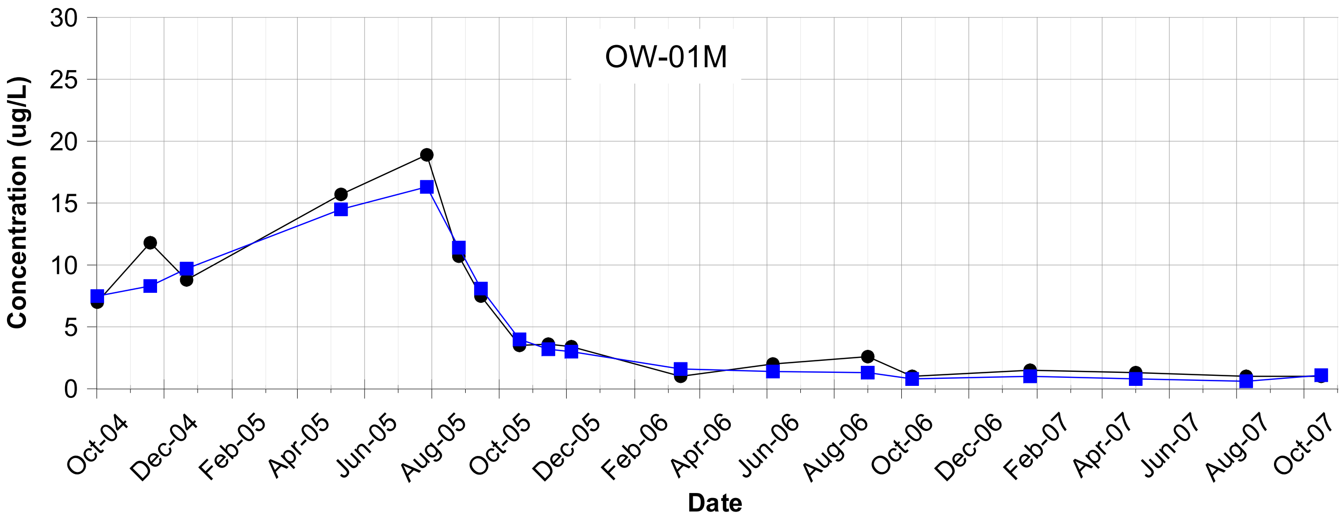

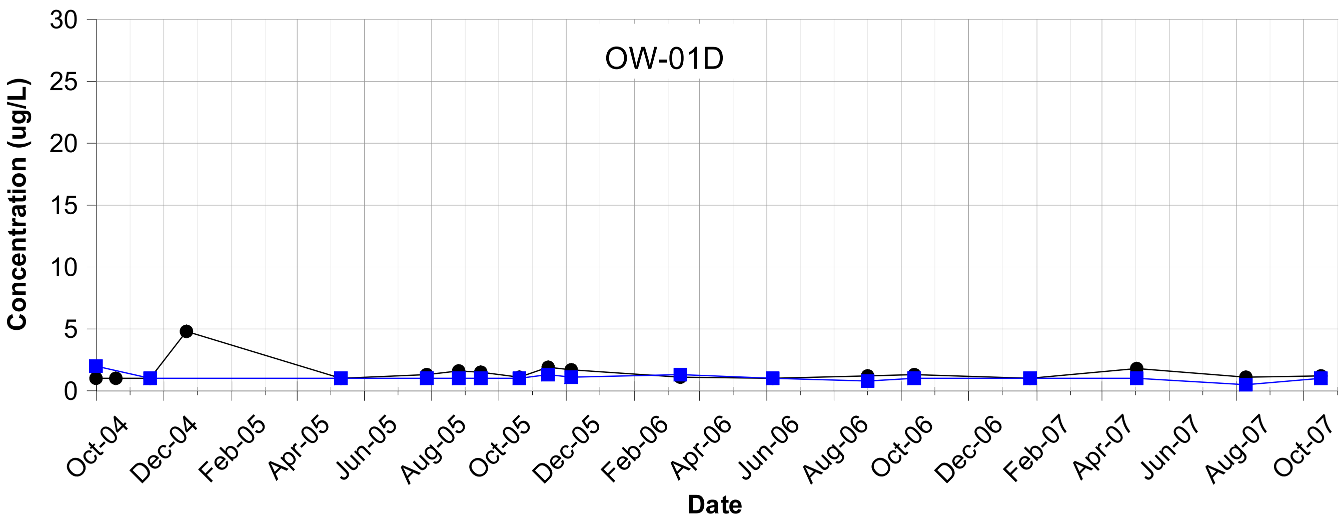

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CHROMIUM CONCENTRATION TRENDS, OW-01 CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
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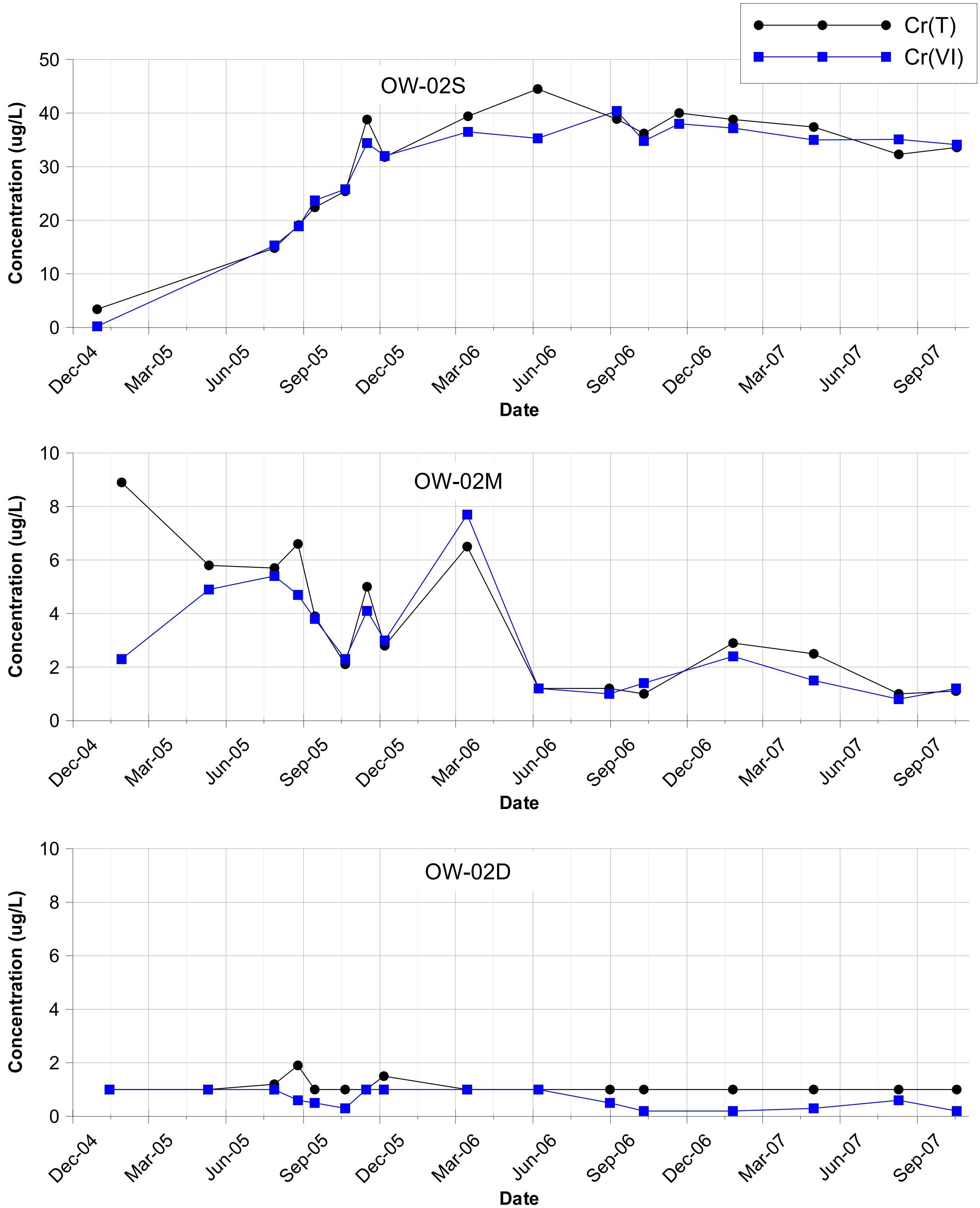

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CHROMIUM CONCENTRATION TRENDS, OW-02 CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
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NEEDLES, CALIFORNIA

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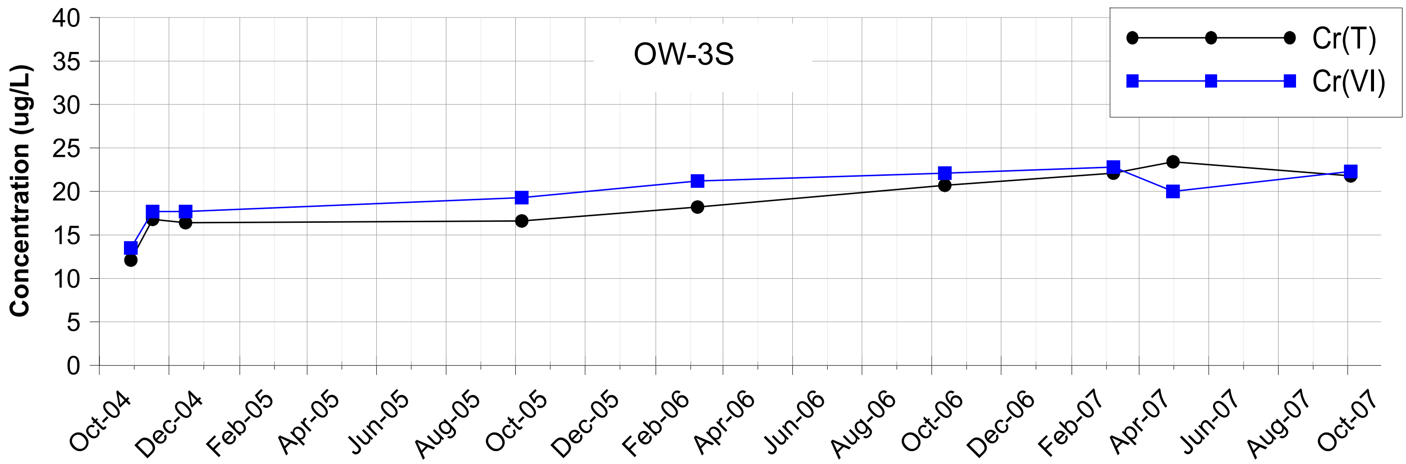

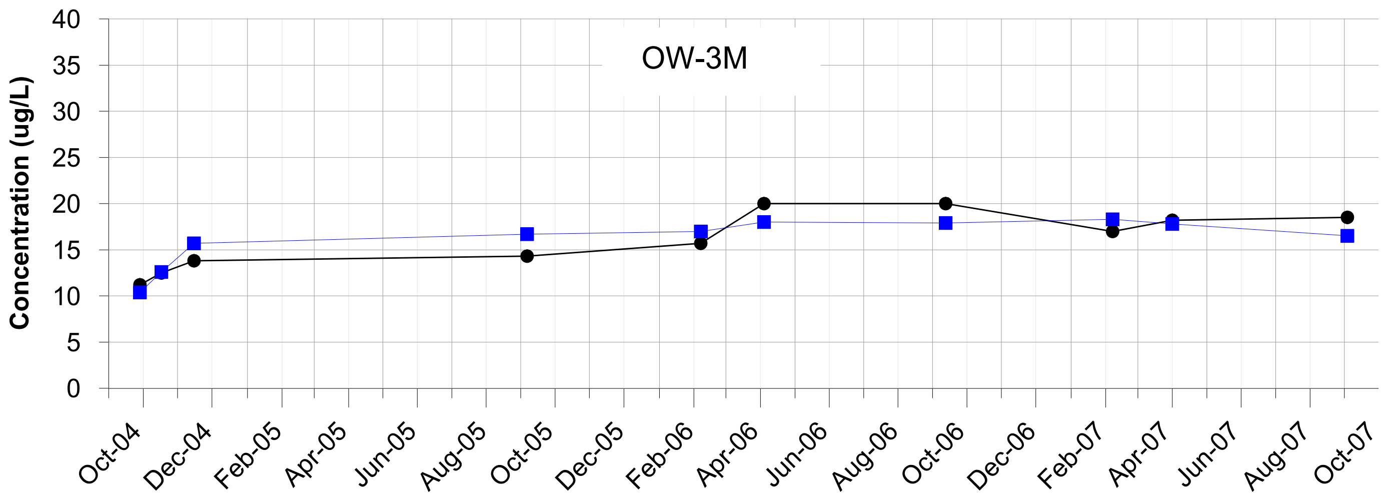

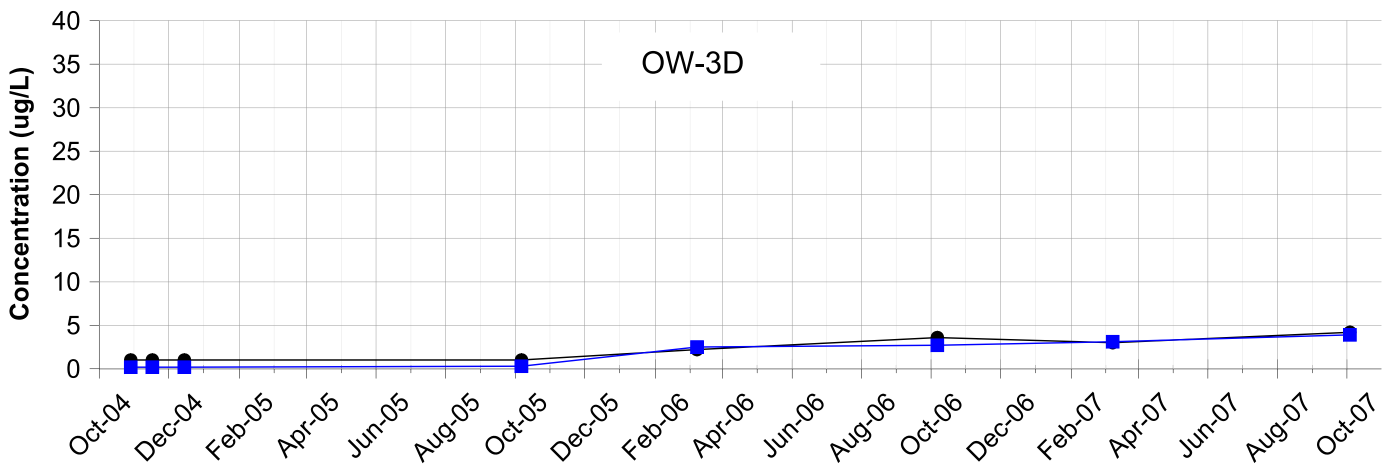

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CHROMIUM CONCENTRATION TRENDS, OW-3 WELL CLUSTER

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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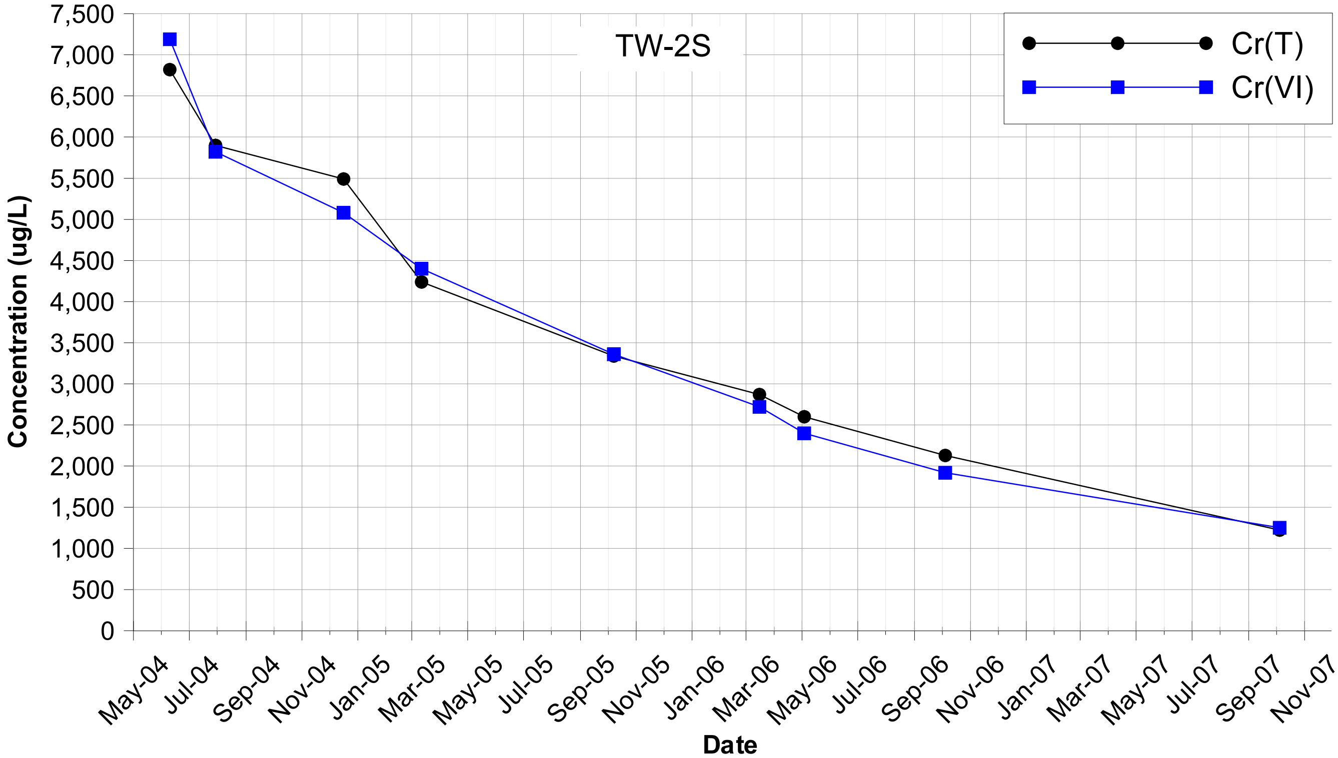

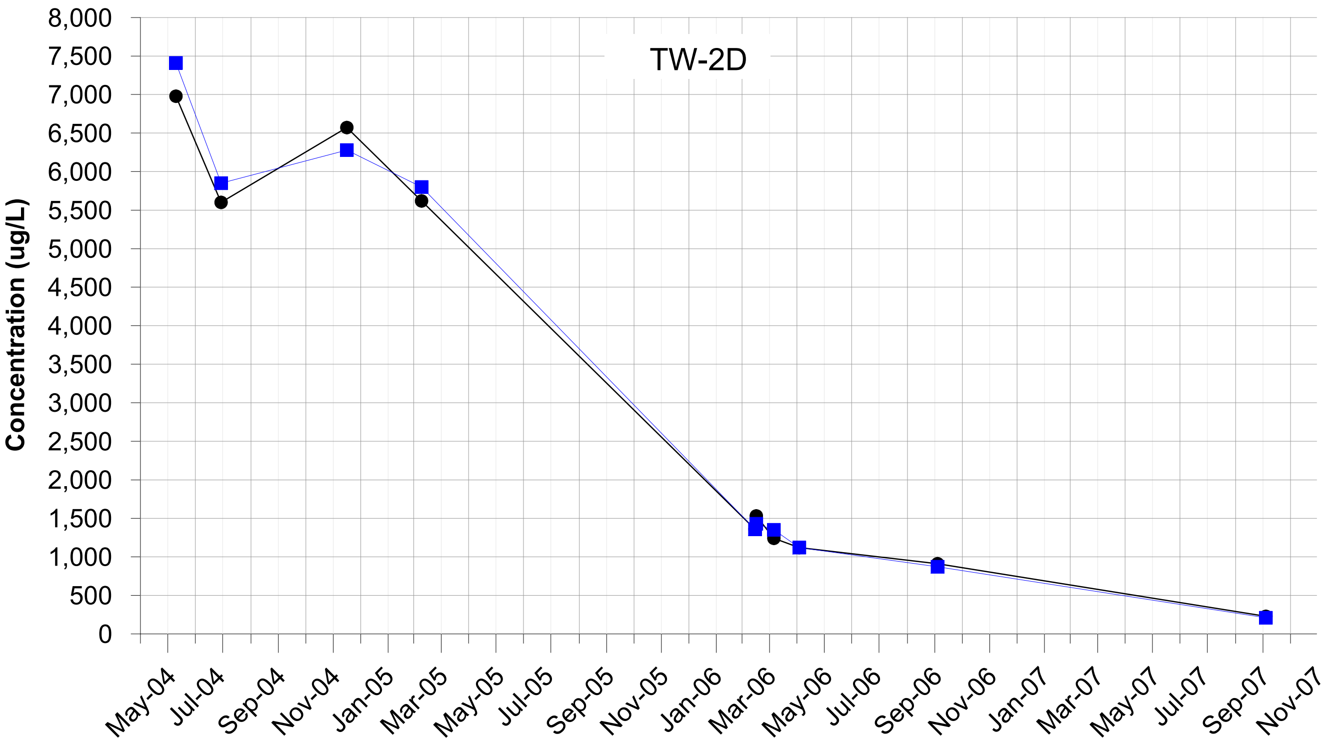

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CHROMIUM CONCENTRATION TRENDS,
TW-2 WELLS, JUNE 2007 TO SEPTEMBER 2007

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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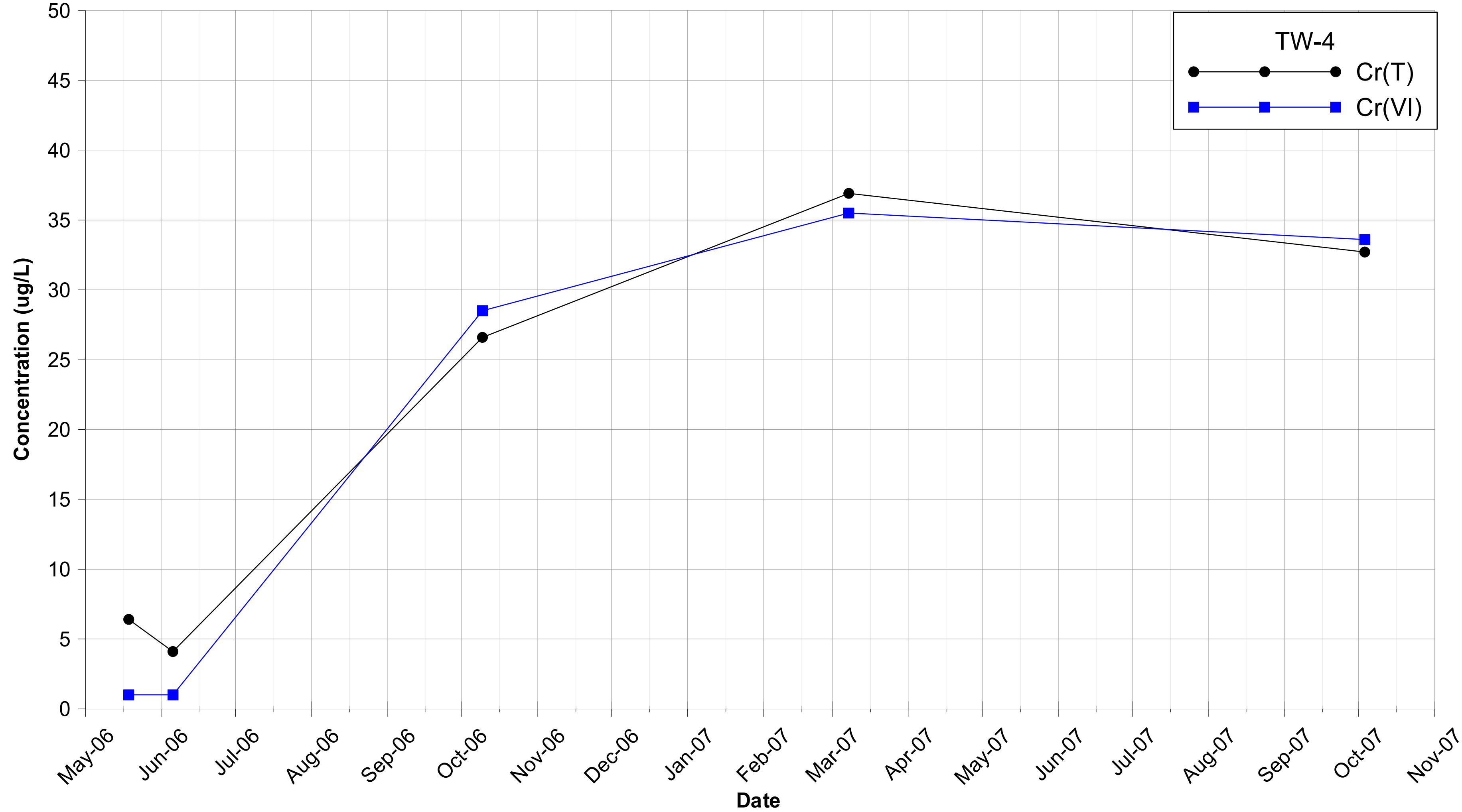

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CHROMIUM CONCENTRATION TRENDS,
TW-4, MAY 2006 TO NOVEMBER 2007

RCRA FACILITY INVESTIGATION/REMEDIAL
INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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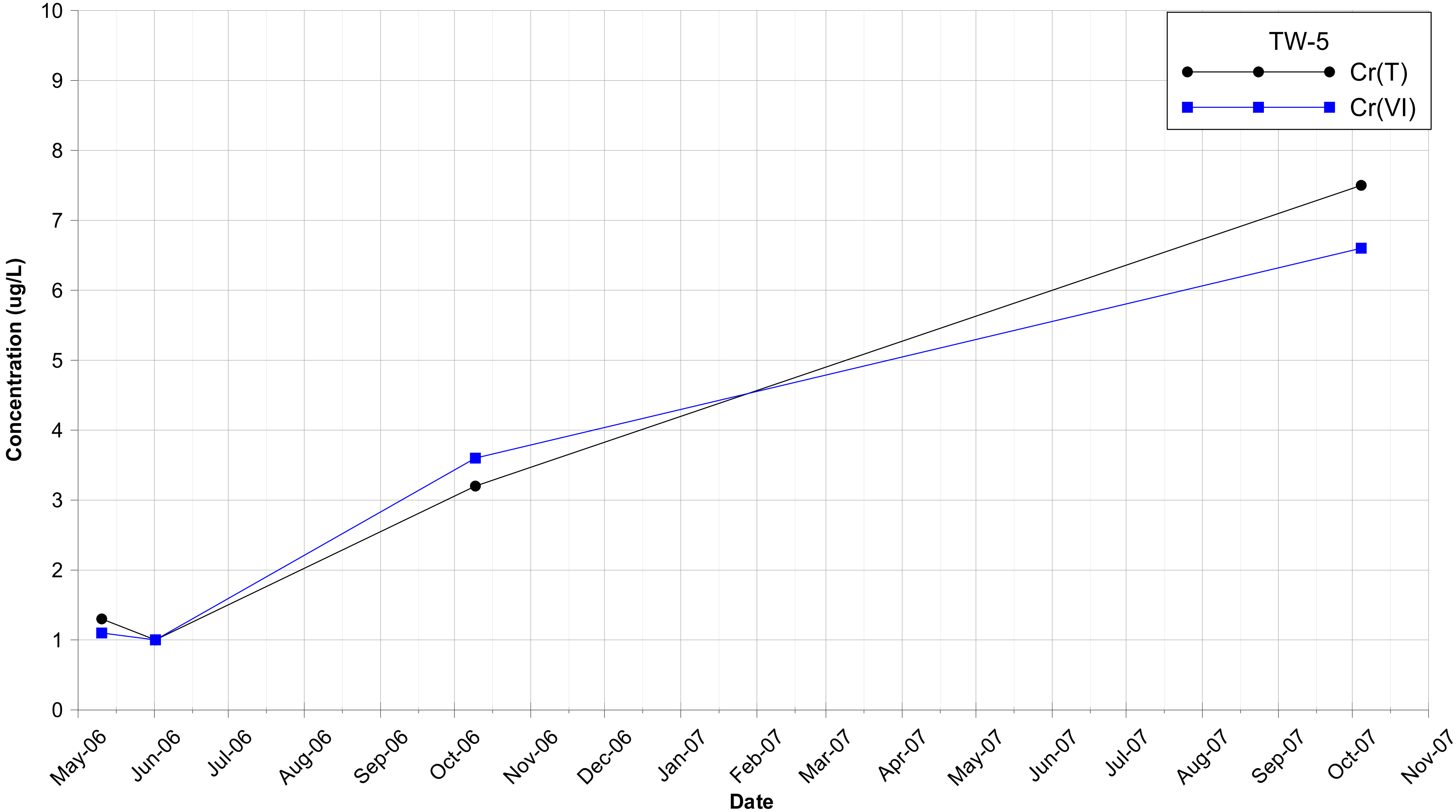

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CHROMIUM CONCENTRATION TRENDS, TW-5, MAY 2006 TO NOVEMBER 2007

RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION REPORT (VOLUME 2)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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Appendix J
Metropolitan Water District Colorado River Monitoring Data

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Executive Office

August 6, 2007

Yvonne Meeks
Topock Project Manager
Pacific Gas & Electric
4325 South Higuera Street
San Luis Obispo, CA 93401

Reply to: 700 Moreno Avenue
La Verne, CA 91750

Dear Ms. Meeks:

PG&E Topock Site – Colorado River Monitoring

Metropolitan Water District of Southern California (Metropolitan) has been monitoring chromium VI in the Colorado River from the Topock area for several years. Table 1 shows the results from three river locations. These water samples were collected from 1 foot depth below the water surface. Metropolitan recently began monitoring the sediment pore water from several locations in the river (Table 2). A map with location coordinates for each sample location is also included (Figure 1).

All analyses were conducted at Metropolitan's Water Quality Laboratory. The analyses for chromium VI and total chromium were conducted using US Environmental Protection Agency Methods 218.6 and 200.8, respectively.

If you have any questions or need additional information, please contact me at (909) 392-5294 or bkoch@mwdh2o.com.

Sincerely,

Bart Koch
Unit Manager

BK:smh
H://letter/bk pge Topock Colorado river monitoring.docx

Enclosures (3)

cc: Eric Fordham
Geopentech
525 North Cabrillo Park Drive
Suite 280
Santa Ana, CA 92701

David Gilbert
Pacific Gas & Electric
Chromium Remediation Program Office
Mail Code B24A
PO Box 770000
San Francisco, CA 94177

Table 1
Monthly Colorado River Chromium Monitoring at Topock (2003-current)
Metropolitan Water District of Southern California

	Near Park Moabi		Above Railroad		Downriver	
Sample Date	Hexavalent Chromium µg/L	Total Chromium µg/L	Hexavalent Chromium µg/L	Total Chromium µg/L	Hexavalent Chromium µg/L	Total Chromium µg/L
7/7/2003	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	NC	ND (<1.0)
8/4/2003	ND (<0.03)	ND (<1.0)	0.04	ND (<1.0)	NC	ND (<1.0)
9/9/2003	0.04	ND (<1.0)	0.03	ND (<1.0)	NC	ND (<1.0)
10/6/2003	0.03	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
11/3/2003	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
12/11/2003	ND (<0.03)	ND (<1.0)	0.04	ND (<1.0)	ND (<0.03)	ND (<1.0)
2/10/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
3/10/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
4/5/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
5/3/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
6/7/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
7/7/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
8/3/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
9/8/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
10/5/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
11/2/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
12/7/2004	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
3/8/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
4/12/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
5/10/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
6/14/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
7/12/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
8/9/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
9/13/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
10/11/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
11/8/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
12/13/2005	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
1/10/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
2/14/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
3/14/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
4/11/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	0.03	ND (<1.0)
5/9/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
6/13/2006	ND (<0.03)	ND (<1.0)	0.03	ND (<1.0)	ND (<0.03)	ND (<1.0)
7/11/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
8/8/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	0.03	ND (<1.0)
9/12/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
10/10/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
11/14/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
12/12/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
1/9/2007	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	0.04	ND (<1.0)
2/13/2007	0.03	ND (<1.0)	0.03	ND (<1.0)	0.03	ND (<1.0)

Table 1
Monthly Colorado River Chromium Monitoring at Topock (2003-current)
Metropolitan Water District of Southern California

	Near Park Moabi		Above Railroad		Downriver	
Sample Date	**Hexavalent Chromium µg/L**	**Total Chromium µg/L**	**Hexavalent Chromium µg/L**	**Total Chromium µg/L**	**Hexavalent Chromium µg/L**	**Total Chromium µg/L**
3/5/2007	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
3/5/2007	ND (<0.03)*	NC	--	--	ND (<0.03)**	NC
3/13/2007	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
4/10/2007	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
5/8/2007	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
6/12/2007	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)
7/10/2006	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)	ND (<0.03)	ND (<1.0)

NC = Not colletced
ND = Not detected at or above the minimum reporting level (MRL)
All samples collected at 1 foot below surface unless indicated otherwise
* sampled at 6 feet below surface
** sampled at 15 feet below surface

Table 2
Colorado River Pore Water/Sediment Interface Sampling at Topock
Metropolitan Water District of Southern California

		Depth (ft) from River Surface	Depth (ft) from water-sediment interface	Hexavalent Chromium µg/L	Total Chromium µg/L
Bat Cave Wash					
Pore Water	4/18/2007	12	7	ND (<0.03)	ND (<1.0)
Pore Water	7/11/2007	13	6	ND (<0.03)	ND (<1.0)
East Bank					
Water-Sediment Interface	3/5/2007	13		ND (<0.03)	ND (<1.0)
Pore Water	3/5/2007	13	5	ND (<0.03)	ND (<1.0)
Pore Water	4/18/2007	14	8	ND (<0.03)	ND (<1.0)
Pore Water	7/11/2007	15	10	ND (<0.03)	ND (<1.0)
Mid River					
Water-Sediment Interface	3/5/2007	9		ND (<0.03)	ND (<1.0)
Pore Water	3/5/2007	9	3	ND (<0.03)	ND (<1.0)
Pore Water	7/11/2007	6	3	ND (<0.03)	ND (<1.0)
West Bank					
Water-Sediment Interface	3/5/2007	5		ND (<0.03)	ND (<1.0)
Pore Water	3/5/2007	5	6	ND (<0.03)	ND (<1.0)
Pore Water	7/11/2007	5	7	ND (<0.03)	ND (<1.0)
Old Wash Outlet					
Pore Water	4/18/2007	12	7	ND (<0.03)	1.2
Pore Water	7/11/2007	11	10	ND (<0.03)	ND (1.0)

ND = Not detected at or above the minimum reporting level (MRL)

Metropolitan Water District of Southern California

Figure 1

Topock Cr6 Sample Locations

DISCLAIMER REGARDING PUBLIC RECORDS
This data is being provided as a public record of Metropolitan. Metropolitan makes no warranties, either expressed or implied, with respect to this data, its quality, or fitness for a particular purpose or use. Metropolitan makes no warranty with respect to the accuracy of the data provided, and in no event will be liable for direct, indirect, consequential or incidental damages resulting from any inaccuracies in the data. The requestor should review and evaluate the data requested to determine its suitability of use for their activities.

Note: This map was prepared by the Metropolitan Water District of Southern California for its own use. No warranty is expressed or implied as to the correctness, timeliness, or content of the information shown herein.

N

S

Not to Scale

Location:	Coordinate Data	
Near Park Moabi	N34.72956	W114.49981
Bat Cave Wash	N34.72495	W114.49245
East Bank	N34.72035	W114.48765
Mid River	N34.72034	W114.48811
West Bank	N34.72023	W114.48872
Above Railroad	N34.71845	W114.48823
Down River	N34.7145	W114.48238
Old Wash Outlet	N34.71483	W114.47418