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July 14, 2004

Norman Shopay
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Geology and Corrective Action Branch
700 Heinz Avenue, Suite 200
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Subject: Sampling and Analysis Plan and Proposed Modifications to the Groundwater and Surface Water Monitoring Program
PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

This letter transmits the *Sampling and Analysis Plan, Groundwater and Surface Water Monitoring* prepared for the PG&E Topock project. A draft version of the Sampling and Analysis Plan (Sampling Plan) for the Topock groundwater and surface water monitoring program (GMP) was submitted to DTSC June 15, 2004 in response to your request. DTSC staff provided initial comments on the draft Sampling Plan in a conference call on June 29, 2004. The enclosed Sampling Plan has been revised to incorporate DTSC's comments discussed during this conference call.

This letter additionally summarizes PG&E's recommendations for modifications to the current Topock GMP presented in Section 3.2 of the enclosed Sampling Plan. At DTSC's request, a re-evaluation of the monitoring scope and schedule for the GMP was completed as part of the update to the monitoring program. Based on review of the sampling data and project needs, the monitoring locations, sampling frequency, and analytical parameters for the GMP were assessed in the draft Sampling Plan and discussed with DTSC in the June 29, 2004 conference call. The proposed modifications to the monitoring program are presented in Figure 3-2 and Table 3-3 in the enclosed Sampling Plan. The primary modifications and changes proposed in the revised Sampling Plan are summarized below.

## MODIFICATIONS TO MONITORING FREQUENCY AND LOCATIONS

**Recommendation 1:** The current **weekly** well sampling activity (hexavalent and total chromium sampling in seven wells) should be transitioned to a **bi-weekly** sampling program, involving four wells selected to better monitor the plume edge nearest the Colorado River. This change is warranted because the seven wells in the current program have been sampled weekly over the past five months yielding a comprehensive set of results to evaluate groundwater data trends. Analysis of these trends indicates that concentrations in these wells are not changing rapidly enough to warrant weekly sampling.

<u>**Recommendation 2**</u>**:** The current **monthly** sampling activity (total and hexavalent chromium sampling at 12 wells and 9 river locations) should be expanded to include 11 additional new monitoring wells installed in the floodplain area in spring 2004. The monitoring data collected from an expanded monthly well sampling program (total 24 wells) will provide additional groundwater data at more strategically located wells to monitor a broader area and depth in the floodplain. The new monthly sampling program will be sufficient to maintain frequent monitoring at the critical existing and new floodplain wells and river locations.

<u>**Recommendation 3**</u>**:** The current **quarterly** groundwater monitoring program should be expanded to include all 22 new groundwater wells installed during the Interim Measures investigations in 2004. The sampling data from an expanded quarterly program (total 55 site wells) will provide more comprehensive site-wide monitoring of groundwater conditions and the chromium plume. As part of this proposed modification, two monitoring wells in background locations will be transitioned from quarterly sampling to **annual** sampling and one additional new well will be added to the annual program.

## MODIFICATIONS TO ANALYTICAL PARAMETERS

<u>**Recommendation 4**</u>**:** The updated Sampling Plan also proposes to discontinue routine quarterly sampling of three metals (copper, nickel, and zinc) that have been part of the GMP monitoring since 1997. The results from seven years of sampling indicate that these metals are generally detected at very low concentrations uniformly in the monitoring wells (not spatially related to the chromium plume or release areas associated with the Compressor Station). Based on the sampling data, continued quarterly monitoring of these metals in all site wells and river sampling locations is not warranted.

<u>**Recommendation 5**</u>**:** As discussed during the June 29, 2004 conference call, monitoring for the full list of metals (per California Code of Regulations, Title 26) in selected monitoring wells is deemed appropriate by DTSC to further establish water quality conditions at the site. Accordingly, nine selected wells will be sampled quarterly for Title 26 metals in the ongoing GMP.

## CONTINUING ASSESSMENT OF GMP

As presented in the Sampling Plan, the new site monitoring program will be continually evaluated and updated periodically as new monitoring needs arise. Additionally, if significant changes in chromium concentrations are observed, increased sampling will be implemented at DTSC's direction to maintain frequent monitoring of critical groundwater and river locations.

In summary, the updated Sampling Plan incorporates 22 new wells into the GMP and includes a combination of bi-weekly, monthly, quarterly, and annual sampling. The Sampling Plan was developed to provide a comprehensive assessment of groundwater conditions across the site.

We request DTSC concurrence with the proposed modifications to the Topock GMP summarized above and described in the more detail in the enclosed Sampling Plan. Please contact me at (805) 546-5243 if you have any questions on this proposal.

Sincerely,

Paul

for Yvonne Meeks

Enclosure

cc: CWG Members

# Sampling and Analysis Plan Groundwater and Surface Water Monitoring

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

Prepared for

**Pacific Gas and Electric Company**

July 14, 2004

Prepared by

**CH2MHILL**

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# Acronyms and Abbreviations

| | |
|---|---|
| CACA | Corrective Action Consent Agreement |
| COC | constituent of concern |
| Cr(T) | total chromium |
| Cr(VI) | hexavalent chromium |
| DTSC | Department of Toxic Substances Control |
| FTM | Field Task Manager |
| GMP | Groundwater and Surface Water Monitoring Program |
| HSP | Health and Safety Plan |
| IM | interim measures |
| MCL | maximum contaminant level |
| mg/L | milligrams per liter |
| ORP | oxidation-reduction potential |
| PCB | polychlorinated biphenyl |
| PG&E | Pacific Gas and Electric Company |
| PPE | personal protective equipment |
| QAPP | Quality Assurance Project Plan |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| SAP | sampling and analysis plan |
| SOP | standard operating procedure |
| SVOC | semi-volatile organic compound |
| TDS | total dissolved solids |
| TOC | total organic carbon |
| USEPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

# 1.0 Introduction

The Pacific Gas and Electric Company (PG&E) Topock Compressor Station is located in eastern San Bernardino County about 15 miles southeast of the city of Needles, California (Figure 1-1). In February 1996, PG&E and the Department of Toxic Substances Control (DTSC) entered into a Corrective Action Consent Agreement (CACA) pursuant to Section 25187 of the California Health and Safety Code. Under the terms of the CACA, PG&E was directed to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and implement corrective measures at the site to address constituents of concern associated with discharges of chromium-bearing wastewater in the Bat Cave Wash area adjacent to the Compressor Station.

This sampling and analysis plan (SAP) for groundwater and surface water monitoring was prepared by CH2M HILL for PG&E in support of RFI and corrective measures activities at the Topock Compressor Station. This SAP is submitted by PG&E in response to DTSC requirements for a revised and updated water quality SAP (DTSC 2004a).

This SAP is prepared to support the Topock groundwater and surface water monitoring program (GMP). However, to ensure consistency in all groundwater and surface water data collected from the site, this SAP will also be used to support other groundwater sampling and investigations being performed in support of RFI, interim measures (IM), and corrective measures studies.

The objectives of this SAP are to:

- Document the specific procedures and equipment to be used while performing groundwater and surface water monitoring at the site.
- Provide guidelines for the review and management of the analytical data generated during groundwater and surface water sampling events.
- Present the current schedule and analytical program for GMP monitoring and sampling.
- Present proposed modifications to sampling locations, sampling frequency, and analytical parameters for the GMP.

Two companion documents, a quality assurance project plan (QAPP) and a health and safety plan (HSP) have also been prepared to support the laboratory analyses and field sampling activities, respectively. The QAPP is provided as Appendix B of this document, while the HSP (CH2M HILL 2004a) is a separate document. This water quality SAP, the QAPP, and the HSP will be used in conjunction to guide and direct all groundwater and surface water sampling activities at the Topock site.

This updated SAP provides description of the site constituents of concern (COCs) for groundwater monitoring, analytical methods and reporting limits, groundwater and surface water monitoring locations, sampling frequency, and the field methods and procedures used for the current Topock GMP. Beginning in November 2003, at DTSC's request, monthly well sampling and, in January 2004, weekly well sampling, were added to the

GMP. Additionally, during March to May 2004, 22 new groundwater monitoring wells were installed at the Topock site as part of the IM hydrogeologic investigations (CH2M HILL 2004b). Therefore, it is appropriate as part of preparing an updated SAP to review and assess the major components of the current GMP, specifically monitoring locations, analytical parameters, and sampling frequency. Based on the review of the GMP and new site investigation data, recommendations for modifying the Topock GMP are presented in this SAP (Section 3.0).

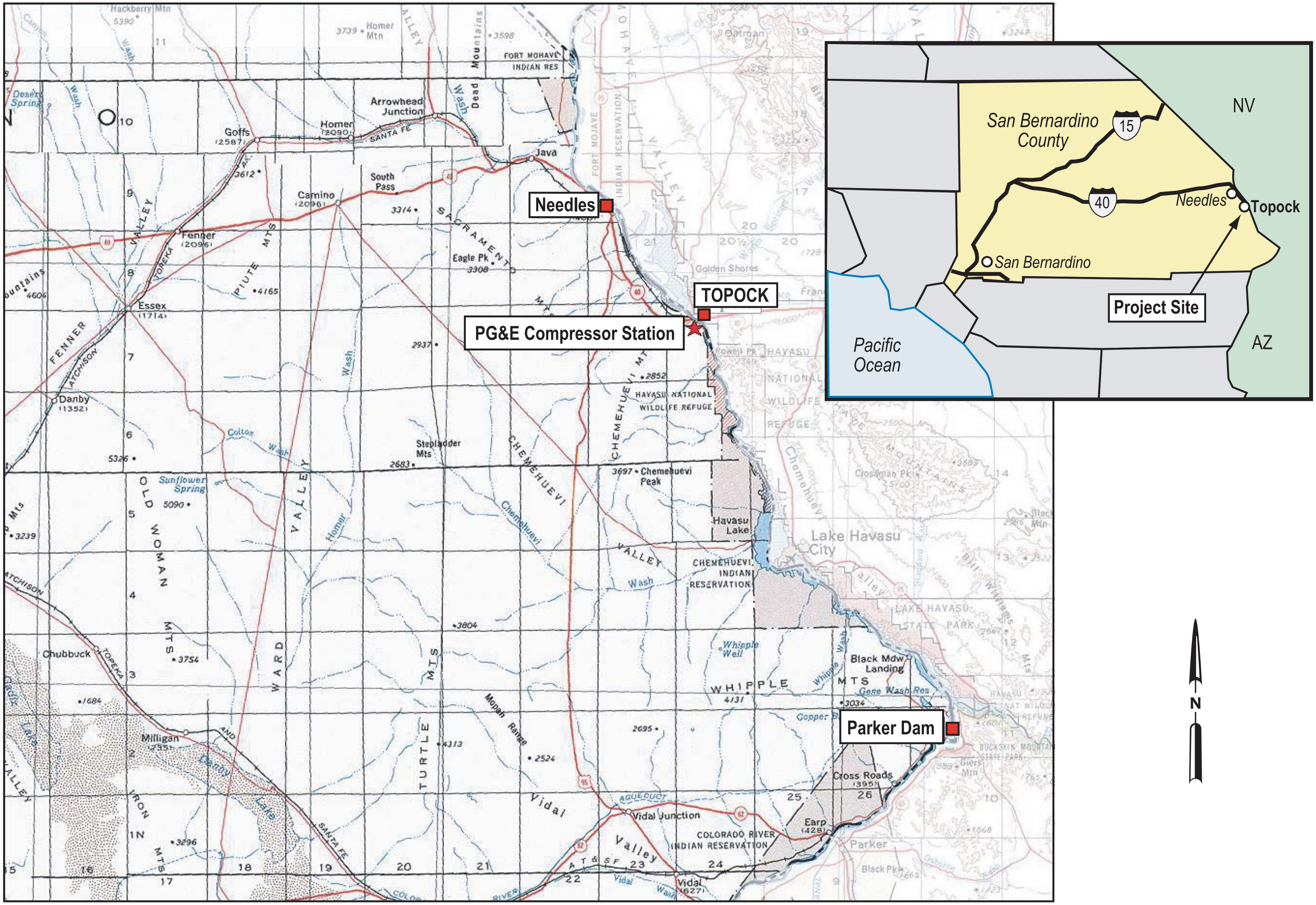


FIGURE 1-1
SITE LOCATION MAP
SAMPLING AND ANALYSIS PLAN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

# 2.0 Background

This section provides a description of the Topock Compressor Station site and its operational history. It also provides a summary of site geology, hydrogeology, and groundwater geochemistry; describes the COCs for groundwater and surface water; and presents the currently identified extent of groundwater impacts.

## 2.1 Site Description

The Topock facility began operations in 1951 to compress natural gas supplied from the southwestern United States for transport through pipelines to PG&E's service territory in central and northern California. The facility occupies approximately 100 acres owned by PG&E along Interstate 40 in San Bernardino County, California, about 15 miles to the southeast of the City of Needles. However, the study area covers land that is owned and managed by a number of government agencies, as shown in Figure 2-1.

The existing facility includes the compressor building, two water cooling towers, and an electric generator building for supplying power to the facility. Adjacent to the main buildings are various auxiliary buildings including offices, a warehouse, a vehicle garage, maintenance, equipment and chemical storage, an oil/water separator, and a water softener building. There are also tanks at the facility that are used for storage of water treatment chemicals, new and used compressor oil, and wastewater. Former structures that have been removed from service, or clean-closed in accordance with regulatory requirements, include a chromium treatment system, a chromate sludge reduction tank, and a chromate sludge drying bed *(*E&E 2004*)*.

From 1951 to 1985, a chromium-based corrosion inhibitor was added to the cooling water prior to its use in the cooling towers. In 1985, PG&E replaced the chromium-based corrosion inhibitor with a phosphate-based corrosion inhibitor.

## 2.2 Geology and Hydrogeology

The site is characterized by arid conditions (with precipitation averaging less than 5 inches/year) and high temperatures. Vegetation is very sparse except in the river floodplain where dense stands of tamarisk and occasional mesquite trees occur. The local near-surface geology consists of recent and older river deposits in the floodplain area progressing westward to older alluvial deposits derived from the local mountains. The alluvial deposits and fluvial deposits in the flood plain comprise the principal groundwater aquifer at the site. The main surface water drainage into the Colorado River is from Bat Cave Wash, an ephemeral streambed that flows only briefly following rain events. The Bat Cave Wash drainage originates in the Chemehuevi Mountains west of the site and extends to the Colorado River. This north-tending wash received the original discharges of cooling water-containing chromium, as described below. Topography near the site is abrupt, rising from around 450 feet above mean sea level at the Colorado River to over 1,200 feet above mean sea level within a mile to the south and southwest.

Groundwater occurs primarily in unconsolidated alluvial sediments that underlie the study area north of the mountains. The saturated unconsolidated sediments are referred to as the Alluvial Aquifer. The main water-bearing zone of the subsurface is within sands and gravels associated with river and alluvial deposition.

Recent unconsolidated fluvial sediments consisting primarily of sand, silt, and clay occur along the floodplain area of the Colorado River. These sediments include Colorado River dredge materials blanketing the floodplain. The fluvial sediments are mostly saturated and are hydraulically connected to the Alluvial Aquifer.

The unconsolidated alluvial sediments cover the majority of the study area and consist of poorly-sorted sand and gravel with minor silt and clay deposits. The aquifer is highly heterogeneous, as is typical of most alluvial aquifers. The saturated thickness of the Alluvial Aquifer is approximately 100 feet near the River and thins to the west, pinching out along the bedrock outcrops west and south. Sediments comprising the Alluvial Aquifer are very porous and permeable, with hydraulic conductivity ranging from $1.0 \times 10^{-4}$ centimeters per second (cm/sec) to $1.0 \times 10^{-2}$ cm/sec (0.3 to 30 feet per day).

Underlying the alluvium at the Topock site is the Red Fanglomerate, a Miocene deposit of cemented sandy gravel (E&E 2004). The fanglomerate has been identified in several site wells, though the depth of the alluvium-fanglomerate contact varies. The Bouse Formation has been mapped nearby and, where present, it lies between the fanglomerate and the alluvium. It has not been positively identified in the boring logs of site wells, though distinction from the alluvium may not be apparent. The Bouse Formation was deposited in brackish or salt water and, where present, may be a source of salts in site groundwater.

The basement bedrock of the area is composed of metadiorite and gneiss evident in the surrounding mountains. In both the fanglomerate and bedrock, groundwater occurs in secondary fractures. Local wells in these zones (PGE-7, PGE-8, MW-23, and MW-24BR) yield very little to moderate volumes of water.

Groundwater is encountered as little as 4 feet below ground surface in shallow wells in the current floodplain to over 200 feet at MW-16 in the western portion of the site. Horizontal groundwater gradients are slight, from $10^{-4}$ to $10^{-3}$. The gradients suggest a north-northeast flow direction, and the distribution of chromium in groundwater samples supports these flow directions. Water levels in well clusters at MW-20, MW-24, MW-32, MW-33, and MW-34 all display upward gradients on the order of $10^{-2}$, about 10 to 20 times the magnitude of the horizontal gradients. This is consistent with the typical conceptual model of regional groundwater flow systems in arid basins, where groundwater recharge occurs primarily at the margins of the basin and groundwater discharges to streams or springs near the center of the basins.

Interaction of groundwater with the Colorado River is complex. The daily fluctuations in river stage cause the surface water-groundwater interaction at this site to be very dynamic. Pressure transducers have been installed in newer wells close to the River to monitor more closely the changes in water levels and to define better the surface water-groundwater interaction.

## 2.3 Groundwater Geochemistry

Groundwater in the Topock area has high total dissolved solids (TDS) concentrations. TDS concentrations in local groundwater can be over 40,000 milligrams per liter (mg/L). Samples collected from most of the monitoring wells have TDS in the range of 1,000 to 3,000 mg/L. However, groundwater sampled in bedrock/fanglomerate wells and deep alluvium wells displays higher values (8,000 to 12,000 mg/L). In contrast, water from the Colorado River has TDS concentrations ranging from 400 to 800 mg/L.

Sources of salts are: (1) connate water in bedrock, (2) remnants of the Bouse Formation where it still exists, (3) evaporite salts associated with recent fluvial sands, (4) dredge spoils, salts exuded by tamarisk (*Tamarix* sp.), and (5) potentially, historic PG&E cooling water discharges, reported to be about 6,600 mg/L (PG&E 1997). As a result, the concentration of TDS in groundwater varies considerably across the site.

Results of groundwater sampling show major ions are dominated by sodium and chloride, with sulfate also significant in some wells (up to 1,300 mg/L). Indications of reduction-oxidation (redox) conditions reflect oxidizing conditions in the Alluvial Aquifer; however, more reducing conditions are observed in monitoring wells in the floodplain.

## 2.4 Constituents of Concern

Sitewide groundwater investigation of the Topock site began in 1997 as part of the RFI (E&E 2004). The primary COCs for groundwater at the Topock site are hexavalent chromium [Cr(VI)] and total chromium [Cr(T)], derived from salts used historically as a corrosion inhibitor in the station's cooling towers (Alisto 1997). Based on historical disposal practices and on data from previous investigations, the CACA also identified copper, nickel, zinc, pH, and electrical conductance as site COCs (DTSC 1996). This list of seven COCs has been the focus of the Topock RFI groundwater investigations and the primary parameters analyzed under the ongoing GMP (E&E 2004; CH2M HILL 2003).

## 2.5 Nature and Extent of Chromium in Groundwater

Currently, under the GMP quarterly monitoring activity, samples are collected from 35 groundwater wells and nine surface water locations and analyzed for the site COCs. Figure 2-2 presents the Cr(VI) results distribution from the most recent March 2004 quarterly monitoring event of the GMP monitoring wells and surface water locations. Figure 2-2 also shows the approximate outline of Cr(VI) in groundwater greater than 0.050 mg/L (the California maximum contaminant level [MCL] for total chromium) based on the March 2004 sampling results. A summary and complete results of the March 2004 quarterly monitoring event are presented in the *Groundwater and Surface Water Monitoring Report, First Quarter 2004* (CH2M HILL 2004c).

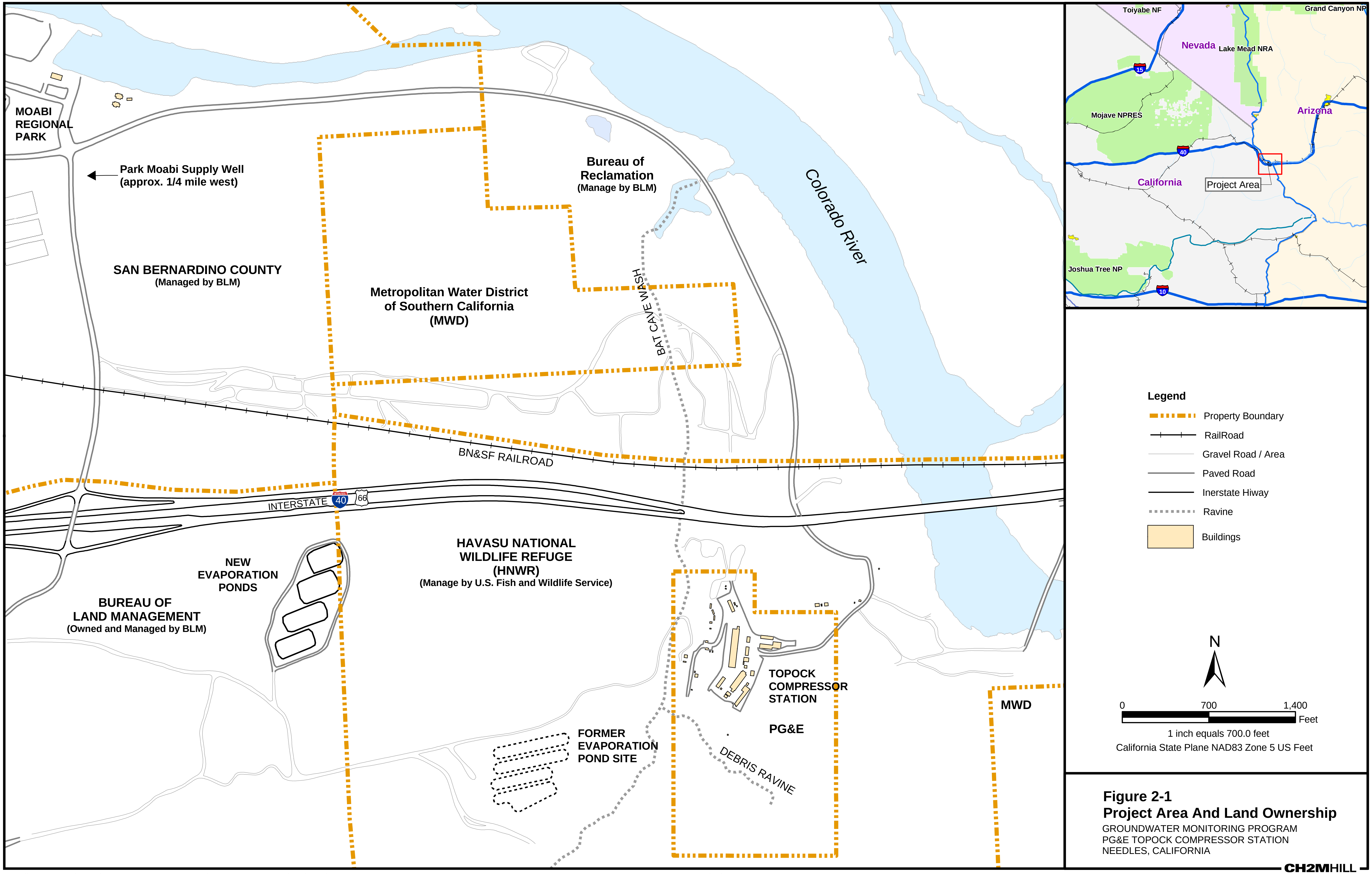
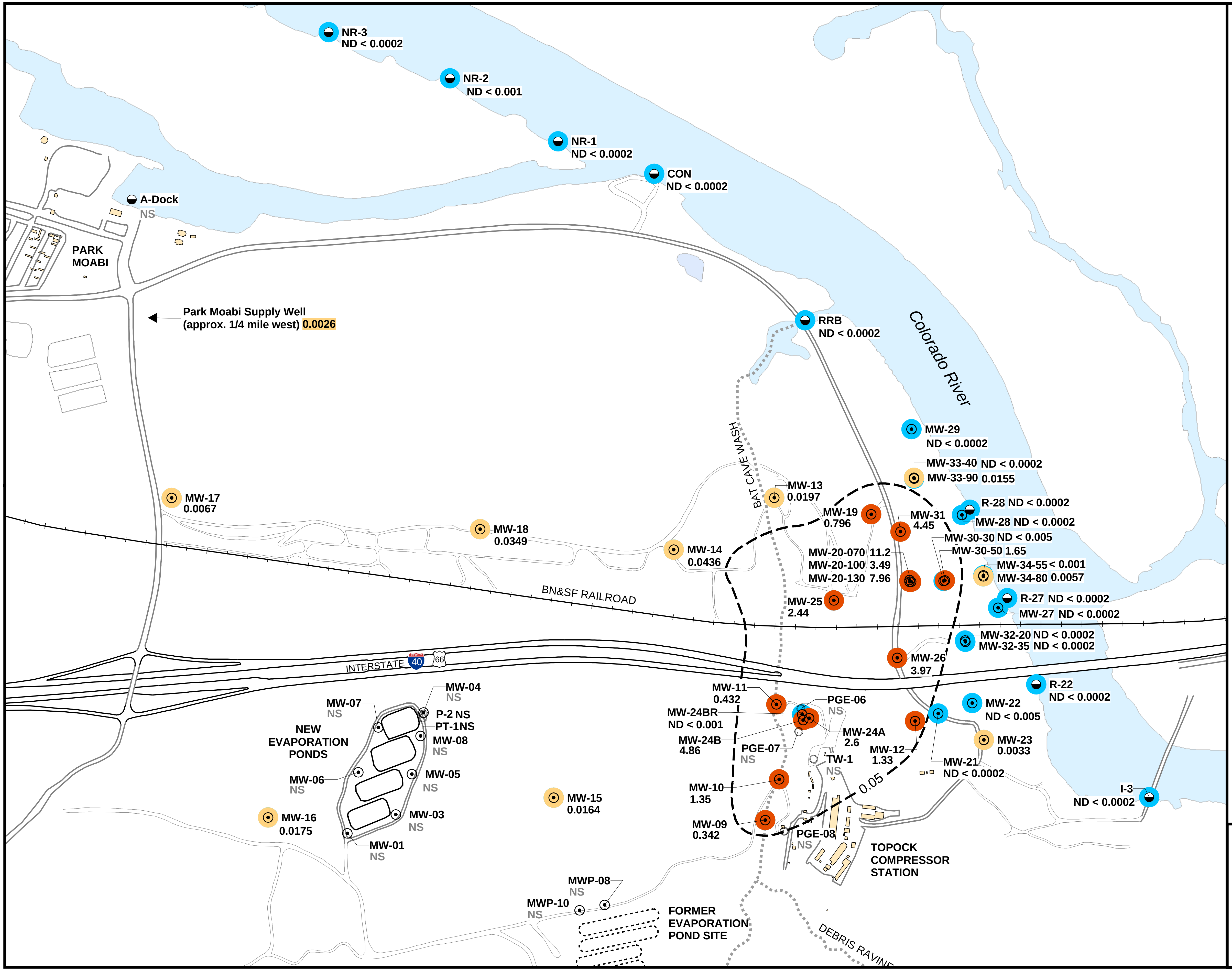


**Figure 2-1**
**Project Area And Land Ownership**
GROUNDWATER MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



**Legend**

⊙ Groundwater Monitoring Well

○ Groundwater Test Well
or Supply Well (Inactive)

◒ Surface Water Monitoring Location

Sampling conducted March 15-19, 2004

3.47 Concentration of hexavalent chromium [Cr(VI)] in milligrams per liter (mg/L)
Results shown are maximum concentrations of primary and duplicate samples

ND < 0.0002 Cr(VI) not detected, at analytical detection (Method SW 7199)

NS Not sampled

**Cr(VI) Concentrations in Water Samples**

● Not detected at analytical reporting limit

● Concentration between reporting limit and 0.05 mg/L

● Concentration greater than 0.05 mg/L

0.05 Approximate outline of Cr(VI) in groundwater >= 0.05 mg/L (California drinking water standard for Total Chromium)

N

0 750 1,500 Feet

## Figure 2-2
## Hexavalent Chromium Sampling Results March 2004 Quarterly Event Groundwater and Surface Water Monitoring

GROUNDWATER MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

# 3.0 Groundwater and Surface Water Sampling Program

## 3.1 Current Monitoring Program

Routine groundwater and surface water monitoring activities were initiated in 1998 as a continuation of the RFI groundwater investigations (E&E 2004). The program initially consisted of quarterly sampling of the monitoring wells and surface water stations developed during the RFI and periodic sampling of the inactive supply wells. The original sampling program was subsequently modified at DTSC's request as follows:

- Beginning in November 2003, monthly sampling of 11 selected monitoring wells on the Colorado River floodplain was initiated for more frequent monitoring of water quality in this area of the site (CH2M HILL 2003).
- Beginning in late January 2004, the weekly sampling of six selected wells in the floodplain area was initiated (DTSC 2004b).
- In February 2004, surface water sampling of the Colorado River (nine locations) was incorporated in the monthly monitoring activity (DTSC 2004c).
- Beginning in mid-May 2004, an additional (seventh) monitoring well on the floodplain was added to the weekly sampling activity (DTSC 2004a).

The current GMP sampling and water quality monitoring activities are performed in accordance with PG&E's *Sampling and Analysis Plan for September 2003 Quarterly Groundwater Monitoring* (Sampling Plan) (CH2M HILL 2003). In February 2004, a supplement to the Sampling Plan was prepared and implemented to provide for a comparison of the groundwater sampling methods used for the monitoring wells in the floodplain area of the site (CH2M HILL 2004d). Following this comparison, the well-volume sampling method was used for the GMP sampling of the monitoring wells in the floodplain.

### 3.1.1 Monitoring Locations and Sampling Frequency

The current GMP, as of May 2004, involves the collection of samples from groundwater wells and surface water stations according to the following schedules:

- Thirty-five groundwater wells and nine surface water stations are sampled quarterly.
- Three inactive supply wells are sampled every 2 years (December events).
- Twelve groundwater wells and nine surface water stations are sampled monthly.
- Seven groundwater wells in the floodplain are sampled weekly.

Figure 3-1 shows the locations of the groundwater wells and surface water stations monitored in the current Topock GMP. Figure 3-1 also indicates the frequency of sampling for the groundwater wells and surface water locations in the GMP.

### 3.1.2 Analytical Parameters

Under the current quarterly schedule, groundwater and surface water are analyzed for the following site COCs: Cr(VI); dissolved Cr(T), copper, nickel, zinc; pH; and electrical conductivity (also referred to as specific conductance). For both the monthly and weekly sampling activities, the water samples are collected for Cr(VI) and Cr(T) analyses only. Groundwater/surface water elevation data and field water quality data are also measured during the monitoring events. Field water quality parameters consist of specific conductance, oxygen-reduction potential (ORP), dissolved oxygen (DO), pH, temperature, total dissolved solids (TDS), and turbidity.

Table 3-1 summarizes the analytical test methods and reporting limits for the site COCs analyzed from groundwater, surface water, and water supply sources under the current GMP. Beginning in September 2003, at DTSC request, a new analytical method (SW 7199) was added for Cr(VI) analyses of water samples at low detection limit (standard reporting limit 0.0002 mg/L). Additionally, the Cr(VI) and Cr(T) analytical methods for drinking water (United States Environmental Protection Agency [USEPA] 218.6, USEPA 200.7) were incorporated for the sampling of active supply wells (e.g., Park Moabi well, Figure 3-1).

For reference in this SAP, Table 3-1 also lists the regulatory drinking water standards for the site COCs, including both primary and secondary MCLs (state and/or federal standards). The State MCL for Cr(T) is 0.050 mg/L and the federal MCL is 0.100 mg/L. There are currently no established groundwater regulatory criteria for Cr(VI).

Groundwater samples are also periodically analyzed for general chemistry parameters including TDS, dissolved total organic carbon (TOC), oxygen 18, deuterium, chloride, sulfate, nitrate, fluoride, barium, calcium, iron, magnesium, manganese, potassium, sodium, alkalinity (carbonate and bicarbonate), orthophosphate, ammonia, and sulfide (see QAPP, Appendix B).

Additionally, at the request of DTSC (DTSC 2004d), additional analytical parameters were requested for selected wells sampled during the June 2004 sampling event. These additional parameters consist of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), perchlorate, polychlorinated biphenyls (PCBs), and California Code of Regulations, Title 26 metals (i.e., aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, molybdenum, selenium, silver, thallium, vanadium, and zinc) (see QAPP, Appendix B).

## 3.2 Proposed Modifications to Monitoring Program

Routine groundwater monitoring has been conducted for the majority of the site RFI wells for since 1997-1998 (over 6 years of quarterly monitoring data). Since late January 2004, the frequency of monitoring and quantity of GMP data has significantly increased for selected wells associated with the recent monthly and weekly sampling programs. Additionally, 22 new groundwater monitoring wells have been installed at the site as part of the 2004 IM site investigations.

Accordingly, a preliminary review and re-evaluation of the monitoring needs for the Topock GMP was completed for inclusion in this water quality SAP. Based on review of the available monitoring data and existing/new monitoring locations, the key components of the GMP (monitoring objectives, monitoring locations, sampling frequency, analytical parameters) are described below and recommendations for modifying the GMP are provided.

### 3.2.1 Monitoring Objectives

The primary purpose of the GMP is to monitor concentrations of Cr(VI), Cr(T), and other site COCs in groundwater so that changes in the distribution or concentration of the COCs can be identified and used in project decision-making and remedial planning. Additionally, the GMP collects groundwater elevation and general chemistry data to support site characterization and other studies.

The data quality objectives developed for the RFI (Alisto 1997; E&E 2004) and GMP include:

- Collection of spatially-appropriate chemical and hydraulic data representative of the site.
- Collection of groundwater data on an appropriate frequency (e.g., quarterly or monthly) to assess changes in distribution and concentration of the COCs.
- Use of appropriate State-certified laboratory methods for the COC analyses and data quality control measures to support decision-making.
- Achieving laboratory reporting limits at levels below screening criteria (i.e., drinking water MCLs).

These data quality objectives are sufficient to support data needs for the current and future GMP and IM activities at the Topock site.

### 3.2.2 Monitoring Locations and Sampling Frequency

Concurrent with preparing this updated water quality SAP, groundwater data from the existing program and new IM groundwater investigations were reviewed to re-assess the monitoring needs and scope for the ongoing GMP. Table 3-2 summarizes well depth, monitoring interval, and sampling information for the 35 wells in the current GMP and the 22 new IM investigation wells installed during spring 2004.

Table 3-3 summarizes information on chromium sampling including the number of sampling events and the minimum and maximum Cr(VI) concentrations detected for the GMP/IM wells. Table 3-3 also summarizes the well status and current sampling frequency for the GMP wells. It should be noted that the second round of groundwater sampling of the new IM investigation wells is being performed in mid-June 2004 and therefore only the initial (April-May 2004) sampling results for these new wells are summarized in Table 3-3.

Based on the available sampling results and monitoring data, several modifications to the sampling locations and frequency for the Topock GMP are proposed at this time. The intent of the modifications proposed in this SAP is to optimize the location and collection of water quality data in areas of new and existing wells where IM activities and remediation efforts will be focused (see Table 3-3 for rationale).

The proposed additions and modifications to the GMP are shown on Figure 3-2 and include:

- All 22 new IM investigation wells will be incorporated in the GMP. The proposed sampling frequencies for the first year sampling of the new IM wells include quarterly, monthly, and biweekly (as described below). These "initial" sampling frequencies are subject to revision based on trend analysis and consideration of data needs after the first year of monitoring.
- As of July 9, 2004, 20 **weekly** sampling events (in addition to monthly and quarterly sampling) have been conducted, generating a sufficient set of monitoring results to evaluate data trends in the seven selected floodplain wells. Analysis of these trends indicates that concentrations in these wells are not changing rapidly enough to warrant weekly sampling. Accordingly it is proposed that the **weekly** well sampling activity be replaced with **biweekly** well sampling of four selected floodplain wells: MW-33-90, MW-34-80, MW-28-90, and MW-36-100 (see Table 3-3 for rationale). Groundwater sampling at these locations on a biweekly schedule is considered an appropriate frequency to monitor potential changes in chromium concentrations in deeper groundwater in these areas of the floodplain.
- The current **monthly** well sampling activity should be expanded to include 11 new IM investigation wells that monitor shallow and deep intervals in two areas in the floodplain: six wells at MW-39 and five wells at MW-36. Monthly sampling at these locations will be sufficient to verify initial sampling results and document potential temporal variations in water quality at these locations. It is also proposed that well MW-21 in the current monthly program be reduced to quarterly sampling frequency (see Table 3-3 for rationale). No other changes to the monthly program are recommended at this time.
- Monitoring wells MW-16 and MW-17 (located in the western portion of the site), installed as background wells for the RFI, have been monitored on a quarterly schedule for over 6 years and are recommended for **annual** monitoring under the ongoing GMP.

There are no changes warranted or recommended for the current river sampling activity, which involves monthly (chromium only) and quarterly (site COC) sampling at nine locations.

Figure 3-2 shows the specific monitoring locations and revised sampling frequency for the Topock GMP recommended for implementation during the second half of 2004.

### 3.2.3 Analytical Parameters

The current analytical program for the GMP consists of the analysis for Cr(VI), Cr(T), copper, nickel, zinc, specific conductance, and pH. Based on data collected to date and the objectives and requirements of GMP and IM activities, Cr(VI), Cr(T), specific conductance, and pH are considered primary parameters that require continued monitoring at the Topock site. However, continued monitoring for copper, nickel, and zinc in the site groundwater wells is not warranted.

Figure 3-3 presents in graphic format the detected concentrations of dissolved copper, nickel, and zinc from 1997 to 2004 sampling data for the GMP wells. These data indicate that over the 7-year period from 1997 to 2004, no groundwater samples contained detected concentrations of copper or zinc that exceeded MCLs. In addition, over that same time period, only eight groundwater samples contained nickel at concentrations slightly above the MCL. Figure 3-4 presents the geographic distribution of detected concentrations of dissolved copper, nickel, and zinc from the March 2004 quarterly sampling event. These data indicate that detected concentrations of copper, nickel, and zinc in groundwater are spatially variable, suggesting that the presence of these metals in groundwater is not related to activities at the compressor station.

Based on the available data trends from RFI (E&E 2004) and GMP sampling, it is recommended that copper, nickel, and zinc be removed from the list of site COCs sampled during the ongoing quarterly monitoring program. At the request of DTSC, quarterly sampling for the full list of metals (per California Code of Regulations, Title 26) will be incorporated, starting in September 2004, at the following locations: MW-20-70, MW-20-130, MW-34-55, MW-34-80, MW-10, MW-11, MW-25, MW-12, and MW-37D.

### 3.2.4 Continuing Assessment of Monitoring Program

Pending approval by DTSC, the proposed modifications to the GMP will be implemented during the second half of 2004. The components of the ongoing GMP, specifically monitoring locations, sampling frequency, and analytical parameters, will be re-assessed annually and revised as needed to address the evaluation new data and current monitoring and remediation design needs. When program modifications have been reviewed and approved by the DTSC, the GMP description table and summary map (Table 3-3 and Figure 3-2, respectively) will be updated and issued as revisions to this SAP.

# Table 3-1
## Site COCs, Test Methods, and Reporting Limits
## Topock Groundwater and Surface Water Monitoring Program

| Site Constituents of Concern (COCs) | Groundwater | | Surface Water | | Drinking Water production wells | | Drinking Water Maximum Contaminant Levels [4] (mg/L) |
|---|---|---|---|---|---|---|---|
| | Analytical Method | Minimum Reporting Limit [1] (mg/L) | Analytical Method | Minimum Reporting Limit [1] (mg/L) | Analytical Method | Minimum Reporting Limit [1] (mg/L) | |
| **Hexavalent Chromium** | SW 7196A [2] | 0.010 | --- | --- | --- | --- | *not established* |
| **Hexavalent Chromium** | SW 7199 [3] | 0.0002 | SW 7199 [3] | 0.0002 | EPA 218.6 | 0.0002 | *not established* |
| **Total Chromium** | SW 6010B | 0.001 | SW 6010B | 0.001 | EPA 200.7 | 0.001 | 0.050 |
| **Copper** | SW 6010B | 0.01 | SW 6010B | 0.01 | EPA 200.7 | 0.01 | 1.30 |
| **Nickel** | SW 6010B | 0.02 | SW 6010B | 0.02 | EPA 200.7 | 0.02 | 0.100 |
| **Zinc** | SW 6010B | 0.02 | SW 6010B | 0.02 | EPA 200.7 | 0.02 | 5.00 |
| **pH** | EPA 150.1 | 0.1 pH units | EPA 150.1 | 0.1 pH units | EPA 150.1 | 0.1 pH units | 6.5 to 8.5 pH units |
| **Specific Conductance** | EPA 120.1 | 2 μmhos/cm | EPA 120.1 | 2 μmhos/cm | EPA 120.1 | 2 μmhos/cm | 1,600 μmhos/cm |

**NOTES:**

[1] Minimum reporting limit for undiluted samples. Reporting limits are increased when sample dilution is required.

[2] Method SW 7196A is used for samples collected from monitoring wells where prior monitoring has detected hexavalent chromium [Cr(VI)] concentrations above 0.010 milligrams per liter (mg/L). The minimum reporting limit for Method 7196A for undiluted samples is 0.010 mg/L.

[3] Method SW 7199 is used for all surface water samples and all groundwater samples collected from monitoring wells where prior monitoring has not detected Cr(VI) concentrations above 0.010 mg/L.

[4] Drinking water maximum contaminant levels (MCLs) listed are California primary MCLs, except specific conductance (Federal & California secondary MCL), and pH (California secondary MCL).

# Table 3-2
# Well Construction and Sampling Summary
# Topock Project Groundwater Monitoring

| Well ID | Site Area | Measure Point Elevation feet MSL | Screen Interval feet BGS | Well Casing | Well Depth feet BGS | Depth to Water May-04 feet TOC | Sampling System | Typical Purge Rate gpm | Typical Purge Volume gallons | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **MW-09** | Bat Cave Wash | 536.56 | 77 - 87 | 4" PVC | 89 | 81 | CD pump | 3 | 11 | |
| **MW-10** | Bat Cave Wash | 530.65 | 74-94 | 4" PVC | 95 | 74 | CD pump | 5 | 40 | |
| **MW-11** | Bat Cave Wash | 522.61 | 63-83 | 4" PVC | 84 | 67 | CD pump | 5 | 30 | |
| **MW-12** | east of Station | 484.01 | 28-48 | 4" PVC | 49 | 29 | CD pump | 10 | 40 | |
| **MW-13** | Bat Cave Wash | 488.64 | 29-49 | 4" PVC | 50 | 32 | CD pump | 4 | 30 | |
| **MW-14** | | 570.99 | 111-131 | 4" PVC | 132 | 116 | CD pump | 4 | 30 | |
| **MW-15** | | 641.52 | 181-201 | 4" PVC | 202 | 185 | CD pump | 5 | 30 | |
| **MW-16** | near New Ponds | 657.31 | 198-218 | 4" PVC | 218 | 202 | CD pump | 7 | 35 | |
| **MW-17** | | 589.96 | 130-150 | 4" PVC | 151 | 134 | CD pump | 5 | 32 | |
| **MW-18** | | 545.32 | 85-105 | 4" PVC | 105 | 90 | CD pump | 5 | 30 | |
| **MW-19** | | 499.92 | 46-66 | 4" PVC | 66 | 44 | CD pump | 7 | 41 | |
| **MW-20-70** | MW-20 bench | 500.15 | 50-70 | 4" PVC | 70 | 45 | CD pump | 10 | 53 | |
| **MW-20-100** | MW-20 bench | 500.58 | 90-100 | 4" PVC | 100 | 47 | CD pump | 10 | 110 | |
| **MW-20-130** | MW-20 bench | 500.66 | 121-131 | 4" PVC | 131 | 52 | CD pump | 10 | 180 | |
| **MW-21** | east of Station | 505.55 | 49-59 | 4" PVC | 60 | 50 | CD pump | 10 | 10 | low recharge well; purges dry at 1 casing volume |
| **MW-22** | floodplain | 460.72 | 6-11 | 2" PVC | 11 | 6 | Peristaltic | 0.2 | 4 | |
| **MW-23** | east of Station | 507.33 | 60-80 | 4" PVC | 80 | 53 | CD Pump | 5 | 20 | low recharge well; purges dry at 1 casing volume |
| **MW-24A** | MW-24 bench | 567.16 | 104-124 | 4" PVC | 125 | 112 | CD pump | 3 | 30 | |
| **MW-24B** | MW-24 bench | 564.76 | 194-214 | 4" PVC | 214 | 110 | CD pump | 7 | 210 | |
| **MW-24BR** | MW-24 bench | 563.95 | 378-438 | 4" PVC | 438 | 109 | CD pump | 8 | 185 | low recharge well; purges dry at 1 casing volume |
| **MW-25** | | 542.90 | 85-105 | 4" PVC | 105 | 87 | CD pump | 5 | 32 | |
| **MW-26** | | 502.22 | 52-72 | 4" PVC | 71 | 46 | CD pump | 7 | 50 | |
| **MW-27** | floodplain | 460.56 | 7-17 | 2" PVC | 17 | 4 | Redi-Flo AR | 1 | 7 | using temporary Redi-Flo pump 6/04 |
| **MW-28-25** | floodplain | 466.85 | 13-23 | 2" PVC | 23 | 10 | Redi-Flo AR | 1 | 5 | using temporary Redi-Flo pump 6/04 |
| **MW-28-90** | floodplain | 467.66 | 70-90 | 2" PVC | 95 | 12 | Redi-Flo AR | 2 | 50 | |
| **MW-29** | floodplain | 485.21 | 30-40 | 2" PVC | 40 | 29 | Redi-Flo AR | 0.5 | 6 | using temporary Redi-Flo pump 6/04 |
| **MW-30-30** | floodplain | 468.12 | 12-32 | 2" PVC | 32 | 12 | Redi-Flo AR | 1.5 | 10 | using temporary Redi-Flo pump 6/04 |
| **MW-30-50** | floodplain | 468.81 | 41-51 | 4" PVC | 51 | 13 | Redi-Flo AR | 2 | 75 | |
| **MW-31-060** | MW-20 bench | 496.81 | 42-62 | 4" PVC | 62 | 41 | CD pump | 7 | 40 | |
| **MW-31-135** | MW-20 bench | 498.11 | 113-133 | 2" PVC | 133 | 42 | Redi-Flo AR | 3 | 60 | using temporary Redi-Flo pump 6/04 |
| **MW-32-20** | floodplain | 461.51 | 10-20 | 2" PVC | 20 | 6 | Redi-Flo AR | 1.5 | 6 | using temporary Redi-Flo pump 6/04 |
| **MW-32-35** | floodplain | 461.63 | 28-35 | 4" PVC | 35 | 5 | Redi-Flo AR | 2 | 60 | using temporary Redi-Flo pump 6/04 |

# Table 3-2
# Well Construction and Sampling Summary
# Topock Project Groundwater Monitoring

| Well ID | Site Area | Measure Point Elevation feet MSL | Screen Interval feet BGS | Well Casing | Well Depth feet BGS | Depth to Water May-04 feet TOC | Sampling System | Typical Purge Rate gpm | Typical Purge Volume gallons | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **MW-33-40** | floodplain | 487.41 | 30-40 | 4" PVC | 40 | 31 | Redi-Flo AR | 0.5 | 4 | using temporary Redi-Flo pump 6/04 |
| **MW-33-90** | floodplain | 487.57 | 77-87 | 4" PVC | 87 | 31 | Redi-Flo AR | 2 | 110 | |
| **MW-34-55** | floodplain | 460.88 | 45-55 | 4" PVC | 55 | 5 | Redi-Flo AR | 2 | 100 | using temporary Redi-Flo pump 6/04 |
| **MW-34-80** | floodplain | 460.99 | 73-83 | 4" PVC | 83 | 5 | Redi-Flo AR | 3 | 150 | |
| **MW-35-060** | north area | 483.51 | 37-57 | 2" PVC | 57 | 28 | Redi-Flo AR | 2 | 18 | using temporary Redi-Flo pump 6/04 |
| **MW-35-135** | north area | 483.57 | 117-137 | 2" PVC | 157 | 28 | Redi-Flo AR | 3 | 66 | using temporary Redi-Flo pump 6/04 |
| **MW-36-20** | floodplain | 469.32 | 10-20 | 1" PVC | 20 | 13 | Peristaltic | 0.5 | 4 | |
| **MW-36-40** | floodplain | 469.64 | 30-40 | 1" PVC | 40 | 14 | Peristaltic | 0.5 | 4 | |
| **MW-36-50** | floodplain | 469.65 | 46-51 | 1" PVC | 51 | 14 | Peristaltic | 0.8 | 5 | |
| **MW-36-70** | floodplain | 469.31 | 60-70 | 1" PVC | 70 | 13 | Peristaltic | 0.5 | 7 | |
| **MW-36-90** | floodplain | 469.68 | 80-90 | 1" PVC | 90 | 14 | Peristaltic | 0.4 | 10 | |
| **MW-36-100** | floodplain | 469.69 | 88-98 | 2" PVC | 108 | 13 | Redi-Flo AR | 2 | 45 | |
| **MW-37S** | Bat Cave Wash | 485.97 | 64-84 | 2" PVC | 84 | 30 | Redi-Flo AR | 2 | 30 | using temporary Redi-Flo pump 6/04 |
| **MW-37D** | Bat Cave Wash | 486.19 | 180-200 | 2" PVC | 225 | 30 | Redi-Flo AR | 3 | 100 | using temporary Redi-Flo pump 6/04 |
| **MW-38S** | Bat Cave Wash | 525.51 | 75-95 | 2" PVC | 95 | 90 | Redi-Flo AR | 1 | 13 | using temporary Redi-Flo pump 6/04 |
| **MW-38D** | Bat Cave Wash | 525.31 | 153-173 | 2" PVC | 188 | 68 | Redi-Flo AR | 3 | 60 | using temporary Redi-Flo pump 6/04 |
| **MW-39-40** | floodplain | 468.02 | 30-40 | 1" PVC | 40 | 12 | Peristaltic | 0.5 | 3.5 | |
| **MW-39-50** | floodplain | 467.93 | 47-52 | 1" PVC | 52 | 12 | Peristaltic | 0.5 | 5 | |
| **MW-39-60** | floodplain | 468.00 | 49-59 | 1" PVC | 64 | 12 | Peristaltic | 0.5 | 6 | |
| **MW-39-70** | floodplain | 468.02 | 60-70 | 1" PVC | 70 | 12 | Peristaltic | 0.5 | 7 | |
| **MW-39-80** | floodplain | 467.92 | 70-80 | 1" PVC | 80 | 12 | Peristaltic | 0.5 | 9 | |
| **MW-39-100** | floodplain | 468.01 | 80-100 | 2" PVC | 115 | 12 | Redi-Flo AR | 2 | 45 | |
| **MW-40S** | I-40 median | 566.04 | 115-135 | 2" PVC | 135 | 110 | Redi-Flo AR | 2 | 13 | using temporary Redi-Flo pump 6/04 |
| **MW-40D** | I-40 median | 566.08 | 240-260 | 2" PVC | 265 | 110 | Redi-Flo AR | 1-2 | 75 | using temporary Redi-Flo pump 6/04 |
| **Water Supply Wells** | | | | | | | | | | |
| **PGE-6** | MW-24 bench | 563.32 | 110-180 | 14" steel | 180 | 108 | CD pump | 24 | 650 | inactive supply |
| **PGE-7** | MW-24 bench | 563.89 | 195-330 | 14" steel & 7" | 330 | 109 | CD pump | 12 | 600 | inactive supply |
| **PGE-8** | Station | 596.01 | 405-554 | 8" steel | 562 | 114 | CD pump | 20 | 1,900 | inactive injection |
| **Park Moabi** | Park Moabi | 518.55 | 80-200 | 8" steel | 210 | 61 | active supply well | --- | --- | call Park Ranger to schedule sampling |
| **TW-01** | Plan B test | 620.55 | 169-269 | 5" PVC | 269 | 167 | CD pump | 20 | 200 | inactive pilot test well |

# Table 3-2
## Well Construction and Sampling Summary
## Topock Project Groundwater Monitoring

| **Well ID** | Site Area | Measure Point Elevation feet MSL | Screen Interval feet BGS | Well Casing | Well Depth feet BGS | Depth to Water May-04 feet TOC | Sampling System | Typical Purge Rate gpm | Typical Purge Volume gallons | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **Other Site Wells not in GMP** | | | | | | | | | | |
| **TW-2S** | MW-20 bench | 499.05 | 44-94 | 6" PVC | 99 | 42 | CD pump | --- | --- | IM extraction well |
| **TW-2D** | MW-20 bench | 499.57 | 113-153 | 6" PVC | 153 | 42 | CD pump | --- | --- | active IM extraction well |
| **MW-01** | New Ponds | 661.76 | 201-211 | 4" PVC | 212 | 209 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **MW-03** | New Ponds | 650.51 | 189-207 | 4" PVC | 207 | 194 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **MW-04** | New Ponds | 625.73 | 165-175 | 4" PVC | 177 | 169 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **MW-05** | New Ponds | 635.69 | 176-185 | 4" PVC | 185 | 179 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **MW-06** | New Ponds | 642.84 | 185-194 | 4" PVC | 194 | 186 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **MW-07** | New Ponds | 631.91 | 173-182 | 4" PVC | 183 | 175 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **MW-08** | New Ponds | 627.54 | 169-178 | 4" PVC | 179 | 170 | air bladder pump | --- | --- | active PG&E pond monitoring well |
| **P-2** | New Ponds | NA | 239-249 | 4" PVC | 249 | 170 | --- | --- | --- | inactive monitoring well |
| **MWP-08** | Old Ponds | 677.48 | 181-211 | 3" PVC | 211 | --- | --- | --- | --- | inactive monitoring well |
| **MWP-10** | Old Ponds | 675.81 | 194-234 | 3" PVC | 235 | --- | --- | --- | --- | inactive monitoring well |
| **MWP-12** | Old Ponds | 663.49 | 96-136 | 4" PVC | 143 | --- | --- | --- | --- | inactive monitoring well |
| **PGE-9N** | Topock AZ | 462.21 | 26-95 | 12" steel | 95 | --- | --- | --- | --- | inactive supply, well ID 15N/21W3A |
| **PGE-9S** | Topock AZ | 461.99 | 30-100 | 12" steel | 100 | --- | --- | --- | --- | inactive supply, well ID 15N/21W3B |

**NOTES:**

1. Well elevations from well surveys conducted Feb. 2004 and May 2004. Well depth, and screen interval and water level depths rounded-off to whole-foot values.
2. Abbreviations: BGS = below ground surface, MSL = mean sea level, TOC = top of polyvinyl chloride (PVC) casing, NA = not known or available
3. CD pump = dedicated constant-discharge electric submersible pump, Redi-Flo AR = adjustable-rate electric submersible pump
4. All GMP wells except low recharge wells and Park Moabi well are purged and sampled using well-volume method.

# Table 3-3
## Monitoring Wells, Cr(VI) Sampling History, and Proposed Sampling Frequency
## Topock 2004 Groundwater Monitoring Program

| | | Cr(VI) Sampling Summary $^{2}$ -- through May 21, 2004 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Well ID** | **Monitored Zone $^{1}$** | Date Installed | Number of Sampling Events | Number of Events Cr(VI) Detected | **Minimum Cr(VI) Concentration** (mg/L) | **Maximum Cr(VI) Concentration** (mg/L) | **Well Status** | **Current Sampling Frequency $^{3}$** | **Proposed Sampling Frequency $^{4}$** | **Rationale for 2004 Sampling Frequency** | **Proposed Modifications to Quarterly Analyses** |
| **MW-09** | Upper UA | Jul-97 | 24 | 24 | 0.33 | 0.402 | existing GMP | **Q** | **Q** | | DELETE Cu, Ni, Zn |
| **MW-10** | Upper UA | Jun-97 | 24 | 24 | 0.755 | 3.47 | existing GMP | **Q** | **Q** | | **ADD** full-list CATitle 26 metals |
| **MW-11** | Upper UA | Jun-97 | 24 | 24 | 0.02 | 1.71 | existing GMP | **Q** | **Q** | | **ADD** full-list CATitle 26 metals |
| **MW-12** | Upper UA | Jul-97 | 24 | 24 | 0.311 | 1.39 | existing GMP | **Q** | **Q** | | **ADD** full-list CATitle 26 metals |
| **MW-13** | Upper UA | Jul-97 | 24 | 22 | 0.01 | 0.028 | existing GMP | **Q** | **Q** | | DELETE Cu, Ni, Zn |
| **MW-14** | Upper UA | Jul-97 | 23 | 22 | 0.01 | 0.099 | existing GMP | **Q** | **Q** | | DELETE Cu, Ni, Zn |
| **MW-15** | Upper UA | Jul-97 | 22 | 13 | 0.01 | 0.05 | existing GMP | **Q** | **Q** | | DELETE Cu, Ni, Zn |
| **MW-16** | Upper UA | Apr-98 | 20 | 13 | 0.01 | 0.03 | existing GMP | **Q** | **A** | Background monitoring well; located upgradient of Bat Cave Wash | DELETE Cu, Ni, Zn |
| **MW-17** | Upper UA | May-98 | 17 | 4 | 0.002 | 0.009 | existing GMP | **Q** | **A** | Background monitoring well; located upgradient of Bat Cave Wash | DELETE copper, nickel, zinc |
| **MW-18** | Upper UA | Apr-98 | 21 | 20 | 0.02 | 0.046 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-19** | Upper UA | Mar-98 | 20 | 20 | 0.557 | 0.966 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-20-70** | Upper UA | Mar-98 | 24 | 24 | 6.78 | 13.2 | existing GMP | **Q** | **Q** | | **ADD** full-list CATitle 26 metals |
| **MW-20-100** | Middle UA | Apr-99 | 23 | 23 | 1.35 | 4.74 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-20-130** | Lower UA | Apr-99 | 23 | 23 | 3.66 | 7.96 | existing GMP | **Q** | **Q** | | **ADD** full-list CATitle 26 metals |
| **MW-21** | Upper UA | May-98 | 25 | 2 | 0.013 | 0.02 | existing GMP | **Q - M** | **Q** | Low-recharge monitoring well (low permeability aquifer zone), not comparable to other Upper UA wells | DELETE copper, nickel, zinc |
| **MW-22** | Floodplain: Upper UA | Apr-98 | 24 | 0* | ND (<0.01) | --- | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-23** | Fanglomerate | Apr-98 | 21 | 1 | 0.003 | 0.003 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-24A** | Upper UA | May-98 | 21 | 21 | 2.6 | 3.87 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-24B** | Lower UA | May-98 | 21 | 21 | 0.741 | 4.92 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-24BR** | Bedrock | Apr-98 | 21 | 1 | 0.346 | 0.346 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-25** | Upper UA | Apr-99 | 21 | 21 | 2.21 | 2.98 | existing GMP | **Q** | **Q** | | **ADD** full-list CATitle 26 metals |
| **MW-26** | Upper UA | Apr-99 | 23 | 22 | 0.759 | 4.06 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-27** | Floodplain: Upper UA | Apr-99 | 40 | 0* | ND (<0.001) | --- | existing GMP | **Q - M - W** | **Q - M** | Monthly sampling sufficient for monitoring in Upper UA near River | DELETE copper, nickel, zinc |
| **MW-28-25** | Floodplain: Upper UA | Apr-99 | 37 | 0* | ND (<0.001) | --- | existing GMP | **Q - M - W** | **Q - M** | Monthly sampling sufficient for monitoring Upper UA at this location | DELETE copper, nickel, zinc |
| **MW-28-90** | Floodplain: Middle UA | Apr-04 | 1 | 0 | ND (<0.001) | --- | *new IM investigation well* | | **Q - M - BW** | New deep monitoring well near River; bi-weekly sampling warranted | |
| **MW-29** | Floodplain: Upper UA | Apr-99 | 25 | 0 | ND (<0.001) | --- | existing GMP | **Q - M** | **Q - M** | | DELETE copper, nickel, zinc |
| **MW-30-30** | Floodplain: Upper UA | Apr-99 | 38 | 0* | ND (<0.001) | --- | existing GMP | **Q - M - W** | **Q - M** | Prior data trend & continued monthly sampling sufficient to monitor water quality at this location & depth | DELETE copper, nickel, zinc |
| **MW-30-50** | Floodplain: Middle UA | Mar-03 | 24 | 16 | 0.091 | 3.76 | existing GMP | **Q - M - W** | **Q - M** | Prior data trend & continued monthly sampling sufficient to monitor water quality at this location & depth | DELETE copper, nickel, zinc |
| **MW-31-60** | Upper UA | Apr-99 | 22 | 22 | 3.02 | 4.52 | existing GMP | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **MW-31-135** | Lower UA | Mar-04 | 1 | 1 | 0.354 | 0.354 | *new IM investigation well* | | **Q** | Well within plume; quarterly sampling confirms Lower UA water quality | |
| **MW-32-20** | Floodplain: Upper UA | Mar-03 | 12 | 0 | ND (<0.001) | --- | existing GMP | **Q - M** | **Q - M** | | DELETE copper, nickel, zinc |
| **MW-32-35** | Floodplain: Middle UA | Mar-03 | 12 | 0 | ND (<0.001) | --- | existing GMP | **Q - M** | **Q - M** | | DELETE copper, nickel, zinc |
| **MW-33-40** | Floodplain: Upper UA | Mar-03 | 11 | 0 | ND (<0.001) | --- | existing GMP | **Q - M** | **Q - M** | | DELETE copper, nickel, zinc |
| **MW-33-90** | Floodplain: Middle UA | Mar-03 | 11 | 5 | 0.001 | 0.016 | existing GMP | **Q - M - W** | **Q - M - BW** | Maintain frequent monitoring (temporal trends) in Lower UA near River | DELETE copper, nickel, zinc |
| **MW-34-55** | Floodplain: Middle UA | Jun-03 | 23 | 0 | ND (<0.001) | --- | existing GMP | **Q - M - W** | **Q - M** | Prior data trend & continued monthly sampling sufficient to monitor water quality at this location & depth | **ADD** full-list CATitle 26 metals |
| **MW-34-80** | Floodplain: Lower UA | Jun-03 | 22 | 12 | 0.001 | 0.111 | existing GMP | **Q - M - W** | **Q - M - BW** | Maintain frequent monitoring (temporal trends) in Lower UA near River | **ADD** full-list CATitle 26 metals |
| **MW-35-60** | Upper UA | Apr-04 | 1 | 1 | --- | 0.005 | *new IM investigation well* | | **Q** | Quarterly sampling to confirm northern limit of plume, Upper UA | |

# Table 3-3
## Monitoring Wells, Cr(VI) Sampling History, and Proposed Sampling Frequency
## Topock 2004 Groundwater Monitoring Program

| | | **Cr(VI) Sampling Summary [2] -- through May 21, 2004** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Well ID** | **Monitored Zone [1]** | Date Installed | Number of Sampling Events | Number of Events Cr(VI) Detected | **Minimum Cr(VI) Concentration** (mg/L) | **Maximum Cr(VI) Concentration** (mg/L) | **Well Status** | **Current Sampling Frequency [3]** | **Proposed Sampling Frequency [4]** | **Rationale for 2004 Sampling Frequency** | **Proposed Modifications to Quarterly Analyses** |
| **MW-35-135** | Lower UA | Apr-04 | 1 | 0 | ND (<0.001) | --- | *new IM investigation well* | | **Q** | Quarterly sampling to confirm northern limit of plume, Lower UA | |
| **MW-36-20** | Floodplain: Upper UA | May-04 | 1 | 1 | --- | 0.003 | *new IM investigation well* | | **Q - M** | New monitoring well (1") near River; monthly sampling to confirm water quality data in Upper UA | |
| **MW-36-40** | Floodplain: Upper UA | May-04 | 1 | 0 | ND (<0.001) | --- | *new IM investigation well* | | **Q - M** | New monitoring well (1") near River; monthly sampling to confirm water quality data in Upper UA | |
| **MW-36-50** | Floodplain: Middle UA | May-04 | 1 | 0 | ND (<0.001) | --- | *new IM investigation well* | | **Q - M** | New monitoring well (1") near River; monthly sampling to confirm water quality data in Middle UA | |
| **MW-36-70** | Floodplain: Middle UA | May-04 | 1 | 0 | ND (<0.001) | --- | *new IM investigation well* | | **Q - M** | New monitoring well (1") near River; monthly sampling to confirm water quality data in Middle UA | |
| **MW-36-90** | Floodplain: Lower UA | May-04 | 1 | 1 | --- | 3.66 | *new IM investigation well* | | **Q - M** | New monitoring well (1") near River; monthly sampling to confirm water quality data in Lower UA | |
| **MW-36-100** | Floodplain: Lower UA | May-04 | 1 | 1 | --- | 2.98 | *new IM investigation well* | | **Q - M - BW** | New monitoring well near River; bi-weekly sampling recommended to confirm water quality data in Lower UA | |
| **MW-37S** | Upper UA | Apr-04 | 1 | 1 | --- | 0.002 | *new IM investigation well* | | **Q** | Quarterly sampling to confirm northern limit of plume, Upper UA | |
| **MW-37D** | Lower UA | Apr-04 | 1 | 1 | --- | 0.93 | *new IM investigation well* | | **Q** | Well within plume, quarterly sampling sufficient | **ADD** full-list CATitle 26 metals |
| **MW-38S** | Upper UA | Apr-04 | 1 | 1 | --- | 0.332 | *new IM investigation well* | | **Q** | Well within plume, quarterly sampling sufficient | |
| **MW-38D** | Lower UA | Apr-04 | 1 | 1 | --- | 0.033 | *new IM investigation well* | | **Q** | Well within plume, quarterly sampling sufficient | |
| **MW-39-40** | Floodplain: Upper UA | Apr-04 | 1 | 0 | ND (<0.001) | --- | *new IM investigation well* | | **Q - M** | New monitoring well (1") on floodplain, IM-2 performance monitoring | |
| **MW-39-50** | Floodplain: Middle UA | Apr-04 | 1 | 1 | --- | 4.14 | *new IM investigation well* | | **Q - M** | New monitoring well (1") on floodplain, IM-2 performance monitoring | |
| **MW-39-60** | Floodplain: Middle UA | Apr-04 | 1 | 1 | --- | 2.07 | *new IM investigation well* | | **Q - M** | New monitoring well (1") on floodplain, IM-2 performance monitoring | |
| **MW-39-70** | Floodplain: Middle UA | Apr-04 | 1 | 1 | --- | 5.88 | *new IM investigation well* | | **Q - M** | New monitoring well (1") on floodplain, IM-2 performance monitoring | |
| **MW-39-80** | Floodplain: Lower UA | Apr-04 | 1 | 1 | --- | 10.9 | *new IM investigation well* | | **Q - M** | New monitoring well (1") on floodplain, IM-2 performance monitoring | |
| **MW-39-100** | Floodplain: Lower UA | Apr-04 | 1 | 1 | --- | 12.9 | *new IM investigation well* | | **Q - M** | New well within plume, monthly sampling warranted to confirm data | |
| **MW-40S** | Upper UA | May-04 | 1 | 1 | --- | 0.002 | *new IM investigation well* | | **Q** | Quarterly sampling to confirm western limit of plume, Upper UA | |
| **MW-40D** | Lower UA | May-04 | 1 | 1 | --- | 0.038 | *new IM investigation well* | | **Q** | Quarterly sampling to confirm western limit of plume, Lower UA | |
| **Water Supply and Test Wells** | | | | | | | | | | | |
| **Park Moabi** | Upper-Middle-Lower UA | 1966 | 21 | 3 | 0.00028 | 0.0067 | active supply | **Q** | **Q** | | DELETE copper, nickel, zinc |
| **PGE-06** | Upper - Middle UA | Jun-64 | 17 | 12 | 0.16 | 3.1 | inactive supply | **every 2 years** | **every 2 years** | | DELETE copper, nickel, zinc |
| **PGE-07** | Lower UA & Bedrock | 1964 | 15 | 15 | 0.827 | 5.4 | inactive supply | **every 2 years** | **every 2 years** | | DELETE copper, nickel, zinc |
| **PGE-08** | Bedrock | Jun-69 | 17 | 0 | ND (<0.001) | --- | inactive injection | **every 2 years** | **every 2 years** | | DELETE copper, nickel, zinc |
| **TW-01** | Upper-Middle-Lower UA | Nov-03 | 2 | 2 | 3.25 | 3.94 | idle test well | not in GMP | **A** | New well within plume, verify water quality with annual sampling | |
| **TW-2S** | Upper-Middle UA | Apr-04 | 3 | 3 | 7.00 | 7.36 | *new IM extraction well* | | IM system monitoring | | |
| **TW-2D** | Lower UA | Mar-04 | 3 | 3 | 7.47 | 7.77 | *new IM extraction well* | | IM system monitoring | | |

**NOTES:**

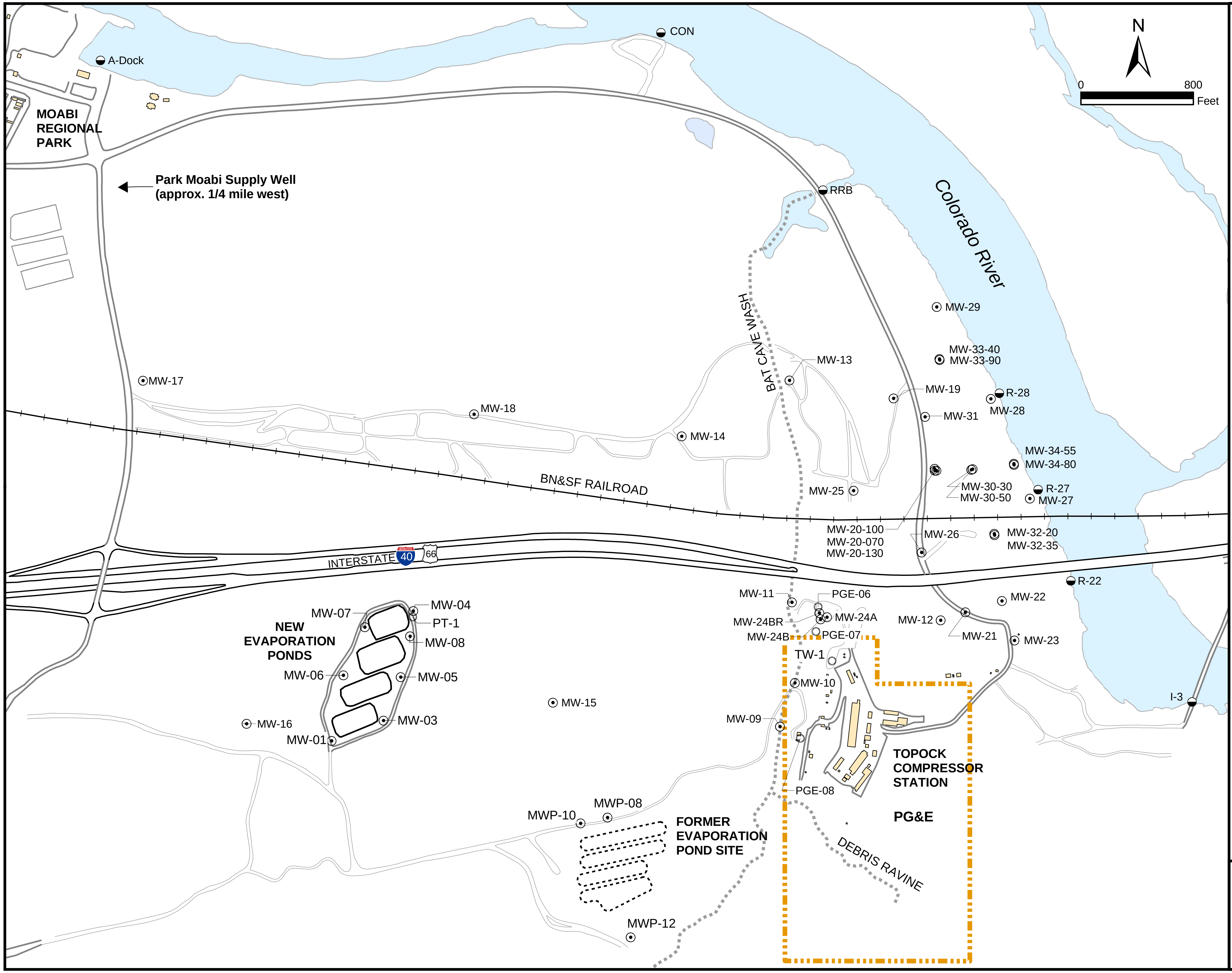
Refer to Figure 3-2 (July 2004 SAP) for location of wells and sampling locations in current Topock GMP and new Interim Measures (IM) investigations.
Pending DTSC approval, the monitoring program identified in this table will be evaluated annually and is subject to updating and revision based on additional data collection and evaluation.

[1] UA refers to Unconsolidated Alluvial Aquifer, includes older & younger alluvial deposits, fluvial deposits, and recent dredged sand

[2] Summary statistics for hexavalent chromium [Cr(VI)] results from 1997-2004 sampling. IM sampling results from April-May 2004. Concentrations in milligrams per liter (mg/L), ND = not detected at listed reporting limit
Sampling records flagged (*) exclude isolated reported Cr(VI) detections in September 2000 and June 2002 sampling (E&E 2004). These results are anomalous and suspect based on laboratory data validation and resampling results.

[3] Sampling schedules: quarterly (Q), monthly (M), weekly (W). All wells in the Q, M, and W monitoring programs are sampled for Cr(VI) and total chromium [Cr(T)] and water quality field parameters.
Wells in the current Q program are additionally sampled for copper, nickel, zinc, pH and specific conductance. Additionally, all new wells and existing wells are sampled for general chemistry parameters periodically for water quality characterization (refer to Section 3 of the SAP).

[4] Proposed changes to current sampling frequency are highlighted in blue shading; bi-weekly sampling (BW)



**Legend**

⦿ Groundwater Monitoring Well

○ Test Well or Supply Well (Inactive)

◒ Surface Water Monitoring Location

| Station ID | Monitored Zone | Well Depth (feet bgs) | Sampling Frequency |
|---|---|---|---|
| MW-09 | Upper UA | 87 | Q |
| MW-10 | Upper UA | 94 | Q |
| MW-11 | Upper UA | 83 | Q |
| MW-12 | Upper UA | 48 | Q |
| MW-13 | Upper UA | 49 | Q |
| MW-14 | Upper UA | 131 | Q |
| MW-15 | Upper UA | 201 | Q |
| MW-16 | Upper UA | 218 | Q |
| MW-17 | Upper UA | 150 | Q |
| MW-18 | Upper UA | 105 | Q |
| MW-19 | Upper UA | 66 | Q |
| MW-20-70 | Upper UA | 70 | Q |
| MW-20-100 | Middle UA | 99 | Q |
| MW-20-130 | Lower UA | 131 | Q |
| MW-21 | Upper UA | 60 | Q & **M** |
| MW-22 | Floodplain sediments | 11 | Q |
| MW-23 | Fanglomerate | 80 | Q |
| MW-24A | Upper UA | 124 | Q |
| MW-24B | Lower UA | 214 | Q |
| MW-24BR | Bedrock | 438 | Q |
| MW-25 | Upper UA | 104 | Q |
| MW-26 | Upper UA | 71 | Q |
| MW-27 | Floodplain sediments | 17 | Q & **M & W** |
| MW-28 | Floodplain sediments | 23 | Q & **M & W** |
| MW-29 | Floodplain sediments | 39 | Q & **M** |
| MW-30-30 | Floodplain sediments | 32 | Q & **M & W** |
| MW-30-50 | Middle UA | 50 | Q & **M & W** |
| MW-31 | Upper UA | 62 | Q |
| MW-32-20 | Floodplain sediments | 20 | Q & **M** |
| MW-32-35 | Middle UA | 35 | Q & **M** |
| MW-33-40 | Floodplain sediments | 39 | Q & **M** |
| MW-33-90 | Middle UA | 89 | Q & **M & W** |
| MW-34-55 | Middle UA | 56 | Q & **M & W** |
| MW-34-80 | Lower UA | 83 | Q & **M & W** |
| PGE-6 | UA | 163 | every 2 years (Q4) |
| PGE-7 | Fangl / Bedrock | 338 | every 2 years (Q4) |
| PGE-8 | Bedrock | 575 | every 2 years (Q4) |
| Park Moabi | UA | 200 | Q |
| **River Stations** | | | |
| A-Dock | slough | | water level only |
| NR-1 | upstream | | Q & **M** |
| NR-2 | upstream | | Q & **M** |
| NR-3 | upstream | | Q & **M** |
| CON | upstream | | Q & **M** |
| RRB | Bat Cave Wash | | Q & **M** |
| R-28 | shoreline area | | Q & **M** |
| R-27 | shoreline area | | Q & **M** |
| R-22 | shoreline area | | Q & **M** |
| I-3 | downstream | | Q & **M** |

UA = Unconsolidated Alluvial Aquifer

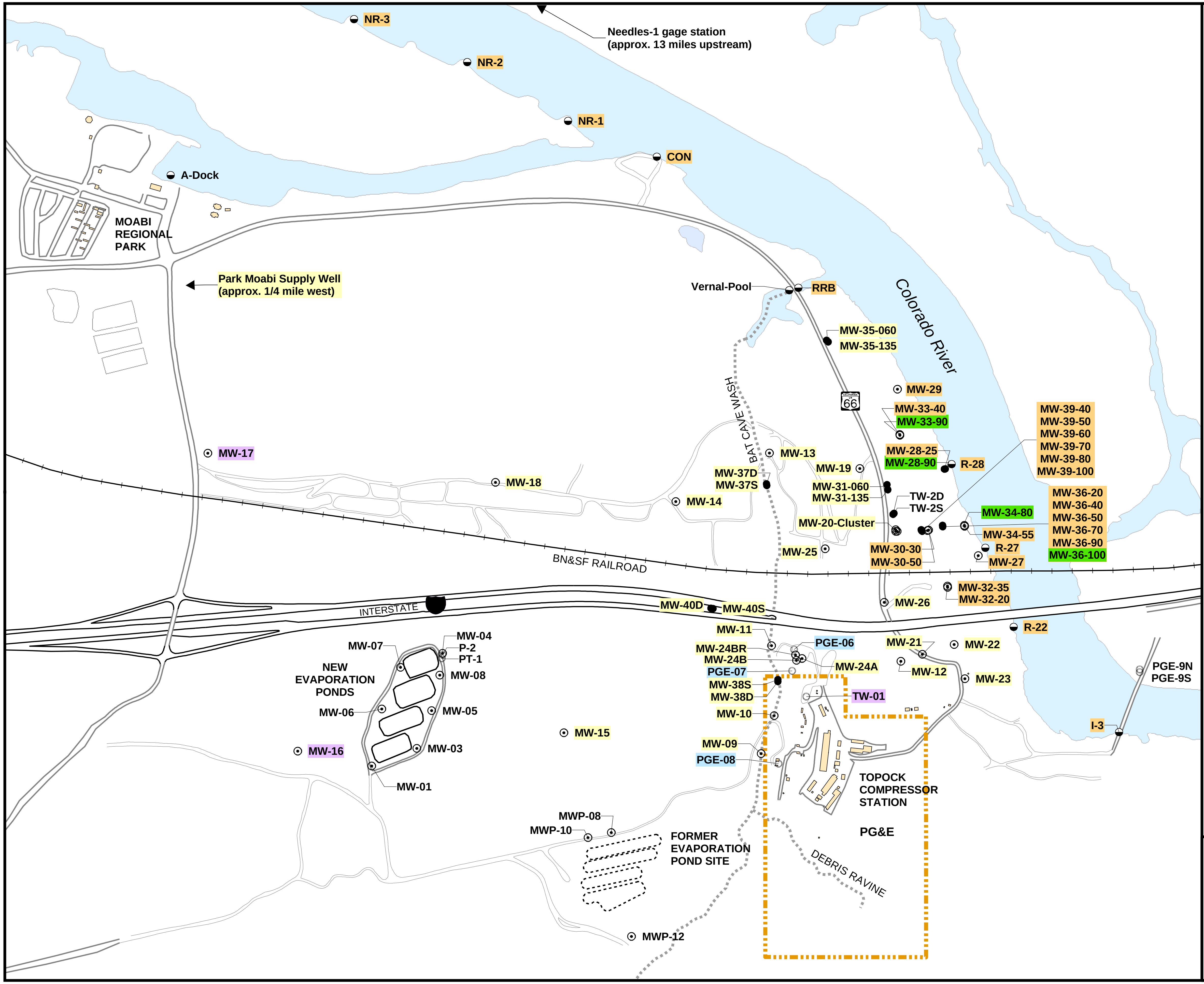
Q = Quarterly monitoring
**M** = Monthly monitoring
W = Weekly monitoring

## Figure 3-1
## Groundwater and Surface Water Monitoring Locations, May 2004

GROUNDWATER MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

SFO \\CABERNET\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\GW_SW_MONITORING_LOCATIONS_PROPERTIES.MXD GW_SW_MONITORING_LOCATIONS_PROPERTIES.PDF 06/10/2004 16:40:06



**Legend**

- ● New Monitoring Well from 2004 IM investigation
- ⊙ Groundwater Monitoring Well
- ○ Test Well or Supply Well (Inactive)
- ◒ Surface Water Monitoring Location

**Proposed Sampling Frequency for GMP - 2nd Half 2004**

| | | |
|---|---|---|
| ⊙ | MW-18 | Quarterly Sampling |
| ⊙ | MW-29 | Monthly Sampling |
| ⊙ | MW-34-80 | Bi-Weekly Sampling |
| ○ | TW-01 | Annual Sampling |
| ○ | PGE-06 | Every 2 Years Sampling |

N

0 800 1,600 Feet

1 inch equals 800 feet

California State Plane NAD83 Zone 5 US Feet

*Revision 0, 7/14/04*

## Figure 3-2
## Proposed Monitoring Locations and Sampling Frequency for GMP July 2004

GROUNDWATER MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

**CH2MHILL**

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\GW_SW_PROPOSED_GMP_LOCATIONS_JULY2004.MXD GW_SW_PROPOSED_GMP_LOCATIONS_JULY2004.PDF 07/14/2004 10:27:08

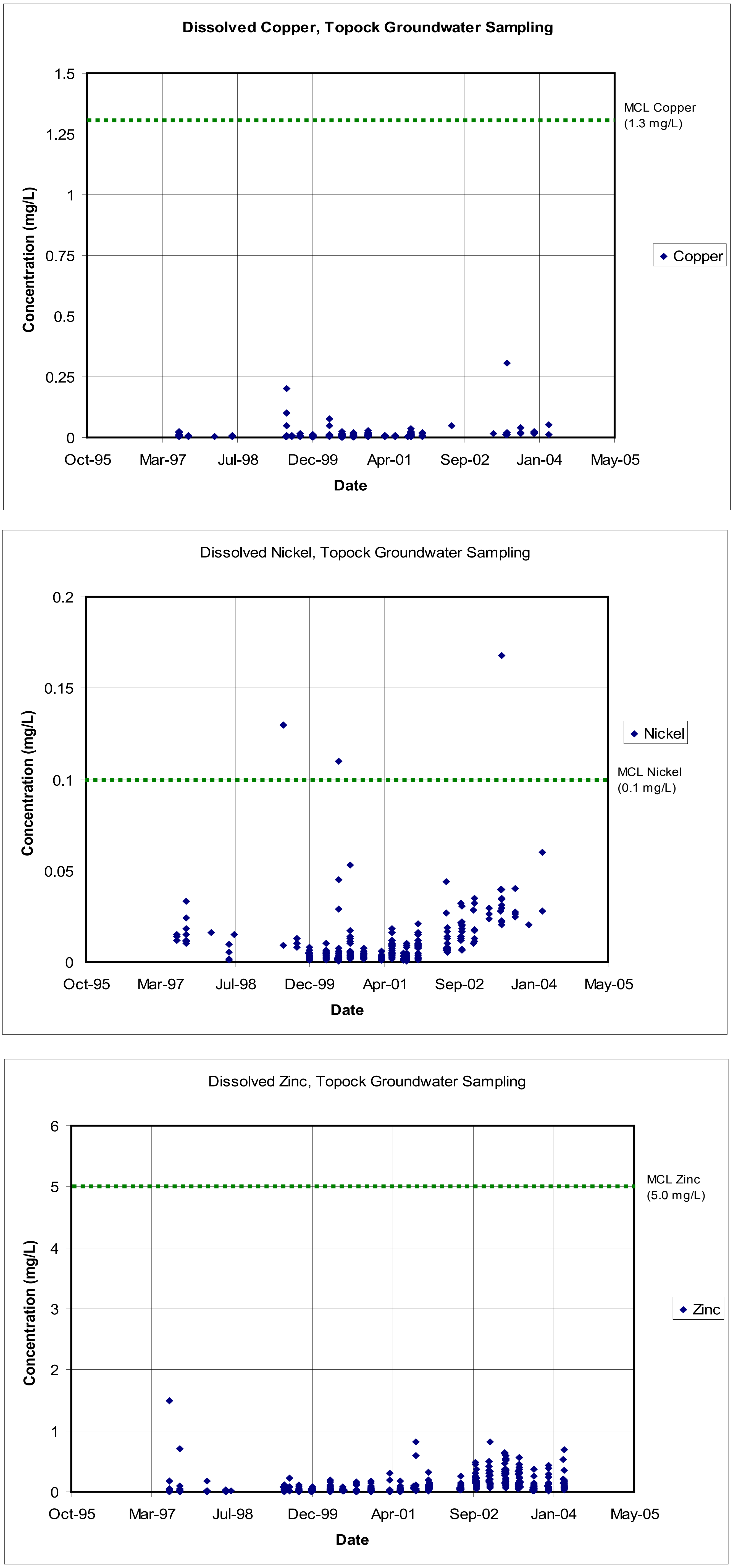
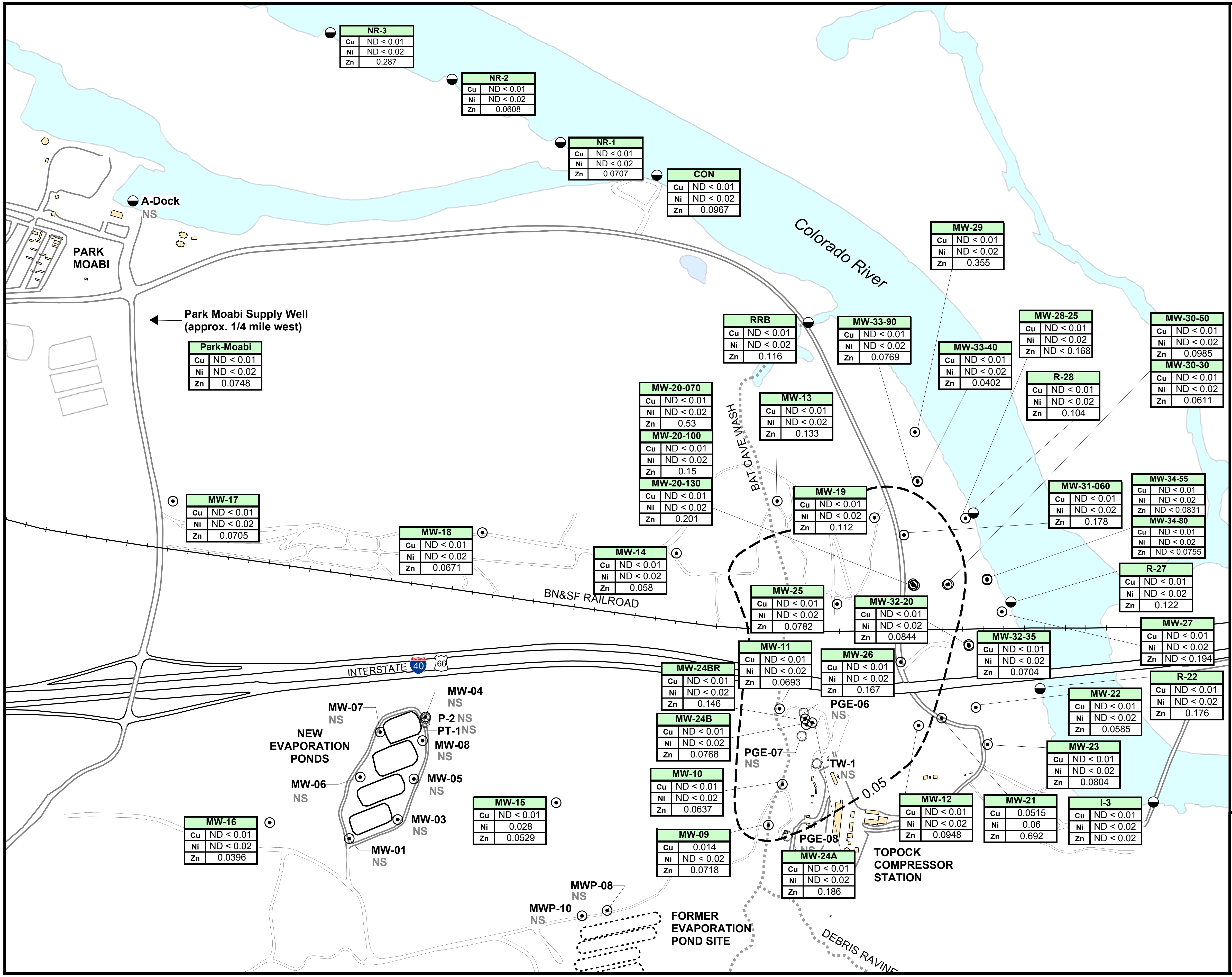


**FIGURE 3-3**
**DETECTED CONCENTRATIONS OF COPPER, NICKEL, AND ZINC**
**1997 T0 2004**
GROUNDWATER MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



## Legend

- ⊙ Groundwater Monitoring Well
- ○ Groundwater Test Well or Supply Well (Inactive)
- ◒ Surface Water Monitoring Location

Sampling conducted March 15-19, 2004

**0.144** Concentration in milligrams per liter (mg/L)
Results shown are maximum concentrations of primary and duplicate samples

**ND < 0.01** Not detected, at analytical detection (Method SW 6010B)

NS Not sampled

Approximate outline of Cr(VI) in groundwater >= 0.05 mg/L (California drinking water standard for Total Chromium)

N

0 750 1,500 Feet

7/14/04

## Figure 3-4
## Detected Concentrations of Copper, Nickel, and Zinc March 2004 Quarterly Event Groundwater and Surface Water Monitoring

GROUNDWATER MONITORING PROGRAM
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\GMP_CU_NI_ZN_CONC.MXD GMP_CU_NI_ZN_CONC.PDF 07/07/2004 12:04:16

# 4.0 Field Methods and Procedures

This section provides a list of necessary pre-sampling activities including field equipment and calibration requirements. It also provides details on field activities including monitoring well purging and sampling, surface water sampling, equipment decontamination procedures, and investigation-derived waste management. To supplement this section, detailed Standard Operating Procedures (SOPs) for major field tasks are included in Appendix C.

## 4.1 Pre-sampling Activities

Pre-sampling activities consist of coordination with the analytical laboratory, a review of previous sampling data, and a kick-off meeting to discuss the specific scope of work to be accomplished during each sampling event. It also includes the acquisition of all required field supplies and the inspection and calibration of field instruments.

### 4.1.1 Field Event Planning

Prior to each field sampling event, the Field Team Manager (FTM) will coordinate the organization of the field team and preparations for field activities. The FTM will contact the analytical laboratory to notify the laboratory of the pending sampling, arrange for the delivery of the appropriate type and number sample containers (see Section 4.2), and coordinate courier service for the pickup and delivery of the collected samples. The FTM will also prepare in spreadsheet format a detailed event-specific sampling and analysis plan that documents the locations to be sampled, required analyses, and other pertinent sampling information. The FTM will distribute the event-specific sampling and analysis plan and copies of previous sampling logs to each field team member.

The FTM will also facilitate a pre-field planning meeting prior to each sampling event. The purpose of the planning meeting will be to ensure that field team members understand the specific scope of work to be accomplished during the field effort. Specific roles and responsibilities for each field team member will also be addressed during this meeting. All necessary parties (e.g., PG&E station personnel, the Park Moabi Ranger) will be contacted prior to sampling.

### 4.1.2 Field Supplies

The following is a list of the primary field supplies that are required for GMP sampling activities. Additional field supplies may be required depending on the exact scope, nature, and duration of the sampling event. It is the responsibility of the FTM to ensure that the field team is equipped with all appropriate supplies; however, the FTM may delegate the acquisition of supplies and equipment to others.

### Field Documents

- SAP, QAPP, and HSP
- Event-specific sampling and analysis plan
- Sampling logs from previous event(s)
- Well Construction Logs
- Blank sampling log forms
- Sample labels
- Chain-of-Custody forms
- Field Logbook

### Field Supplies

- Sample containers (see Section 4.2)
- Coolers and ice
- Container for purge water
- Decontamination equipment (e.g., deionized water, buckets, spray bottles, brushes, Alconox, etc.)
- Personal protective equipment (PPE) (refer to HSP for specific requirements)
- Tool kit
- Miscellaneous field supplies (e.g., water proof pens, paper towels, plastic bags, etc.)

## 4.1.3 Field Instruments

Field instruments required for GMP sampling activities consist of:

- Water Level Indicator (Solinist or equivalent)
- Flow-through Water Quality Meter (Horiba U-22 or equivalent)
- Turbidity Meter (Hach 2100-P or equivalent)
- Oxygen-reduction potential (ORP) Meter (Orion 290A or equivalent)

If possible, dedicated field instruments should be employed for monitoring activities. Prior to use, field instruments must be inspected and calibrated.

### 4.1.3.1 Inspection and Calibration of Field Instruments

Prior to sampling, all field instruments must be inspected and calibrated. Each instrument will be inspected to ensure that it is working properly. Any damage that effects the proper operation or safe use of the instrument will be logged in the field notebook, and the instrument will be tagged so that it is not inadvertently used and removed from the equipment inventory until it has been properly repaired. Each field instrument will also be calibrated prior to use. Calibration will be in accordance with procedures and schedules by the manufacturer. Calibration results logged in the field book and/or the calibration log for that specific instrument. Any instrument “drift” from prior calibration should also be recorded in the field notebook or log. Additional details regarding procedures for instrument calibration are presented in SOP-1, *Calibration of Field Instruments* (included in Appendix C).

Calibrated equipment will be uniquely identified by using either the manufacturer’s serial number or other means. A label with the identification number and the date when the next calibration is due will be physically attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook.

Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device shall be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a re-calibration can be performed or a substitute piece of equipment can be obtained. Results of activities performed using equipment that has failed re-calibration will be evaluated. If the activity results are adversely affected, the results of the evaluation will be documented, and FTM and Project Chemist will be notified.

## 4.2 Sample Volumes, Container Types, and Preservation Requirements

USEPA-recommended containers will be used for field sampling and sampling procedures will adhere to USEPA-recommended preservation requirements for each parameter of concern. Only certified, pre-cleaned sample containers provided by the laboratory will be used. No sample containers will be reused. It is the FTM's responsibility to coordinate delivery of the appropriate sampling containers prior to sampling. Required container type(s) and preservation methods required for each analyte and analytical method are presented in Table 4-1.

## 4.3 Groundwater Sampling

At the Topock site, groundwater samples are collected from both monitoring wells installed as part of the site investigation and remediation program and from existing water supply wells in the area. Due to construction and configuration differences, the sampling of each type of well (monitoring and supply) requires different sampling procedures.

### 4.3.1 Monitoring Wells

As of May 2004, there are 34 groundwater monitoring wells that are sampled under the GMP quarterly schedule. The majority of the wells are conventional monitoring wells constructed of 2-inch and 4-inch-diameter PVC casing. However, several new well clusters constructed with 1-inch-diameter casing were installed in 2004 and require modified sampling procedures as referenced below.  Table 3-2 includes well construction data and sampling summary information for wells that are included in the 2004 GMP.

#### 4.3.1.1 Pressure Transducer Removal and Replacement

Many of the monitoring wells at the site are equipped with pressure transducers for the continuous recording of water levels within the well. To facilitate manual water level measurements, purging, and sampling, the transducer must be temporarily removed from the well. Following completion of sampling activities, the transducer must be placed back into the well in the exact same position and depth from which it was removed. Detailed procedures for transducer handling are provided in SOP-2, *Temporary Removal and Replacement of Pressure Transducers* (Appendix C).

#### 4.3.1.2 Water Level Measurements

Groundwater level measurements will be taken prior to purging using an electronic water level indicator (Solinist or equivalent). Depth to water level measurements will be measured from the marking on the well casing, or if no marking exists, from the north side of the well casing. Water level elevations will be recorded in the field sampling logs at the time of the measurement. Detailed protocols for the collection of water level measurements provided in the SOP-3, *Water Level Measurements* (Appendix C).

#### 4.3.1.3 Well Purging and Field Parameters

All monitoring wells will be purged prior to sampling to ensure that stagnant water present in the well and well screen interval is removed and that collected samples are representative of aquifer conditions.

Wells will be sampled in order of least to most impacted. Based on the most recent chromium concentration data, wells that were non-detect will be sampled first, followed by wells with trace detections. Wells with the highest detections of chromium will be sampled last.

In high-yield wells (wells that exhibit 80-percent recovery in less than 2 hours), purging will be conducted at a flow rate sufficient to remove water from the entire screened interval of the well. However, the purge rate should be low enough so that substantial drawdown in the well does not occur during purging. Purging will consist of the removal of a minimum of three well volumes of water.

Purge water samples will be evaluated in the field using the Horiba U-22 flow-through water quality meter for temperature, specific conductivity, and dissolved oxygen. The Orion ORP meter will be used to evaluate ORP and pH, and the Hach meter will be used to monitor turbidity. At least four to six readings will be taken during the purging process. Purging will be considered complete when three casing volumes of water have been removed from the well and three consecutive field parameter measurements stabilize within prescribed limits. However, in some instances field parameters may not stabilize within prescribed ranges and the FTM may sample based on knowledge of previous site data.

For low-yield wells (those that exhibit less than 80-percent recovery in less than 2 hours), one well volume of water shall be removed. The well then shall be allowed to recover sufficiently to provide enough water for the specified analytical parameters and sampled.

Detailed protocols and groundwater sampling logs for recording field parameter measurements during monitoring well purging are provided in SOP-4, *Purging and Sampling of Groundwater Monitoring Wells* and SOP-5, *Purging and Sampling of 1-Inch Diameter Monitoring Wells* (Appendix C).

#### 4.3.1.4 Sample Collection

For high-yield wells, sample collection shall occur immediately following purging. Samples will be collected by transferring water directly from the pump outlet to the appropriate sample container(s). Sample containers, appropriate preservation, and sample hold times are included in Table 4-1. Following collection, each sample shall be handled according to the procedures outlined in Section 5.0.

Currently, samples for Cr(VI) and Cr(T) are sent to the laboratory unpreserved and unfiltered. Filtration followed by preservation is performed in the laboratory within 12 hours of sample collection, prior to analysis. However, to evaluate whether field filtration may be preferable to laboratory filtration for quality assurance, a test plan to compare field versus laboratory filtration will be submitted to DTSC by August 15, 2004. Because the groundwater matrix is highly variable over the site area, and Cr(VI) concentrations vary spatially and temporally, a carefully planned and implemented comparative test is necessary to ensure the integrity of long-term data and the achievement of data quality objectives. The proposed field filtering and sample preservation procedures for use in the comparative test are presented as SOP-7, *Groundwater Sample Collection for Hexavalent Chromium and Total Chromium* (Appendix C).

Samples will be collected and containerized according to the volatility of the target analytes. As appropriate, the preferred collection order will be VOCs, SVOCs, general chemistry (cations, anions, stable isotopes), then metals (including Cr[VI] and Cr[T]).

For low-yield wells, a sample shall be collected after the well has recovered sufficiently to provide enough volume for the required analyses. Samples will be collected by transferring water directly from the pump outlet to the appropriate sample container(s). Following collection, each sample shall be handled according to the procedures outlined in Section 5.0.

Detailed protocols and groundwater sampling logs for monitoring well sampling are provided in SOP-4, *Purging and Sampling of Groundwater Monitoring Wells* and SOP-5, *Purging and Sampling of 1-Inch Diameter Monitoring Wells* (Appendix C).

#### 4.3.1.5 Well Inspection

At minimum, every 2 years each monitoring well in the GMP program will be inspected (condition of well casing, well lock, markings, standing water at surface, etc.) and total depth will be recorded. Total well depth will be measured to the nearest 0.1 foot from the marking on the casing, or if no marking exists from the north side.  This information will be presented in the GMP quarterly reports as needed.

### 4.3.2 Water Supply Wells

Water supply wells currently being sampling in the Topock GMP include one active production well (Park Moabi well) and three inactive water wells PGE-6, PGE-7, and PGE-8. Procedures for the acquisition of groundwater samples from these supply wells are as follows.

#### 4.3.2.1 Water Level Measurements

Groundwater level measurements can be obtained from the inactive supply wells PGE-6, PGE-7, and PGE-8. However, due to its construction and near constant operation, groundwater levels measurements cannot be obtained from the active supply well at Park Moabi.

Groundwater level measurements will be taken prior to purging using an electronic water level indicator (Solinist or equivalent). Water level elevations will be recorded in the field sampling logs at the time of the measurement. Detailed protocols for the collection of water level measurements provided in the SOP-3, *Water Level Measurements* (Appendix C).

#### 4.3.2.2 Well Purging and Field Parameter Measurement

The inactive supply wells (PGE-6, PGE-7, PGE-8) must be purged prior to sampling to ensure that stagnant water present in the well and well screen interval is removed and that collected samples are representative of aquifer conditions.

Purging of the inactive supply wells will be accomplished using the dedicated pumps installed in these wells. Purging will consist of the removal of a minimum of three well volumes of water. Refer to SOP-4, *Purging and Sampling of Groundwater Monitoring Wells* (Appendix C) and incorporate all procedures applicable to the sampling for the inactive supply wells.

Purge water samples will be evaluated in the field using the Horiba U-22 flow-through water quality meter for temperature, specific conductivity, and dissolved oxygen. Use the groundwater sampling log attached to SOP-4 (Appendix C) to record field parameter measurements. The Orion ORP meter will be used to evaluate ORP and pH, and the Hach meter will be used to monitor turbidity. At least four to six readings will be taken during the purging process. Purging will be considered complete when three casing volumes of water have been removed from the well and three consecutive field parameter measurements stabilize within prescribed limits. However, in some instances field parameters may not stabilize within prescribed ranges and the FTM may sample based on knowledge of previous site data.

Because the Park Moabi well is active and it is being pumping on an almost continuous basis, purging of this well is not necessary. Field parameters will be measured by filling a clean bucket from the sampling port and placing the Horiba and Orion meter probes into the bucket. The Hach turbidity meter sampling vial is filled directly from the sampling port.

#### 4.3.2.3 Sample Collection

Sample acquisition shall occur immediately following purging. Samples shall be collected by transferring water directly from the sampling port to the appropriate sample container(s). Samples from water supply wells will never be filtered in the laboratory or field. Following collection, each sample shall be handled according to the procedures outlined in Section 5.0.

## 4.4 Surface Water Sampling

Surface water samples are currently collected from the Colorado River at nine locations (RRB, I-3, NR-1, NR-2, NR-3, CON, R-22, R-27, and R-28). Procedures for the collection of surface water samples and field data from these stations are as follows.

### 4.4.1 Water Level Measurements

Water level elevation measurements are recorded at three Colorado River sampling locations during quarterly monitoring events: RRB, A-Dock, and I-3. Water level measurements will be recorded using an electronic water level indicator (Solinist or equivalent). At RRB, water level measurement will be taken at the surveyed point identified "X" on the bridge. Water level elevation is recorded from the 4-foot water level mark on the water level elevation pole at A-Dock. At I-3, there is a bolt and nut in the metal bridge, water level is recorded from the base of the nut. Water level elevations will be recorded in the field sampling logs at the time of the measurement.

### 4.4.2 Field Parameters

Field parameters are collected at each location sampled by placing all necessary probes in a bucket. The bucket is filled with Colorado River water collected 6 to 12 inches below surface using a bailer or by directly filling the bucket. Where possible (all locations except RRB), flowing water is sampled and collected for field parameters.

#### 4.4.2.1 Sample Collection

At locations RRB and I-3 samples are collected using a disposable bailer and directly filling the sample bottles. At all other locations, samples are collected using a surface water sampling pole which is extended 4 to 5 feet from the shoreline and the sample collected 6 to 12 inches below the surface. Sampling containers are filled from the bottle attached to the sampling pole. Samples for hexavalent chromium and total chromium will be field filtered in accordance with SOP-7, *Groundwater Sample Collection for Hexavalent Chromium and Total Chromium.* Following collection, each sample shall be handled according to the procedures outlined in Section 5.0.

Detailed protocols for surface water sampling are provided in SOP-6, *Surface Water Sampling* (Appendix C).

## 4.5 Decontamination Procedures

All field equipment used during sampling that is not dedicated to one location must be decontaminated to prevent cross-contamination. Sampling personnel will decontaminate all sampling equipment as described below. All field and sampling equipment that may contact samples must be decontaminated after each use.

The minimum decontamination procedure for sampling equipment will consist of the following:

- Wash the equipment with non-phosphate detergent.
- Rinse the equipment with tap water.
- Rinse the equipment with deionized or distilled water.

Equipment will be protected from dust and allowed to air-dry. Decontaminated equipment will not be allowed to touch contaminated surfaces. The equipment will be labeled as decontaminated with the decontamination date included on the label. For the GMP, at least one equipment blank per sampling team per day will be collected to verify the effectiveness of the decontamination procedure when using portable equipment.

All decontamination waste media must be collected, stored, and transported in approved containers (see Section 4.4).

## 4.6 Investigation-derived Waste Management

Different types of potentially-contaminated investigation-derived waste will be generated during groundwater and surface water sampling efforts. These may include:

- Used PPE.
- Disposable sampling equipment.
- Decontamination fluids.
- Purged groundwater and excess groundwater collected for sample container filling.

Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster at the compressor station. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of that could still be reused will be rendered inoperable before disposal in the refuse dumpster.

Decontamination fluids that will be generated in the sampling event will consist of purge water and decontamination water (deionized water, residual contaminants, and water with non-phosphate detergent). Fluids will be contained on the sampling vehicle until the end of the day when the water shall be transferred to an on-site wastewater storage tank. The wastewater is then managed and disposed by PG&E following the compressor station’s waste management and off-site disposal procedures.

## 4.7 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to the sampling procedures as presented in this SAP. Prior to varying from established procedures, the field team lead nor FTM will notify the Project Manager and/or Project Chemist of the proposed modification and reason for the modification. Implementation of any modifications will not be made until at least verbal approval has been obtained. Any variances or modifications to procedures in the approved SAP will be documented in the field notes, sampling logs, and in the sampling project report.

TABLE 4-1
Sample Containers, Preservation, and Holding Times
Groundwater and Surface Water Sampling
*PG&E Topock Compressor Station, Needles, California*

| | | **Container and Minimum Quantity** | | |
|---|---|---|---|---|
| **Analyte** | **Method** | **Water** | **Preservation** | **Holding Time** |
| Dissolved Metals* | SW6010B<br>SW6020<br>EPA 200.7<br>EPA 200.8<br>SW7000 series methods | 1-L; P or G | Laboratory or field filtration. Add nitric acid to pH<2; cool to 4°C. | 180 days |
| Hexavalent Chromium | SW7199<br>EPA 218.6 | 500-mL; P or G | Laboratory or field filtration. Cool to 4°C. after adding $(NH_4)_2SO_4/NH_4OH$ buffer solution to pH 9-9.5 | 24 hours |
| Hexavalent Chromium | SW7196A | 500-mL; P or G | Cool to 4°C | 24 hours |
| Ammonia | EPA 350.2 | 1-L; P or G | Add $H_2SO_4$ to pH<2; cool to 4°C | 28 days |
| Alkalinity (Total, Bicarbonate, Carbonate, Hydroxide) | EPA 310.1 | 500-mL; P or G | Cool to 4°C | 14 days |
| TDS | EPA 160.1 | 500-mL; P or G | Cool to 4°C | 7 days |
| TSS | EPA 160.2 | 500-mL; P or G | Cool to 4°C | 7 days |
| Turbidity | EPA 180.1 | 500-mL; P or G | Cool to 4°C | 48 hrs |
| Specific Conductance | EPA 120.1<br>SW9050 | 500-mL; P or G | Cool to 4°C | 28 days |
| pH | EPA 150.1<br>SW9040 | 500-mL; P or G | Cool to 4°C | ASAP |
| TOC/DOC | EPA 415.2 | 500-mL; P, G or 40ml VOA | Add $H_2SO_4$ to pH<2; chill to 4°C | 28 days |
| Perchlorate | EPA 314.0 | 500-mL; P or G | Cool to 4°C | 28 days |
| Sulfide | EPA 376.2 | 500-mL; P or G | Add zinc acetate and NaOH to pH>9; cool to 4°C. | 7 days |
| Total Kjeldahl Nitrogen (TKN) | EPA 351.4 | 500-mL; P or G | Add $H_2SO_4$ to pH<2; cool to 4°C | 28 days |
| Ferrous Iron ($Fe^{+2)}$ | SM3500D | 500-mL; P or G | Cool to 4°C | 24 hours |
| Dissolved Silica | EPA 370.1/2 | 500-mL; P only | Cool to 4°C | 28 days |
| $^{18}O$ and deuterium | Laboratory SOP, Continuous Flow Mass Spectrometer (CF-IRMS) | 100-mL; P or 40ml VOA | Cool to 4°C | None |

TABLE 4-1
Sample Containers, Preservation, and Holding Times
Groundwater and Surface Water Sampling
*PG&E Topock Compressor Station, Needles, California*

| | | Container and Minimum Quantity | | |
|---|---|---|---|---|
| **Analyte** | **Method** | **Water** | **Preservation** | **Holding Time** |
| Anions | SW9056<br>EPA 300.0<br>EPA 365.2 | 125 mL; P or G | Cool to 4°C | Bromide, Chloride, Fluoride, Sulfate, Iodide in 28 days<br>Nitrate and Ortho-phosphate in water 48 hours |

Polyethylene (P); glass (G)
* If Boron is a target analyte, a polyethylene bottle must be used for sample collection.

# 5.0 Sample Documentation and Shipment

The following sections describe the sample documentation and shipment procedures applicable to groundwater and surface water sampling under the Topock program.

## 5.1 Field Notes

Field notes for sampling activities may consist of logbooks, chain of custody forms, pre-printed sampling forms and photographs.

### 5.1.1 Field Logbooks

All sampling activities will be recorded in a bound field notebook. Entries must be dated, legible, written in permanent ink, and contain accurate and inclusive documentation of project activities. Language should be objective and factual. Entries must include (if applicable):

- Names of all personnel.
- Names of all Site visitors/observers.
- General description of weather conditions.
- Location of each sampling point.
- Date and time of sample collection.
- Legible corrections, which will be single lines through the error, signed and dated by the person making the correction.
- Observations of sampling procedure.
- Reference to any photographs taken.
- Field observations and descriptions of problems encountered or change made to the original plan.
- Field instruments calibration information.

### 5.1.2 Chain-of-Custody Forms

Appropriate chain-of-custody procedures will be followed through collection, transfer, analysis, and disposal to ensure the integrity of the samples is maintained. Chain-of-custody forms will be filled out for all samples collected as described below:

- The chain-of-custody documentation will completed using the information included on each sample label including a unique sample identification number that will correspond to the sample ID (location or well number), the date and time the sample was collected, the initials of the sampler, identification of any preservatives used, the analysis requested, and the required turnaround time for analysis.

- The chain-of-custody will also include the name, address, phone number, and fax number of the FTM and/or Project Manager.
- Additional information included on the chain-of-custody are any special instructions or warnings for the laboratory.
- Each chain-of-custody form will be signed by the sampler and again be signed by the laboratory official once the samples have been delivered.
- The chain-of-custody will be included with each sample it documents until such time the samples have been delivered to the laboratory.

### 5.1.3 Sampling Logs

Standard sampling logs will be used for each sampling event in order to ensure consistency and completeness in data collection. Example sampling logs are provided in Appendix C.

### 5.1.4 Photographs

If photographs are required for any sampling event, the following information will be written for each photograph in the logbook or recorded in a separate field photography log:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Orientation of the photograph
- Name of person taking the photograph

## 5.2 Labeling

To prevent sample misidentification, a label will be permanently affixed to each sample container. Sample labels should be sufficiently durable to remain legible even when wet and they should be filled in using waterproof ink. Sample labels should contain, at a minimum, the following information:

- Sample identification number
- Name or initials of collector
- Date and time of collection
- Location of collection
- Parameters requested (if space permits)

Labeling format is as follows:

- Regular samples are named by their Location or Well Identification Number followed by the sampling event number (i.e., -026 for the 26th sampling event conducted by CH2M HILL).
- Field duplicates are identified with MW-90, MW-91, and etc. followed by the sampling event number; as these well numbers do not exist on this site. The groundwater

sampling log (attached to SOP-4, SOP-5, SOP-6) are used to record field duplicate sample information.

- Equipment blanks are identified by the well number sampled prior to decontamination and equipment blank sampling, followed by –EB, followed by the sampling event number.

## 5.3 Packaging and Shipment

### 5.3.1 Preparing Sample Coolers

1. Remove all previous labels used on cooler.
2. Seal all drain plugs (outside and inside).
3. Place a cushioning layer at bottom of cooler.
4. Double bag all ice in plastic bags and seal.

### 5.3.2 Packing Sample Coolers

1. Place chain-of-custody form in sealable plastic bag.
2. Place samples in upright position in cooler.
3. Fill void space between samples with cushioning material.
4. Place ice on top of water samples and between samples.

### 5.3.3 Sealing Sample Coolers

1. Tape cooler lid with strapping tape, encircling cooler several times.

2. Place the coolers containing samples upright on a flat, stable surface to avoid tipping and/or sliding during transport. Store all coolers out of the sun. Transfer to the courier for shipment to the laboratory immediately upon completion of daily sampling activities.

3. Copies of the chain-of-custody forms shall be retained by the field crew and transmitted by facsimile or e-mail to the FTM on a daily basis. The FTM will in turn transmit copies of the chain-of-custody forms to the laboratory to notify the lab of a pending sample delivery and provide the laboratory with advance notice of the number and type of samples to be analyzed.

# 6.0 Quality Control

Quality control procedures will be implemented for both field activities and laboratory work. Detailed descriptions of quality control procedures are also provided in the QAPP (Appendix B).

## 6.1 Field Quality Control

### 6.1.1 Field Audits

Audits of field activities will be performed during various sampling events to evaluate the execution of field tasks including the instrument calibrations, collection of field data, field documentation, and chain-of-custody procedures. The audit will be performed to evaluate the extent of adherence to this SAP, SOPs, and the QAPP. The results of the audit will be used to identify any deficiencies in the sampling program and develop corrective actions (if necessary).

Field documents pertaining to sample identification and control will be reviewed for completeness and accuracy. Field notebooks and logs will be reviewed to verify that the contents are legible, contain accurate and complete documentation of sampling activities, and that all entries are dated and signed. Sampling and chain-of-custody procedures will be checked to ensure that established sampling protocols are being followed, the appropriate samples are being collected, the proper containers and preservatives are being used, proper sampling packaging and shipment protocols are being followed, and proper chain-of-custody procedures are being maintained.

Field measurements will be evaluated by checking the field instruments for proper calibration and frequency of calibration. Procedures for obtaining measurements will also be reviewed to ensure that established protocols or SOPs are being followed.

The field audit will be performed by the Project Chemist, the Project Manager, or designee. At a minimum, field audits will be performed twice per year. The results of the field audits will be summarized and appropriate corrective action implemented within 4 weeks of the audit.

### 6.1.2 Field Duplicates

Field duplicate samples are collected to evaluate sampling precision. Field duplicates will be collected at a minimum frequency of 10 percent, or one per sampling event, whichever is more frequent, for each matrix and for each type of analysis. The number and location of field duplicates to be collected during each sampling event will be determined by the FTM or Project Chemist prior to field activities and will be on the event-specific sampling and analysis plan spreadsheet (see Section 4.1.1).

Collection of a field duplicate at a certain well location implies taking twice the required sample volume. The locations where field sample duplicates are taken are to be recorded in the field logbook and on the sampling logs.

### 6.1.3 Equipment Blanks

Equipment blanks will be collected in order to verify the effectiveness of the sampling equipment decontamination procedures. At least one equipment blank per sampling team per day will be collected following decontamination of the first piece of equipment. The equipment blank sample will be labeled with a well identification number followed by a hyphen and "EB" to indicate that it is an equipment blank. The well number corresponds to the well sampled prior to equipment decontamination and the rinse water sample was taken.

## 6.2 Laboratory Quality Control

Laboratory quality control procedures and protocols are discussed detail in the QAPP (see Appendix B).

## 6.3 Data Validation

The analytical results of groundwater and surface water samples will be evaluated to verify whether the data are sufficiently accurate, precise, and representative of site conditions for decision-making purposes in support of ongoing site investigation and remediation activities. Details regarding data validation for the Topock GMP are provided in the QAPP (see Appendix B).

# 7.0 Data Management and Reporting

## 7.1 Data Management

All field documents are transmitted to and managed by the FTM. Hardcopy originals of all field sampling documents are retained in a central Project File. Field data are entered into electronic format, quality assurance/quality control is performed, and uploaded to the Topock Project Database. Hardcopy laboratory reports and data are transmitted to the Project Manager and stored in the central Project File. Electronic laboratory data are transmitted to the Project Chemist for validation against a hard copy report. Validated electronic data are uploaded to the Topock Database and validation reports are retained in the Project File.

## 7.2 Reporting

The GMP currently includes the preparation of quarterly groundwater and surface water monitoring reports and monthly/weekly well sampling data transmittals.

### 7.2.1 Quarterly Reports

Groundwater and surface water monitoring reports are generated quarterly for the GMP according to the following schedule:

- First Quarter monitoring period: report issued May
- Second Quarter monitoring period: report issued August
- Third Quarter monitoring period: report issued November
- Fourth Quarter monitoring period: report issued February

The quarterly reports summarize all sampling activities that occurred within the specified quarter (CH2M HILL 2004c). Analytical data from that quarter, as well as historic analytical data are summarized in tabular format. The analytical results of the quarterly sampling event are also presented graphically. Appendix D of this SAP includes examples of tabular and graphic displays for reporting the GMP monitoring data. The graphical depiction of the quarterly data includes an isoconcentration line delineating the approximate extent of Cr(VI) concentrations above 0.05 mg/L, the California MCL for Cr(T) (see Figure 2-2).

### 7.2.2 Monthly Data Transmittals

Selected monitoring wells in the floodplain area are currently sampled monthly and weekly (see Section 3.1). Validated analytical laboratory and field data from these monitoring events are complied and presented in tabular sampling results reports (see Appendix D for example report). The monthly/weekly sampling results data reports are transmitted to the DTSC and the project stakeholders on an approximately a monthly schedule.

# 8.0 References

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# Appendix A
# Project Organization and Contacts

**APPENDIX A**

# Project Organization and Contacts

The Topock Groundwater and Surface Water Monitoring Program (GMP) is being performed for Pacific Gas and Electric Company (PG&E) by CH2M HILL. The GMP is part of a RCRA Facility Investigation (RFI) being performed at the PG&E Topock Compressor Station under a Corrective Action Consent Agreement issued in 1996 by the California Department of Toxic Substances Control (DTSC). The Topock Compressor Station is located in eastern San Bernardino County, 15 miles southeast of the city of Needles, California.

This section identifies and describes the responsibilities of key project positions related to project management, field task management, quality assurance/quality control (QA/QC) management, and data management. Contact information for the CH2M HILL staff is provided in Table A-1.

## A.1 Project Manager

The CH2M HILL Project Manager (PM) for the GMP is responsible for:

- Development and implementation of the project.
- Technical oversight of groundwater and surface water monitoring and sampling.
- Schedule, financial, technical status, and contract management.
- Overall project QA.
- Primary contact with the client, the DTSC project manager, and DTSC technical staff.
- Interfacing with the Topock program manager, other project managers, the Project Chemist, Data Manager, and field task manager.
- After independent QA review by a senior review team, the PM and the senior review team will identify the appropriate corrective action to be initiated when QA problems or deficiencies requiring special action are uncovered.

The current CH2M HILL Project Manager for the Topock GMP is Paul Bertucci.

## A.2 Field Task Manager

The Field Task Manager (FTM) for the GMP is responsible for:

- Coordinating field schedules.
- Coordinating CH2M Hill field personnel, subcontractors, and equipment at the site.
- Maintaining communication with the Project Chemist regarding scheduled sampling events and coordinating delivery of samples to the laboratory.
- Management of project tasks associated with sampling, general QA oversight of field personnel in sampling activities, coordination of sample collection, and coordinating sample submittal to the analytical lab.

- Collecting and reviewing all field task related documents, and archiving the documents in the project file.
- Coordinating with field personnel, the Project Chemist, and the Data Manager to facilitate data transfer to the project database.

The current FTM for the GMP is Tina Girard.

## A.3 Project Chemist

The Project Chemist for the Topock GMP is responsible for:

- Approving and maintaining adherence to QA/QC requirements specified in this SAP and the QAPP (Appendix B).
- Providing guidance regarding environmental analytical chemistry methodologies and QC procedures applicable to environmental analytical chemistry.
- Managing project tasks associated with coordination of sample collection and analysis with the FTM; acting as liaison between the FTM and contract laboratories.
- Managing sample tracking, sample analysis, and data reporting from the laboratory.
- Coordinating validation of the analytical data.
- Performing quality audits and surveillance, preparation of QA reports, and implementation of QC activities and suggesting corrective actions, as necessary.
- Communicating QA/QC issues to the PM and FTM.
- Providing input into resolution of any anomalies or out of control events that arise during the analysis of samples.

The current Project Chemist for the GMP is Dan Moore.

## A.4 Data Manager

The Data Manager for the GMP is responsible for:

- Overall management and control of all analytical and field data that will be used for decision-making and project reporting purposes.
- Coordinating with the FTM and the Project Chemist to facilitate data transfer into the project database.
- Coordinating the output of data from the database to the data users (e.g., PM and technical staff) and provide QC for all data outputs.

The current Data Manager for the GMP is Tuesdai Powers.

## A.5 Site Safety and Health Manager

The site Safety and Health Manager for the Topock GMP is responsible for:

- Site safety and health for CH2M HILL and subcontractor personnel working on the project.

- Implementation of CH2M HILL's site-specific Health and Safety Plan, contractor safety, and training.

The current site Safety and Health Manager is Rick Cavil.

TABLE A-1
Key Project Staff
*PG&E Topock Groundwater & Surface Water Monitoring Program*

| Title | Name/Address | Phone | Fax | Email |
|---|---|---|---|---|
| Project Manager | Paul Bertucci<br>155 Grand Ave, Suite 1000<br>Oakland, CA 94612 | 510-587-7629 | 510-622-9629 | pbertucc@ch2m.com |
| Field Task Manager | Tina Girard<br>155 Grand Ave, Suite 1000<br>Oakland, CA 94612 | 510-587-7586 | 510-622-9586 | tgirard@ch2m.com |
| Project Chemist | Dan Moore<br>6001 Indian School Rd N.E.<br>Suite 350<br>Albuquerque, NM 87110 | 505-855-5235 | 505-883-7507 | dmoore4@ch2m.com |
| Data Manager | Tuesdai Powers<br>155 Grand Ave, Suite 1000<br>Oakland, CA 94612 | 510-587-7595 | 510-622-9595 | tpowers@ch2m.com |
| Health and Safety Manager | Rick Cavil<br>1737 North First Street<br>Suite 300<br>San Jose, CA 95112 | 408-436-4909 ext. 429 | 408-436-4829 | rcavil@ch2m.com |

# Appendix B
# Quality Assurance Project Plan

# Quality Assurance Project Plan Addendum

# Groundwater and Surface Water Monitoring

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

Prepared for

**Pacific Gas and Electric Company**

July 14, 2004

Prepared by

CH2MHILL

155 Grand, Suite 1000
Oakland, CA 94604-2681

# Contents

**Tables**

# Acronyms and Abbreviations

| | |
|---|---|
| COC | chain-of-custody |
| GMP | Groundwater Monitoring Program |
| ICP | inductively-coupled plasma |
| ICP/MS | inductively-coupled plasma/mass spectrometer |
| LCS | laboratory control sample |
| MDL | method detection limit |
| µg/L | micrograms per liter |
| mg/L | milligrams per liter |
| MS/MSD | matrix spike and matrix spike duplicate |
| QA/QC | quality assurance/quality control |
| QAM | Quality Assurance Manual |
| QAPP | Quality Assurance Project Plan |
| RPD | relative percent difference |
| SAP | Sampling and Analysis Plan |
| SOP | standard operating procedure |
| USEPA | United States Environmental Protection Agency |

# 1.0 Introduction

This Quality Assurance Project Plan (QAPP) Addendum was prepared to present the project-specific quality assurance/quality control (QA/QC) requirements for the groundwater and surface water monitoring program (GMP) at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station located near Needles, California. This addendum supplements and supercedes the requirements presented in the *PG&E Program Quality Assurance Project Plan* (Program QAPP). The QAPP Addendum is an integral part of the project-specific Sampling and Analysis Plan (SAP) that governs the sampling and analysis activities for the GMP. These plans ensure that data of appropriate quality are collected and meet the project-specific requirements. The QAPP is intended for use by CH2M HILL and the subcontractors who provide services associated with the environmental data collection effort.

## 1.1 QAPP Objectives

The QAPP presents the QA/QC requirements designed to ensure that environmental data collected for the GMP are of the appropriate quality to achieve the project objectives defined in Section 3.0 of the SAP. The SAP describes the background of the site and GMP, sources of contamination, and information derived from previous investigations. The SAP also discusses the specific protocols for sampling, equipment decontamination, handling of investigation-derived wastes, sample handling and storage, chain of custody requirements, and field quality control. Requirements for laboratory analyses, data handling, and data evaluation and assessment performance evaluations, corrective actions, and preventive maintenance of equipment are specified in the QAPP.

The elements included in this QAPP are consistent with those specified in the United States Environmental Protection Agency (USEPA) *Requirements for Quality Assurance Project Plans, EPA QA/R-5,* March 2001. The objectives of the PG&E Program QAPP are to:

- Ensure that data collection and measurement procedures are standardized among all participants.
- Monitor the performance of the various measurement systems being used in the program to maintain statistical control and provide rapid feedback, so that corrective measures, if needed, can be taken before data quality is compromised.
- Periodically assess the performance of these measurement systems and system components.
- Verify that reported data are sufficiently complete, comparable, representative, unbiased, and precise to ensure that the data are suitable for intended use.

# 2.0 Project Organization and Responsibility

## 2.1 Project/Task Organization

Project responsibilities for each of the GMP staff listed in Table 2-1 below are addressed in Appendix A, Project Organization and Contacts of the SAP.

TABLE 2-1
Project Staff
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Title | Name/Address | Phone | Fax | Email |
|---|---|---|---|---|
| Project Manager(PM) | Paul Bertucci<br>155 Grand Ave, Suite 1000<br>Oakland, CA 94612 | 510/587-7629 | 510/622-9629 | pbertucci@ch2m.com |
| Task Manager (TM) | Tina Girard<br>155 Grand Ave, Suite 1000<br>Oakland, CA 94612 | 510/587-7586 | 510/893-8205 | tgirard@ch2m.com |
| Project Chemist | Dan Moore<br>6001 Indian School Rd N.E.<br>Suite 350<br>Albuquerque, NM 87110 | 505/855-5235 | 505/816-0580 | dmoore4@ch2m.com |
| Data Manager | Tuesdai Powers<br>155 Grand Ave, Suite 1000<br>Oakland, CA 94612 | 510/587-7595 | 510/622-9595 | tpowers@ch2m.com |
| Health and Safety Manager | Rick Cavil<br>1737 North First Street<br>Suite 300<br>San Jose, CA 95112 | 408/436-4909<br>ext. 429 | 510/587-7502 | rcavil@ch2m.com |

## 2.2 Certification Requirements

All laboratories participating in analytical services will be certified under the State of California Department of Toxic Substances Control's Environmental Laboratory Accreditation Program for the fields of testing for the GMP. The laboratory managers will be responsible for ensuring that all personnel have been properly trained and are qualified to perform their assigned tasks.

# 3.0 Sampling Procedures

## 3.1 Sampling Design

The number and location of samples collected for the current GMP are discussed in the June 2004 Draft SAP (CH2M HILL 2004). The Draft SAP additionally presents the rationale for proposed modifications to the quarterly, monthly, and weekly sampling programs described in the SAP. The sampling design is a function of the medium sampled, information about the sampling site, the type of data to be collected, and how the data are to be used. The specific protocols for sampling, equipment decontamination, handling of investigation-derived wastes and field quality control are discussed in the Program QAPP and the project-specific SAP.

# 4.0 Sample Handling and Custody

## 4.1 Containers and Preservatives

Laboratories will provide the required sample containers for all environmental and associated QC samples. All containers will be certified free of the analytes of concern for this project. No sample containers will be reused. The contracted laboratory will add preservatives, if required, prior to shipping the sample containers to the field. The laboratory, upon receipt of the samples, will verify the adequacy of preservation and will add additional preservative, if necessary. The containers, minimum sample quantities, required preservatives, and maximum holding times for many parameters are shown in Table 4-1.

TABLE 4-1
Sample Containers, Preservation, and Holding Times
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| | | **Container and Minimum Quantity** | | |
|---|---|---|---|---|
| **Analyte** | **Method** | **Water** | **Preservation** | **Holding Time** |
| Dissolved Metals* | SW6010B<br>SW6020<br>EPA 200.7<br>EPA 200.8<br>SW7000 series methods | 1-L; P or G | Laboratory or field filtration. Add nitric acid to pH<2; cool to 4°C. | 180 days |
| Hexavalent Chromium | SW7199<br>EPA 218.6 | 500-mL; P or G | Laboratory or field filtration. Cool to 4°C. after adding $(NH_4)_2SO_4/NH_4OH$ buffer solution to pH 9-9.5 | 24 hours |
| Hexavalent Chromium | SW7196A | 500-mL; P or G | Cool to 4°C | 24 hours |
| Ammonia | EPA 350.2 | 1-L; P or G | Add $H_2SO_4$ to pH<2; cool to 4°C | 28 days |
| Alkalinity (Total, Bicarbonate, Carbonate, Hydroxide) | EPA 310.1 | 500-mL; P or G | Cool to 4°C | 14 days |
| Total Dissolved Solids | EPA 160.1 | 500-mL; P or G | Cool to 4°C | 7 days |
| Total Suspended Solids | EPA 160.2 | 500-mL; P or G | Cool to 4°C | 7 days |
| Turbidity | EPA 180.1 | 500-mL; P or G | Cool to 4°C | 48 hrs |
| Specific Conductance | EPA 120.1<br>SW9050 | 500-mL; P or G | Cool to 4°C | 28 days |

TABLE 4-1
Sample Containers, Preservation, and Holding Times
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| | | **Container and Minimum Quantity** | | |
|---|---|---|---|---|
| **Analyte** | **Method** | **Water** | **Preservation** | **Holding Time** |
| pH | EPA 150.1<br>SW9040 | 500-mL; P or G | Cool to 4°C | ASAP |
| Total Organic Carbon / Dissolved Organic Carbon | EPA 415.2 | 500-mL; P, G or 40ml VOA | Add $H_2SO_4$ to pH<2; cool to 4°C | 28 days |
| Perchlorate | EPA 314.0 | 500-mL; P or G | Cool to 4°C | 28 days |
| Sulfide | EPA 376.2 | 500-mL; P or G | Add zinc acetate and NaOH to pH>9; cool to 4°C. | 7 days |
| Total Kjeldahl Nitrogen (TKN) | EPA 351.4 | 500-mL; P or G | Add $H_2SO_4$ to pH<2; cool to 4°C | 28 days |
| Ferrous Iron ($Fe^{+2}$) | SM3500D | 500-mL; P or G | Cool to 4°C | 24 hours |
| Dissolved Silica | EPA 370.1/2 | 500-mL; P only | Cool to 4°C | 28 days |
| $^{18}O$ and deuterium | Laboratory SOP, Continuous Flow Mass Spectrometer (CF-IRMS) | 100-mL; P or 40ml VOA | Cool to 4°C | None |
| Anions | SW9056<br>EPA 300.0<br>EPA 365.2 | 125 mL; P or G | Cool to 4°C | Bromide, Chloride, Fluoride, Sulfate, Iodide in 28 days<br>Nitrate and Ortho-phosphate in water 48 hours |

Polyethylene (P); glass (G)
* If Boron is a target analyte, a polyethylene bottle must be used for sample collection.

### 4.1.1 Field Filtration and Preservation of Hexavalent Chromium and Metals

Upon completion of a comparative test evaluating field filtration results against laboratory filtration results, hexavalent chromium and metals samples may be collected with field filtration and preservation. Samples for hexavalent chromium analysis by SW7199 will be adjusted to a pH of 9.0 to 9.5 with a $(NH_4)_2SO_4/NH_4OH$ buffer solution (Table 4-1). Metals samples will also be adjusted to a pH of less than 2 with nitric acid (Table 4-1).

## 4.2 Chain of Custody

Procedures must be followed to preserve and ensure the integrity of all samples from the time of collection through analysis. Sample custody records must be maintained both in the field and in the subcontractor laboratory. A sample is considered to be in a person's custody if it is either in his or her physical possession or view, locked up, or kept in a secured and restricted area. Until the samples are shipped, custody will be the responsibility of the field team leader.

Chain-of-custody (COC) records document sample collection and shipment to the laboratory. A chain-of-custody form will be completed for each sampling event. The original copy will be provided to the laboratory with the sample-shipping cooler, and a copy will be retained in the field documentation files. The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. All chain-of-custody forms will be signed and dated by the responsible sampling team personnel. The "relinquished by" box will be signed by the responsible sampling team personnel, and the date, time, and air bill number will be noted on the chain-of-custody form. The laboratory will return the executed copy of the chain-of-custody with the hard-copy report.

The shipping coolers containing the samples will be sealed with a custody seal any time they are not in someone's possession or view before shipping. Shipping coolers delivered by courier do not require the use of custody seals. All custody seals will be signed and dated by the responsible sampling team personnel.

At a minimum, the following information must be documented on the chain-of-custody form:

- Unique sample identification
- Date and time of sample collection
- Source of sample (including name, location, and sample type)
- Designation of matrix spike/matrix spike duplicate (MS/MSD)
- Preservative used
- Analyses required
- Name of sampler
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratories
- Bill of lading or transporter tracking number (if applicable)

### 4.2.1 Laboratory Responsibilities

Once the samples reach the laboratory, they shall be checked against information on the COC form for anomalies. The condition, temperature, and appropriate preservation of samples shall be checked and documented on the COC form. Checking an aliquot of the sample using pH paper is an acceptable procedure, except for volatile organic compounds, where an additional sample is required to check preservation (precautions must be taken to avoid contamination of the sample). The occurrence of any anomalies in the received samples and their resolution shall be documented in laboratory records. All sample information shall then be entered into a tracking system, and unique analytical sample identifiers shall be assigned.

A copy of this information shall be reviewed by the laboratory for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete.

Subcontracted analyses shall be documented with the COC form. Procedures ensuring internal laboratory COC shall also be implemented and documented by the laboratory. Ideally, sample custody will be maintained using an internal custody system that requires samples to be kept in a secured and restricted area when not in use and to be checked out and checked back in by the analysts who use the samples. Internal custody records must be maintained by the laboratory as part of the documentation file for each sample. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory, samples shall be stored in limited-access, temperature-controlled areas. Refrigerators, coolers, and freezers shall be monitored for temperature seven days a week. Acceptance criterion for the temperatures of the refrigerators and coolers is 4°C ± 2°C. Acceptance criterion for the temperatures of the freezers shall be less than 0°C. All of the cold storage areas shall be monitored by thermometers that have been calibrated with a NIST-traceable thermometer. As indicated by the findings of the calibration, correction factors shall be applied to each thermometer. Records that include acceptance criteria shall be maintained. Samples shall be stored after analysis until disposed of in accordance with applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory.

Along with sample receipt documentation, the following information will be documented on Sample Receipt Forms by the sample custodian:

- Date samples received
- CH2M HILL sample identification number
- Laboratory sample identification number
- Analytical tests requested for the sample batch
- Sample matrix
- Number of samples in the batch
- Container description and location in the laboratory
- Verification of sample preservation

Standard operating procedures (SOPs) describing sample control and custody shall be maintained by the laboratory.

## 4.3 Sample Packaging and Transport

The Program QAPP contains guidelines for sample packaging and transport. The SAP contains the project-specific requirements for sample packaging and transport.

# 5.0 Data Quality Objectives and Quality Assurance Program

The data quality objectives for the GMP are specified in the SAP. They are the basis for the design of the data collection plan, and as such, they specify the type, quality, and quantity of data to be collected, and how the data are to be used to make the appropriate decisions for the project. The final output of the process is a data collection design that meets the qualitative and quantitative needs of the project.

## 5.1 Precision, Accuracy, Representativeness, Completeness, and Comparability

Data quality will be evaluated based on their precision, accuracy, representativeness, completeness, and comparability.

### 5.1.1 Precision

Precision is a measure of reproducibility of analytical results. It can be defined as the degree of mutual agreement among individual measurements obtained under similar conditions. Total precision is a function of the variability associated with both sampling and analysis. Precision will be evaluated as the relative percent difference (RPD) between field duplicate sample results, laboratory sample duplicates, or between the MS and MSD results. Field duplicates will comprise 10 percent of the sampling effort. MS/MSD samples will be field-designated at a 5-percent frequency.

### 5.1.2 Accuracy

Accuracy is the degree of agreement between a measured value and the "true" or expected value. It represents an estimate of total error from a single measurement, including both systematic error, or bias, and random error that may reflect variability due to imprecision. Accuracy is evaluated in terms of percent recoveries determined from results of MS/MSD and laboratory control sample (LCS) analyses.

### 5.1.3 Representativeness

Representativeness is the degree to which sample data accurately reflect the characteristics of a population of samples. It is achieved through a well-designed sampling program and by using standardized sampling strategies and techniques and analytical procedures. Factors that can affect representativeness include site homogeneity, sample homogeneity at a single point, and available information around which the sampling program is designed. Using multiple methods to measure an analyte can also result in non-representativeness of sample data.

### 5.1.4 Completeness

Completeness is the amount of valid measurements compared to the total amount generated. It will be determined for each method, matrix, and analyte combination. The completeness goals of each project are optimized to meet the data quality objectives. The goals for this program are 95 percent.

### 5.1.5 Comparability

Comparability is the confidence with which one data set can be compared to another. It is achieved by maintaining standard techniques and procedures for collecting and analyzing samples and reporting the analytical results in standard units. Results of performance evaluation samples and systems audits will provide additional information for assessing comparability of data among participating subcontractor laboratories.

## 5.2 Method Detection Limits, Reporting Limits, and Instrument Calibration Requirements

### 5.2.1 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero. Each participating laboratory will determine the MDL for each method, matrix, and analyte for each instrument that will be used to analyze samples. The MDLs will be initially determined prior to analyzing samples and will be redetermined at least once every 12 months.

(1) Estimate the MDL using one of the following:

   a) the concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5, or

   b) the concentration equivalent of 3 times the standard deviation of replicate measurement of the analyte in reagent water, or

   c) the region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve).

(2) Prepare (i.e., extract, digest) and analyze seven samples of a matrix spike (ASTM Type II/deionized water containing the analyte of interest at a concentration three to five times the estimated MDL.

(3) Determine the variance ($S^2$) for each analyte as follows:

$$S^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2\right] \qquad (1)$$

where $x_i$ = the nth measurement of the variable x and $\overline{x}$ = the average value of x.

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad (2)$$

(4) Determine the standard deviation (s) for each analyte as follows:

$$s = (S^2)^{1/2}$$

(5) Determine the MDL for each analyte as follows:

$$MDL = 3.14(s)$$

(Note: 3.14 is the one-sided t-statistic at the 99-percent confidence level appropriate for determining the MDL using seven samples.)

(6) If the spike level used in step 2 is more than 10 times the calculated MDL, repeat the process using a smaller spiking level.

### 5.2.2 Reporting Limits

Reporting limits should be greater than two times the calculated method detection limit. Reporting limits used by the laboratory should not be greater than the detection limit objectives listed in Tables 5-1 and 5-2.

When calibrating instruments, a standard at a concentration equal to or less than the reporting limit must be included. Analytes that are not detected at or above the RL will be reported as not detected at the reporting limit, and flagged “U.” Reporting limits and sample results should be reported to 2 significant figures if less than 10 micrograms per liter (µg/L) for metals analyses, 10 milligrams per liter (mg/L) for general chemistry analyses, and to three significant figures otherwise.

### 5.2.3 Instrument Calibration

Laboratory instruments shall be calibrated by qualified personnel prior to sample analysis according to the procedures specified in each method. Calibration shall be verified at method specified intervals throughout the analysis sequence. The frequency and acceptance criteria for calibration are specified for each analytical method. When multi-point calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples should be diluted, if necessary, to bring analyte responses within the calibration range. Data that exceed the calibration range cannot be reported by the laboratory. The initial calibration curve shall be verified as accurate with a standard purchased or prepared from an independent second source. The initial calibration verification involves the analysis of a standard containing all the target analytes—typically in the middle of the calibration range—each time the initial calibration is performed. Quantitation based on extrapolation is not desirable.

#### 5.2.3.1 Continuing Calibration

Periodic verification of the initial calibration is essential in generating analytical data of known quality. The continuing calibration verification analyses ensure that the instrument has not been adversely affected by the sample matrix or other instrument failures that would increase or decrease the sensitivity or accuracy of the method. The laboratory will perform continuing calibration for all methods per the specific requirements in the method and applicable laboratory SOP.

## 5.3 Elements of Quality Control

Laboratory QC checks indicate the state of control that prevailed at the time of sample analysis. QC checks that involve field samples, such as matrix spikes, field duplicates and laboratory sample duplicates also provide an indication of the presence of matrix effects. Field-originated blanks provide a way to monitor for potential contamination that field samples are subjected to. The QAPP specifies requirements for method blanks, LCSs, and MS/MSDs that must be followed by laboratories participating in the data collection effort.

A laboratory QC batch is defined as a method blank, LCS, MS/MSD, or a sample duplicate depending upon the method, and 20 or fewer environmental samples of similar matrix that are extracted or analyzed together. Each preparation or analytical batch should be identified in such a way as to be able to associate environmental samples with the appropriate laboratory QC samples.

### 5.3.1 Method Blank

Blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential contaminant sources within the laboratory. A method blank is analyte-free matrix (laboratory reagent water for aqueous samples) to which all reagents are added in the same amount or proportions as are added to samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch. There should be at least one method blank per preparation or analytical batch. If a target analyte is found at a concentration that exceeds the reporting limit, corrective action must be performed to identify and eliminate the contamination source. All associated samples must be re-prepared and/or reanalyzed after the contamination source has been eliminated. No analytical data may be corrected for the concentration found in the blank.

### 5.3.2 Laboratory Control Sample

The LCS will consist of analyte-free matrix (laboratory reagent water for aqueous samples) spiked with known amounts of analytes that come from a source different than that used for calibration standards. Target analytes specified in the QAPP will be spiked into the LCS. The spike levels should be less than or equal to the mid-point of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation and/or reanalysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results of all the LCSs must be reported.

### 5.3.3 Matrix Spike/Matrix Spike Duplicate

A sample matrix fortified with known quantities of specific compounds is called an MS. It is subjected to the same preparation and analytical procedures as the native sample. Target analytes specified in the QAPP are spiked into the sample. Matrix spike recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. An MSD is a second fortified sample matrix. The RPD between the results of the duplicate matrix spikes measures the precision of sample results. The spike levels will be less than or equal to the mid-point of the calibration range unless otherwise specified.

#### 5.3.3.1 MS for Hexavalent Chromium Analyses

Interference from the groundwater at some well locations are known to reduce the sensitivity of the SW7199 method and may result in underestimating the sample specific reporting limit if the MS spike and dilution protocol is not followed. The following locations are required to follow the protocol below until the Project Chemist determines that this protocol is no longer necessary: MW-21, MW-29, MW-30-30, MW-30-50, MW-32-20, MW-32-35, MW-33-40, MW-33-90, MW-34-55 and MW-34-80. All other samples being analyzed by the SW7199 method for this program will follow the protocol below as determined by the Project Chemist.

#### 5.3.3.2 MS Spike and Dilution Protocol

If a sample peak is suspected to be hexavalent chromium but is not within the retention time window, the sample must be post-spiked with 1 µg/L of hexavalent chromium to establish identification. Also, samples that do not exhibit peaks in the chromatograms must be post-spiked with 1 µg/L of hexavalent chromium unless the Project Chemist has directed the laboratory to do otherwise. If the post spike is not recovered or the peak is outside of the established retention time window, the laboratory will dilute two aliquots of the sample at 1:5 dilution factor. The first aliquot will be analyzed without the post spike, and the second will be spiked with 1 µg/L of hexavalent chromium, and the recovery and peak's retention time will be evaluated. If the post-spike recovery is not within 85 to 115 percent and/or the peak is not within the laboratory retention time window, the laboratory will take two additional aliquots, further dilute by another 5X factor, and continue this procedure until the peak identified is within the retention time window and the recovery is within the 85- to 115-percent criteria.

### 5.3.4 Laboratory Sample Duplicate

A sample duplicate selected by the laboratory is called a laboratory sample duplicate. It is subjected to the same preparation and analytical procedures as the native sample. The RPD between the results of the native sample and laboratory sample duplicate measures the precision of sample results. The data collected may also yield information regarding whether the sample matrix is homogenous or heterogeneous.

### 5.3.5 Interference Check Samples

The interference check samples are used in inductively-coupled plasma (ICP) analyses to verify background and inter-element correction factors. They consist of two solutions: A and AB. Solution A contains the interfering analytes, and Solution B contains both the analytes of interest and the interfering analytes. Both solutions are analyzed at the beginning and at the end of each analytical sequence. When the interference check samples results are outside the control limits, corrective action must be taken, including sample reanalysis, if appropriate.

### 5.3.6 Retention Time Windows

Retention time windows must be established for each column and efluent batch. This may be done by running a mid-range standard repeatedly over a period of at least 72 hours. The width of the window will be plus or minus 3 times the standard deviation of the retention times. The average of the retention times of all the calibration verification standards analyzed with each analytical batch will be the center of the retention time window for that batch. In order for an analyte to be reported as positive, its elution time must be within the retention time window.

### 5.3.7 Equipment Blank

Equipment blanks, also sometimes referred to as rinseate blanks, are used to assess the effectiveness of the sampling equipment decontamination procedure. They are obtained immediately following sampling equipment decontamination by rinsing the decontaminated sampling equipment with deionized or ASTM Type II water. The rinse water is collected in sample bottles, preserved, handled, and analyzed in the same manner as the samples. Equipment rinsate blanks will be collected at a frequency of one per day per sampling crew for each decontaminated equipment type.

### 5.3.8 Field Duplicates

A field duplicate is an independent sample collected as close as possible to the original sample from the same source under identical conditions, and is used to evaluate sampling precision. The duplicates are collected simultaneously or in immediate succession, and are treated in exactly the same manner during storage, shipment, and analysis. Field duplicates will be collected at a minimum frequency of 10 percent or one per sampling event, whichever is more frequent, for each matrix and for each type of analysis. The sampling locations for field samples will be recorded in the field logbook.

The field duplicates will be identified in such a manner as to not enable the laboratory to recognize them as field duplicates.

## 5.4 Additional Quality Control Requirements

### 5.4.1 Holding Time

The holding time requirements specified in this QAPP must be met. For methods requiring both sample preparation and analysis, the preparation holding time will be calculated from the time of sampling to the completion of preparation. The analysis holding time will be calculated from the time of completion of preparation to the time of completion of the analysis, including any required dilutions, confirmation analysis, and reanalysis. For methods requiring analysis only, the holding time is calculated from the time of sampling to completion of the analysis, including any required dilutions, confirmation analysis, and reanalysis.

### 5.4.2 Standard Materials and Other Supplies and Consumables

Standard materials must be of known high purity and traceable to an approved source. Pure standards must not exceed the manufacturer’s expiration date or one year following receipt, whichever comes first. Solutions prepared by the laboratory from the pure standards must be used within the expiration date specified in the laboratory's SOP.

All other supplies and consumables must be inspected prior to use to ensure that they meet the requirements specified in the appropriate SOP. The laboratory's inventory and storage system should ensure their use within the manufacturer's expiration date and storage under proper conditions.

### 5.4.3 Manual Integration

The laboratory is required to provide all analysts performing methods that rely on interpretation of chromatographic data with training on appropriate software or manual integration practices. The laboratory also will make every effort to minimize the use of manual integration of data. If the need arises to use manual integration to correct a software auto-integration error, the manual integration will be clearly identified in the instrument data. Before and after enlargements of the region of the chromatogram where the manual integration was performed will be provided on an appropriate scale that allows an independent reviewer to evaluate the need and quality of the manual integration. The analyst will also document the reason for the manual integration on the chromatogram along with their date and initials. The laboratory manager or designee, will approve the manual integration by dating and initialing the chromatogram.

### 5.4.4 Laboratory Quality Assurance Program

The laboratory will maintain a Quality Assurance Manual (QAM) or equivalent document. The QAM will define the laboratory's internal procedures for QA/QC as follows:

- QA policies, objectives and requirements
- Organization and personnel
- Document control
- SOPs (analytical methodology and administrative)
- Data generation
- Software verification
- QA
- QC
- Nonconformance /corrective action procedures
- Data review

#### 5.4.4.1 Laboratory Standard Operating Procedures

The laboratory will maintain SOPs for all analytical methods and laboratory operations. The format for SOPs should conform with the following references:

- Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, 3rd Edition, Update III, Section 1 (USEPA 1996)
- "Good Laboratory Practices" in Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations (USEPA 1995)

All SOPs must have a unique identification number that is traceable to previous revisions of the same document.

### 5.4.4.2 Demonstration of Capability

Laboratory QA department personnel will maintain records documenting the ability of each analyst to perform applicable method protocols. Documentation will include annual checks for each method and analyst. In addition, internal, blind performance evaluation samples for each method and matrix demonstrating overall laboratory performance must be submitted annually. The laboratory may receive blind performance evaluation samples in conjunction with the GMP.

## 5.5 Reporting Limits and Analytical Requirements

Tables 5-1 and 5-2 contain lists of target analytes, the methods to be used, and the reporting limit objectives specific to this project. The Program QAPP contains additional analyses, methods, and guidance. The reporting limits included herein reflect quantifiable levels that are attainable with a specified degree of confidence using the specified methods.

The accuracy and precision limits are listed in Table 5-3 through 5-5. Calibration and QC requirements are specified in Tables 5-6 through 5-11.

TABLE 5-1
Reporting Limit Objectives for Metals
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | Reporting Limits Water (mg/L) |
|---|---|---|
| Aluminum | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.05 |
| Antimony | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8* | 0.003 |
| Arsenic | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.005 |
| Barium | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.5 |
| Beryllium | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.001 |
| Boron | SW6010B/EPA200.7 | 0.2 |
| Calcium | SW6010B/EPA200.7 | 1 |
| Cadmium | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.002 |
| Chromium | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.001 |
| Cobalt | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.005 |
| Copper | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.01 |
| Iron | SW6010B/EPA200.7 | 0.5 |
| Lead | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.005 |
| Magnesium | SW6010B/EPA200.7 | 1 |
| Manganese | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.5 |
| Mercury | SW7470A/EPA245.1 | 0.0002 |
| Molybdenum | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8* | 0.005 |
| Nickel | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.02 |

TABLE 5-1
Reporting Limit Objectives for Metals
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | Reporting Limits Water (mg/L) |
|---|---|---|
| Potassium | SW6010B/EPA200.7 | 1 |
| Selenium | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.005 |
| Silver | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.005 |
| Sodium | SW6010B/EPA200.7 | 1 |
| Thallium | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.001 |
| Vanadium | SW6010B/SW6020/SW7000*/EPA200.7/EPA200.8 | 0.005 |
| Zinc | SW6010B/SW6020/EPA200.7/EPA200.8 | 0.02 |

* The corresponding SW7000 method that will achieve the reporting limit may also be used.

TABLE 5-2
Reporting Limit Objectives for General Chemistry and Other Parameters
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | Reporting Limits Water (mg/L) |
|---|---|---|
| Chloride | EPA 300.0/SW9056 | 0.5 |
| Fluoride | EPA 300.0/SW9056 | 0.5 |
| Sulfate | EPA 300.0/SW9056 | 0.5 |
| Bromide | EPA 300.0/SW9056 | 0.5 |
| Nitrate | EPA 300.0/SW9056 | 0.5 |
| Total Alkalinity | EPA310.1 | 5 |
| Bicarbonate Alkalinity | EPA310.1 | 5 |
| Specific Conductance | EPA120.1/SW9050 | 2 μmhos/cm |
| pH | EPA150.1/SW9040 | 0.1 pH units |
| Total Dissolved Solids | EPA160.1 | 10 |
| Total Suspended Solids | EPA160.2 | 10 |
| Turbidity | EPA180.1 | 0.1 NTU |
| Carbonate Alkalinity | EPA310.1 | 5 |
| Hydroxide Alkalinity | EPA310.1 | 5 |
| Perchlorate | EPA314.0 | 0.004 |
| Ammonia | EPA350.2 | 0.5 |

TABLE 5-2
Reporting Limit Objectives for General Chemistry and Other Parameters
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | Reporting Limits Water (mg/L) |
|---|---|---|
| ortho- Phosphate | EPA365.1 | 0.02 |
| Sulfide | EPA376.1/2 | 2 |
| Ferrous Iron (Fe $^{+2}$) | SM3500D | 0.2 |
| Total Kjeldahl Nitrogen (TKN) | EPA351.4 | 0.5 |
| Dissolved Silica | EPA370.1 | 0.04 |
| Total Organic Carbon | EPA415.2 | 0.5 |
| Dissolved Organic Carbon | EPA415.2 | 0.5 |
| Chromium (hexavalent) | SW7199/EPA218.6 | 0.0002 |
| Chromium (hexavalent) | SW7196A | 0.01 |
| Iodide | EPA 300.0MOD | 0.2 |
| $^{18}$O | Laboratory SOP (CF-IRMS) | NA |
| Deuterium | Laboratory SOP (CF-IRMS) | NA |

TABLE 5-3
Accuracy and Precision Limits for ICP-ICP/MS Metals
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | LCS Accuracy Water (% R) | MS/MSD Accuracy Water (% R) | Precision Water (% RPD) |
|---|---|---|---|---|
| Aluminum | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Antimony | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Arsenic | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Barium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Beryllium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Boron | SW6010B//EPA200.7 | 85-115 | 75-125 | ≤ 20 |
| Calcium | SW6010B/EPA200.7 | 85-115 | 75-125 | ≤ 20 |
| Cadmium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Chromium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |

TABLE 5-3
Accuracy and Precision Limits for ICP-ICP/MS Metals
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | LCS Accuracy Water (% R) | MS/MSD Accuracy Water (% R) | Precision Water (% RPD) |
|---|---|---|---|---|
| Cobalt | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Copper | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Iron | SW6010B/EPA200.7 | 85-115 | 75-125 | ≤ 20 |
| Lead | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Magnesium | SW6010B/EPA200.7 | 85-115 | 75-125 | ≤ 20 |
| Manganese | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Molybdenum | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Nickel | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Potassium | SW6010B/EPA200.7 | 85-115 | 75-125 | ≤ 20 |
| Selenium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Silver | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Sodium | SW6010B/EPA200.7 | 85-115 | 75-125 | ≤ 20 |
| Thallium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Vanadium | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |
| Zinc | SW6010B/SW6020/EPA200.7/EPA200.8 | 85-115 | 75-125 | ≤ 20 |

R = recovery.
MS = mass spectrometer.

TABLE 5-4
Accuracy and Precision Limits for SW7000 Series
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analyte | Method | LCS Accuracy Water (% R) | MS/MSD Accuracy Water (% R) | Precision Water (% RPD) |
|---|---|---|---|---|
| Various Elements | SW7000 series | 75-125 | 75-125 | ≤ 15 |
| Mercury | SW7470A/EPA245.1 | 75-125 | 75-125 | ≤ 15 |

R = recovery.

TABLE 5-5
Accuracy and Precision Limits for General Chemistry and Other Analyses
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| **Analyte** | **Method** | **LCS Accuracy Water (% R)** | **MS/MSD Accuracy Water (% R)** | **Precision Water (% RPD)** |
|---|---|---|---|---|
| Chloride | EPA300.0/SW9056 | 85-115 | 75-125 | ≤ 20 |
| Fluoride | EPA300.0/SW9056 | 85-115 | 75-125 | ≤ 20 |
| Sulfate | EPA300.0/SW9056 | 85-115 | 75-125 | ≤ 20 |
| Bromide | EPA300.0/SW9056 | 85-115 | 75-125 | ≤ 20 |
| Nitrate | EPA300.0/SW9056 | 85-115 | 75-125 | ≤ 20 |
| Total Alkalinity | EPA310.1 | 85-115 | 75-125 | ≤ 20 |
| Bicarbonate Alkalinity | EPA310.1 | 85-115 | 75-125 | ≤ 20 |
| Specific Conductance | EPA120.1/SW9050 | 85-115 | 75-125 | ≤ 20 |
| pH | EPA150.1/SW9040 | NA | NA | ≤ 20 |
| Total Dissolved Solids | EPA160.1 | 75-125 | NA | ≤ 5 |
| Total Suspended Solids | EPA160.2 | 75-125 | NA | ≤ 5 |
| Turbidity | EPA180.1 | NA | NA | ≤ 20 |
| Carbonate Alkalinity | EPA310.1 | 85-115 | 75-125 | ≤ 20 |
| Hydroxide Alkalinity | EPA310.1 | 85-115 | 75-125 | ≤ 20 |
| Perchlorate | EPA314.0 | 85-115 | 75-125 | ≤ 20 |
| Ammonia | EPA350.2 | 85-115 | 75-125 | ≤ 20 |
| ortho- Phosphate | EPA365.1 | 85-115 | 75-125 | ≤ 20 |
| Dissolved Silica | EPA370.1 | 75-125 | 75-125 | ≤ 20 |
| Total Organic Carbon | EPA415.2 | 85-115 | 75-125 | ≤ 20 |
| Dissolved Organic Carbon | EPA415.2 | 85-115 | 75-125 | ≤ 20 |
| Chromium (hexavalent) | SW7199/EPA218.6 | 90-110 | 85-115 | ≤ 20 |
| Chromium (hexavalent) | SW7196A | 90-110 | 75-125 | ≤ 20 |
| Sulfide | EPA376.1/2 | 75-125 | 75-125 | ≤ 20 |
| Ferrous Iron ($Fe^{+2}$) | SM3500D | 75-125 | 75-125 | ≤ 20 |
| Total Kjeldahl Nitrogen (TKN) | EPA351.4 | 75-125 | 75-125 | ≤ 20 |
| Iodide | EPA300Mod | 75-125 | 75-125 | ≤ 20 |
| $^{18}O$ | Laboratory SOP (CF-IRMS) | NA | NA | NA |
| Deuterium | Laboratory SOP (CF-IRMS) | NA | NA | NA |

NA = not applicable.

TABLE 5-6
Calibration and QC Requirements for SW6010B/EPA200.7
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| Initial calibration (a blank and at least one standard) | Before sample analysis, every 24 hours, whenever modifications are made to the system, or when continuing calibration verification fails | If more than one standard is used, correlation coefficient must be > 0.995 | N/A |
| Second-source calibration verification | Immediately following each initial calibration | All analytes within ±10% of expected value for SW6010B and within ±5% of expected value for 200.7 | Correct problem and repeat initial calibration. |
| Calibration blank | After every Second-source or Continuing calibration verification analysis | No analytes detected at or above the reporting limit | Correct the problem, then reanalyze previous 10 samples. |
| Continuing calibration verification | After every 10 samples and at the end of the analysis sequence | All analytes within ±10% of expected value for SW6010B and within ±10% of expected value for 200.7 | Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification. |
| Method Blank | At least one per analytical batch | No analytes detected at or above the reporting limit | Correct the problem and re-prep and reanalyze all associated samples. |
| Interference check standard | At the start and end of each analytical sequence or twice during an 8-hour period, whichever is more frequent | All analytes within ±20% of expected value | Correct the problem, recalibrate, reanalyze ICS and all affected samples. |
| MS/MSD | One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed | All analytes within limits specified in Accuracy and Precision table | None. |
| Laboratory sample duplicate | Once per analytical batch if MSD not performed | Concentration of reported analytes are > 5 times the reporting limit in either sample and RPD >20%<br>One sample result < RL and a difference of ±2 times the reporting limit | None. |
| LCS | At least one per analytical batch | All analytes within limits specified in Accuracy and Precision table | Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch. |
| Dilution test | Each new sample matrix | Result from 1:5 dilution must be within ±10% of the undiluted sample result (applies only if undiluted sample result is at least 25 times the reporting limit) | Perform post-digestion spike addition. |
| Linear Range Calibration check standard | Once per quarter | All analytes within ±10% of expected value | Correct problem then reanalyze or re-set linear range. |
| Post-digestion spike addition | When dilution test fails | Recovery within 75-125% of expected value | None. |

TABLE 5-7
Calibration and QC Requirements for SW6020/EPA200.8
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| Initial calibration (a blank and at least one standard) | Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails | N/A | N/A |
| Second-source calibration verification | Immediately following each initial calibration | All analytes within ±10% of expected value | Correct problem and repeat initial calibration. |
| Calibration blank | After every Second-source or Continuing calibration verification analysis | No analytes detected at or above the reporting limit | Correct the problem, then reanalyze previous 10 samples. |
| Continuing calibration verification | After every 10 samples and at the end of the analysis sequence | All analytes within ±10% of expected value | Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification |
| Method Blank | At least one per analytical batch | No analytes detected at or above the reporting limit | Correct the problem and re-prep and reanalyze all associated samples |
| Interference check standard | At the start and end of each analytical sequence or twice during an 8-hour period, whichever is more frequent | All analytes within ±20% of expected value | Correct the problem, recalibrate, reanalyze ICS and all affected samples. |
| MS/MSD | One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed | All analytes within limits specified in Accuracy and Precision table | None |
| Laboratory sample duplicate | Once per analytical batch if MSD not performed | Concentration of reported analytes are > 5 times the reporting limit in either sample and RPD >20%.<br>One sample result < RL and a difference of ±2 times the reporting limit | None |
| LCS | At least one per analytical batch | All analytes within limits specified in Accuracy and Precision table | Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch. |
| Dilution test | Each new sample matrix | Result from 1:5 dilution must be within ±10% of the undiluted sample result (applies only if undiluted sample result is at least 25 times the reporting limit) | Perform post-digestion spike addition. |
| Post-digestion spike addition | When dilution test fails | Recovery within 75-125% of expected value | None |

TABLE 5-8
Calibration and QC Requirements for SW7000 Series/EPA 245.1
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| Multi-point initial calibration (a blank and at least five standards) | Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails | Correlation coefficient of linear regression is ≥ 0.995 | Correct the problem and repeat the initial calibration. |
| Second-source calibration verification | Immediately following each initial calibration | All analytes within ±20% of expected value | Correct the problem and repeat initial calibration. |
| Calibration blank | After every Second-source or Continuing calibration verification analysis | No analytes detected at or above the reporting limit | Correct the problem, then reanalyze previous 10 samples. |
| Continuing calibration verification | After every 10 samples and at the end of the analysis sequence | All analytes within ±20% of expected value | Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification |
| Method Blank | At least one per analytical batch | No analytes detected at or above the reporting limit | Correct the problem and re-prep and reanalyze all associated samples |
| MS/MSD | One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed | All analytes within limits specified in Accuracy and Precision table | None |
| Laboratory sample duplicate | Once per analytical batch if MSD not performed | Concentration of reported analytes are > 5 times the reporting limit in either sample and RPD >20%.<br>One sample result < RL and a difference of ±2 times the reporting limit | None |
| LCS | At least one per analytical batch | All analytes within limits specified in Accuracy and Precision table | Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch |
| Dilution test | Each new sample matrix | Result from 1:5 dilution must be within ±10% of the undiluted sample result (applies only if undiluted sample result is at least 25 times the reporting limit) | Perform recovery test |
| Recovery test | When dilution test fails | Recovery within 85-115% of expected value | Analyze all samples by MSA |

TABLE 5-9
Calibration and QC Requirements for General Chemistry and Other Parameters*
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| Multi-point initial calibration (a blank and at least five standards) – does not apply to titrimetric method | Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails | Correlation coefficient of linear regression is ≥ 0.995 | Correct the problem and repeat the initial calibration. |
| Second-source calibration verification | Immediately following each initial calibration | Analytes within ±15% (±10% for SW9056/EPA300.0) of expected value | Correct the problem and repeat initial calibration. |
| Calibration blank – does not apply to titrimetric method | After every Second-source or Continuing calibration verification analysis | No analytes detected at or above the reporting limit | Correct the problem, then reanalyze previous 10 samples. |
| Continuing calibration verification | After every 10 samples and at the end of the analysis sequence | Within ±15% (±10% for SW9056/EP300.0) of expected value | Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification |
| Method Blank | At least one per analytical batch | No analytes detected at or above the reporting limit | Correct the problem and re-prep and reanalyze all associated samples |
| MS/MSD | One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed | All analytes within limits specified in Accuracy and Precision table | None |
| Laboratory sample duplicate | Once per analytical batch if MSD not performed | Concentration of reported analytes are > 5 times the reporting limit in either sample and RPD >20%.<br>One sample result < RL and a difference of ±2 times the reporting limit | None |
| LCS | At least one per analytical batch | All analytes within limits specified in Accuracy and Precision table | Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch |
| Instrument Performance Check (IPC) (EPA 314.0 only) | Daily, before sample analysis | Conductance within 10% of original value (original value within ± 10% of MCT) | Prepare fresh IPC solution |

TABLE 5-9
Calibration and QC Requirements for General Chemistry and Other Parameters*
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| | | $PD_{A/H} < 25\%$, instrument response within ± 20% of expected response | Redetermined MCT or correct problem and reanalyze IPC |
| | | Retention time shifts < 5%, or overall retention time < 80% of original recorded value | Correct problem, clean or replace column |
| Initial calibration verification (EPA 314.0 only) | Daily, before sample analysis or when eluent is changed | Instrument response within ± 25% of expected value using a standard at or below the RL | Correct problem then repeat initial calibration |
| Pretreated laboratory reagent blank (EPA 314.0 only) | Required in any analytical batch which includes samples that have been pretreated to reduce the common anion levels | Perchlorate must be ≤ ½ RL | Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank |
| Low-level MDL Check Std. (EPA 314.0 only) | Analyzed weekly, and with initial calibration | Must meet QC acceptance criteria, 50-150% of its true concentration | Re-analyze low-level MDL Check Std., if still out of criteria repeat initial calibration. |

* Unless calibration and QC requirements are specified for an individual method.

TABLE 5-10
Calibration and QC Requirements for SW7199/EPA218.6
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| Multi-point initial calibration (a blank and at least five standards) – does not apply to titrimetric method | Before initial sample analysis, every 24 hours, whenever modifications are made to the analytical system, or when continuing calibration verification fails | Correlation coefficient of linear regression is ≥ 0.999 | Correct the problem and repeat the initial calibration. |
| Second-source calibration verification | Immediately following each initial calibration | All analytes within ±10% of expected value | Correct the problem and repeat initial calibration. |
| Calibration blank | After every Second-source or Continuing calibration verification analysis | No analytes detected at or above the reporting limit | Correct the problem, then reanalyze previous 10 samples. |
| Continuing calibration verification | After every 10 samples and at the end of the analysis sequence | All analytes within ±10% of expected value for SW7199 and within ±5% of expected value for | Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification |

TABLE 5-10
Calibration and QC Requirements for SW7199/EPA218.6
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| | | EPA218.6 | |
| Duplicate Sample Injections | Every Sample | RPD between injections must be <20% | Correct the problem and re-prep and reanalyze all associated samples |
| Method Blank | At least one per analytical batch | No analytes detected at or above the reporting limit | Correct the problem and re-prep and reanalyze all associated samples |
| MS/MSD | One set per 20 project-specific samples. MSD is optional if a laboratory sample duplicate is performed | All analytes within limits specified in Accuracy and Precision table | None |
| Laboratory sample duplicate | Once per analytical batch if MSD not performed | Concentration of reported analytes are > 5 times the reporting limit in either sample and RPD >20%.<br>One sample result < RL and a difference of ±2 times the reporting limit | None |
| LCS | At least one per analytical batch | All analytes within limits specified in Accuracy and Precision table | Correct the problem, and re-prep and reanalyze the LCS and all samples in the analytical batch |
| pH Buffer Solution Modification | As needed due to sample matrices that cause the analytical column to overload. All QC samples and analyses will use the modified buffered solution when needed. | A modified pH-adjustment buffer that contains ten times less ammonium sulfate (33 g/L) but the same concentration of ammonium hydroxide as the buffer prescribed in SW7199/EPA 218.6. | None |
| MS Dilute and Spike (see Section 5.3.3.1) | As directed in Section 5.3.3.1 | Spike recovery 85-115% and peak within RT window. | Dilute two aliquots 1:5, spike one with 1 μg/L of hexavalent chromium and analyze the other unspiked. Continue the aforementioned procedure using successively greater dilutions of two aliquots until RT and recovery criteria are met. |

TABLE 5-11
Calibration and QC Requirements for Stable Isotopes ($^{18}$O and Deuterium)
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| QC Check | Frequency | Criteria | Corrective Action |
|---|---|---|---|
| Instrument Standardization | Daily, prior to sample analysis | Laboratory SOP | Perform instrument maintenance |
| Laboratory sample duplicate | Every sample analyzed five times | Laboratory SOP | Perform instrument maintenance and reanalyze samples |

# 6.0 Calibration Procedures and Frequency

## 6.1 Field Calibration Procedures

The June 2004 Draft SAP (CH2M HILL 2004) addresses the field calibration requirements specific for the GMP activities. Refer to SOP-1 (Appendix C in the SAP) for the specific field instrument calibration procedures.

## 6.2 Laboratory Calibration Procedures

Qualified personnel will appropriately calibrate laboratory instruments prior to sample analysis. The requirements specified in each method will be followed. Only certified standards of known purity may be used for calibration. Calibration will be verified at specified intervals throughout the analysis. The frequency and acceptance criteria for calibration are specified for each analytical method in Tables 5-6 through 5-11. When multi-point calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples. Samples must be diluted, if necessary, to bring analyte responses within the calibration range. The laboratory may only report those data that result from quantitation within the demonstrated working calibration range. Quantitation based on extrapolation is not acceptable. Section 5.3 addresses initial and continuing calibration requirements in greater detail.

# 7.0 Analytical Procedures

The Program QAPP includes the majority of analytical procedures to be employed for the PG&E Program. The QAPP supercedes or supplements the analytical procedures in the Program QAPP. Specifically, included in Tables 5-1 and 5-2 are the project specific parameters to be measured, the required methods, and reporting limits.

The allowed sample preparation methods are presented in Table 7-1. Analytical and preparation methods for SW7000 series are provided in Table 7-1 as alternate methods to SW6010B/SW6020. These methods will be allowed, provided the reporting limit objectives are met. Once a method is chosen, it must be used throughout the duration of a specific project to maintain data comparability.

Analytical services will be provided by laboratories contracted by CH2M HILL or its subcontractors.

The calibration and QC requirements specified for each method will be followed. These are discussed in Sections 5.2.3 and 6.2 and in Tables 5-6 through 5-11. Appropriate corrective action will be taken when acceptance criteria are not met. If corrective action is not effective, and data quality is potentially degraded, the occurrence must be documented in a corrective action report and in the data package case narrative. The laboratory manager or a designated person must notify the Project Chemist.

TABLE 7-1
Extraction and Digestion Methods
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Analytical Method | Parameter | Preparatory Methods |
|---|---|---|
| SW6010B | Trace metals by ICP | SW3005A, SW3010A, SW3015 |
| SW6020 | Trace metals by ICP-MS | SW3005A, SW3010A, SW3015 |
| SW7000 Series | Various Elements | SW3015, SW3020A |
| EPA200.7/EPA200.8 | Trace metals by ICP/ICP-MS | See analytical method |
| SW7470A/EPA245.1 | Mercury by Cold Vapor Atomic Adsorption | See analytical method |
| SW7196A/SW7199/EPA218.6 | Hexavalent Chromium | See analytical method |
| Laboratory SOP (CF-IRMS) | Stable Isotopes | See laboratory SOP |
| EPA 300MOD | Iodide | See analytical method |
| Various[a] | General Chemistry | See analytical method |

[a] EPA 120.1/SW9050, EPA 150.1/SW9040, EPA160.1, EPA160.2, EPA 180.1, EPA 300.0/SW9056, EPA 310.1, EPA 350.1-3,EPA354.1, EPA 365.1, EPA 370.1, EPA376.1/2, SM3500D and EPA 415.2.

# 8.0 Data Reduction, Validation, and Reporting

## 8.1 Laboratory Data Management

Data reduction will be done manually or by using appropriate application software. Quantitation procedures specified for each method must be followed. If data reduction is done manually, the documentation must include the formulas used. Any application software used for data reduction must have been previously verified by the laboratory for accuracy. Documentation of the software's verification must be maintained on file in the laboratory. All documentation of data reduction must allow re-creation of the calculations.

All data will undergo a minimum of three levels of review at the laboratory prior to release. The analyst performing the tests shall initially review 100 percent of the data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the section supervisor for accuracy, compliance with calibration, and QC requirements, holding time compliance, and for completeness. Analyte identification and quantitation must be verified. Calibration and QC results will be compared with the applicable control limits. Reporting limits should be reviewed to make sure they meet the project objectives. Results of multiple dilutions should be reviewed for consistency. Any discrepancies must be resolved and corrected. Laboratory qualifiers will be applied when there are non-conformances that could potentially affect data usability. These qualifiers must be properly defined as part of the deliverables. All issues that are relevant to the quality of the data must be addressed in a case narrative. The laboratory QC manager will review a minimum of 10 percent of data or deliverables generated for this program against the project specific requirements. A final data review will be conducted by the Laboratory Manager or Client Services Representative to ensure that all required analyses were performed on all samples and that all documentation is complete.

The hardcopy and electronic laboratory reports for all samples and analyses will contain the information necessary to perform data evaluation.

The Topock project uses two types of reporting deliverables. The following is a brief synopsis of what when it is appropriate to use each deliverable:

| | |
|---|---|
| Level 3 | Appropriate for investigative, confirmatory, or closure results. Critical project decisions may be made using this data. |
| Level 4 | Appropriate for investigative, confirmatory, or closure results. Critical decisions may be made using this data and should be used for projects that require a high degree of confidence in the accuracy of the data. |

Hardcopy deliverables will be provided as described below and should be organized in a format that facilitates identification and retrieval of data. Refer to the Program QAPP if other deliverables are determined to be needed for this project.

At a minimum, the following information (when applicable) will be included in a ***Level 3*** report:

- Cover letter complete with the following information:
  - Title of report and laboratory unique report identification
  - Project name, site location
  - Name and location of laboratory and second-site or subcontracted laboratory
  - Client name and address
  - Statement of authenticity and official signature and title of person authorizing report release
- Table of contents
- Summary of samples received that correlates field sample ids with the laboratory ids
- Laboratory qualifier flags and definitions
- Case Narrative that addresses the following information at a minimum:
  - Sample receipt discrepancies, such as temperature exceedances, etc.
  - Descriptions of all non conformances in the sample receipt, handling, preparation, analytical and reporting processes and the corrective action taken in each occurrence.

- Identification and justification for sample dilution
- Field identification number
- Date received
- Date prepared
- Date analyzed (and time of analysis if the holding time is less than or equal to 48 hours)
- Preparation and analytical methods
- Dilution factor (provide both diluted and undiluted results when available)
- Sample-specific reporting limit adjusted for sample size, dilution/concentration
- Sample-specific MDL adjusted for sample size, dilution/concentration (when project objectives require reporting less than the reporting limit)
- Units
- MS/MSD and LCS spike concentrations, native sample results, spiked sample results, percent recoveries, and RPDs between the MS and MSD results. Associated QC limits must also be provided.
- Method blank results
- Analytical batch reference number that cross references samples to QC sample analyses

- Executed chain of custody and sample receipt checklist
- Analytical sequence or laboratory run log that contains sufficient information to correlate samples reported in the summary results to the associated method QC information, such as initial and continuing calibration analyses.
- Calibration blank results for inorganic analyses (required in hardcopy format only)
- ICP or ICP/mass spectrometer interference check sample true and measured concentrations and percent recoveries (required in hardcopy format only)
- Method of standard addition results (if applicable; required in hardcopy format only)
- Post-digestion spike recoveries (if applicable; required in hardcopy format only)
- Initial calibration summary, including standard concentrations, response factors, average response factors, relative standard deviations or correlation coefficients, and calibration plots or equations, if applicable (required in hardcopy format only)
- Continuing calibration verification summary, including expected and recovered concentrations and percent differences (required in hardcopy format only)
- Any other method-specific QC sample results

A ***Level 4*** report will include all elements outlined above for the Level 3 report and all of the associated raw data. It is imperative that the relative scale used for all chromatographic and other instrument data be supplied in a scale that facilitates review from hard copy. Sufficient “blow ups” of complex areas of sample chromatograms will be provided. The additional information below will also be supplied:

- Sample preparation logs that include the following information:
  - Preparation start and end times
  - Beginning and ending temperatures of water baths, digestion blocks, etc.
- Example calculation for obtaining numerical results from at least one sample for each matrix analyzed; provide algorithm.

Within the timeframe specified in the laboratory statement of work or specified on the chain of custody, the laboratory shall deliver two hardcopy sets of documentation that are in compliance with the specifications herein. In addition the laboratory shall deliver one electronic copy of the data as specified in the format described in Table 8-1 via a 3.5-inch floppy disk or via e-mail (edata@ch2m.com) in ASCII format within the same timeframe. All

TABLE 8-1
Data Guidelines for Electronic Deliverables
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Field Number | Field Name | Data Type | Data Length | Rqmt | Description and Comments |
|---|---|---|---|---|---|
| 1 | VersionCode | text | 15 | R | Code identifying the version of the EDD deliverable. |
| 2 | LabName | text | 10 | R | Identification code for the laboratory performing the work. This value is used to distinguish among different facilities. |
| 3 | SDG | text | 8 | R | Sample delivery group designation. Always populated for all samples, including QC. |
| 4 | FieldID | text | 13 | R | Client sample ID as appears on chain-of-custody form with optional lab-assigned suffixes and/or prefixes to make it unique. If the sample identifier on the chain-of-custody form and the prefix/suffix is greater than 13 characters, abbreviate the value but make it unique. For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. |
| 5 | NativeID | text | 13 | R | Client sample ID, exactly as on the chain-of-custody form. No prefix or suffix allowed. Used to identify the native sample from which other samples are derived (e.g., QAQCType = ”LR,” “MS,” or “SD”). For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. For lab blank spike (and blank spike duplicate) samples, use the FieldID value that was assigned to the associated method blank. |
| 6 | QAQCType | text | 2 | R | This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the chain-of-custody form should have the designation of “N” (normal field sample). No suffix allowed (i.e., do not add numbers as suffixes to the QAQCType values as is called for in the ERPIMS guidelines).<br>Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of “LR” and a LRType value of “DL” (see LRType, below). |
| 7 | LRType | text | 3 | C | This is the code for laboratory replicate sample type. Values are:<br>blank (if QAQCType value is not “LR”),<br>“DL” (dilution),<br>“RE” (re-analysis),<br>“D” (inorganic duplicate),<br>“CF” (confirmation).<br>For multiple dilutions or re-analyses of the same sample, append the replicate number after the LRType value (i.e., “RE,” “RE2,” “RE3”.). |

TABLE 8-1
Data Guidelines for Electronic Deliverables
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Field Number | Field Name | Data Type | Data Length | Rqmt | Description and Comments |
|---|---|---|---|---|---|
| 8 | Matrix | text | 5 | R | Sample matrix code. Valid values are as follows: “AIR,” “WATER,” “SOIL,” unless otherwise provided by the project data manager and marked on the chain-of-custody form. The use of “liquid,” “solid,” etc. for lab QC is not allowed. |
| 9 | LabSampleID | text | 20 | R | Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Ex: “D97-11111RE” is acceptable. |
| 10 | AnalysisMethod | text | 20 | R | Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as “EPA” should not be used. |
| 11 | ExtractionMethod | text | 20 | R | Preparation method code. A value in this field is required. If the preparation is described in the method, use “METHOD”. If there is no separate preparation required, use “NONE”. Note that Total and Dissolved metal analyses are differentiated by the value in this column. Note that Total, TCLP, and SPLP analyses are now differentiated by the value in the LeachMethod column (see below). |
| 12 | SampleDate | date | | C | Date of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy |
| 13 | SampleTime | time | | C | Time of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. 24-hour format: hh:mm |
| 14 | ReceiveDate | date | | C | Date of sample receipt in the lab. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy |
| 15 | ExtractDate | date | | C | Date of sample preparation (extraction or digestion). Value is required if the ExtractionMethod field value is other than “NONE”. Format: mm/dd/yyyy |
| 16 | ExtractTime | time | | C | Time of sample preparation. Value is required if the ExtractionMethod field value is other than “NONE”. 24-hour format: hh:mm |
| 17 | AnalysisDate | date | | R | Date of sample analysis. Value is required for all records. Format: mm/dd/yyyy |
| 18 | AnalysisTime | time | | R | Time of sample analysis. Value is required for all records. 24-hour format: hh:mm |
| 19 | PercentSolids | number | | R | Percent solids within the sample. Should be zero for water samples. |
| 20 | LabLotCtlNum | text | 10 | C | Identifier of an autonomous group of environmental samples and associated QC samples **prepared** together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank. |

TABLE 8-1
Data Guidelines for Electronic Deliverables
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Field Number | Field Name | Data Type | Data Length | Rqmt | Description and Comments |
|---|---|---|---|---|---|
| 21 | CAS | text | 20 | C | CAS number of analyte, if available. |
| 22 | ParamID | text | 12 | R | Parameter identifier code for the parameter listed in the Analyte field. |
| 23 | Analyte | text | 60 | R | Name of analyte, chemical name. |
| 24 | Result | text | 10 | R | Result of the analysis. Surrogate analytes will be reported in units of percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted reporting limit, depending on the project. (Reported as a text field to preserve significant figures.) |
| 25 | ExpectedValue | number |  | C | “100” for surrogates; “0” (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc. |
| 26 | Units | text | 10 | R | Units of measure used in the analysis. Report “PERCENT” for surrogate analytes and concentration units for all others. |
| 27 | Dilution | number |  | R | Total dilution reported in the analysis. Default value should be 1 (one). This value should reflect changes to sample preparation amounts as defined by the method (e.g., less sample used for standard VOC analysis). |
| 28 | MDL | number |  | C | Minimum detection limit adjusted for preparation and dilution. Note that this value may be the MDL or the instrument detection limit, depending on the method and the project requirements. This value is **not** adjusted for percent moisture. |
| 29 | Reporting limit | number |  | C | Reporting limit adjusted for preparation and dilution. Value is **not** adjusted for percent moisture. Equivalent to PQL. |
| 30 | LabQualifier | text | 6 | R | Lab qualifier for the results, as reported on the hard copy. Use “=” as first (or only) qualifier value for detected results. |
| 31 | Surrogate | text | 1 | R | Is the chemical a surrogate? Report “Y” for yes or “N” for no. |
| 32 | Comments | text | 240 | O | Comment field |
| 33 | ParValUncert | text | 16 | C | Radiological parameter value uncertainty. |
| 34 | Recovery | number |  | C | Percent recovery for MS, SD, LCS, and surrogate compounds. |

TABLE 8-1
Data Guidelines for Electronic Deliverables
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Field Number | Field Name | Data Type | Data Length | Rqmt | Description and Comments |
|---|---|---|---|---|---|
| 35 | LowerControlLimit | number | | C | Lower control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34). |
| 36 | UpperControlLimit | number | | C | Upper control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34). |
| 37 | Basis | text | 1 | R | Weight basis for soil (or solid) sample analysis. Use "D" for dry-weight basis, "W" for wet-weight basis, or "X" if not applicable. |
| 38 | ConcQual | text | 1 | R | Concentration qualifier. Use "=" for detects, "J" for estimated value (value between detection limit and reporting limit), "U" for undetected result, or "E" for exceeded result. |
| 39 | MDLAdjusted | number | | C | Minimum detection limit adjusted for preparation, dilution **and percent moisture**. See the description of the MDL field (Field No. 28) for an explanation of the contents of this field. |
| 40 | RLAdjusted | number | | C | Reporting limit adjusted for preparation, dilution **and percent moisture**. Equivalent to PQL |
| 41 | SampleDescription | text | 20 | C | Full sample identifier value as it appears on the chain-of-custody form. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on the chain-of-custody form, or derived from samples that are collected in the field and specified on the chain-of-custody form. |
| 42 | LeachMethod | text | 20 | R | Analytical method used for leaching the sample. This applies to TCLP, STLC, or other leaching or pre-extraction leaching procedures. Use "NONE" if the sample was not leached. |
| 43 | LeachDate | date | | C | Date that the leaching method was performed (start date for multi-date leaching procedures). Value is required if the LeachMethod field value is other then "NONE". Format: mm/dd/yyyy. |
| 44 | LeachTime | time | | C | Time that the leaching procedure started. Value is required if the LeachMethod field value is other then "NONE". 24-hour format: hh:mm. |
| 45 | LeachLot | text | 20 | C | Identifier of an autonomous group of environmental samples and associated QC samples **leached** at the same time. If the sample was not leached, leave this field blank. |
| 46 | AnalysisLot | text | 20 | R | Identifier of an autonomous group of environmental samples and associated QC samples **analyzed** together. A value in this field is mandatory (i.e., it should not be blank). |

TABLE 8-1
Data Guidelines for Electronic Deliverables
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Field Number | Field Name | Data Type | Data Length | Rqmt | Description and Comments |
|---|---|---|---|---|---|
| 47 | CalRefID | text | 20 | C | Identifier of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run. |

Note:
The electronic data deliverable file from the laboratory will be a comma-delimited ASCII file in the format listed above. There will be one file per hard copy report and the filename of the electronic data deliverable file will be in the format REPORTID.csv, where REPORTID is the hard copy report identifier of sample delivery group.

electronic data files shall match the final hard copy results. CH2M HILL requires receipt of final hard copy results in conjunction with submittal of electronic files.

All raw data will be maintained on file in the laboratory and will be available upon request by project management. Complete documentation of sample preparation and analysis and associated QC information will be maintained in a manner that allows easy retrieval in the event that additional validation or information is required. All documentation must be retained for a minimum of 10 years after data acquisition.

The primary responsibility for the implementation of these procedures within the laboratory will reside with the laboratory manager or equivalent. The laboratory manager will approve laboratory reports before transferring the information to the client.

## 8.2 Data Validation

The analytical results of the data collection effort will be validated by CH2M HILL. Personnel involved in the data validation function will be independent of any data generation effort. The Project Chemist will have responsibility for oversight of the data validation effort. Data validation will be carried out when the data packages are received from the laboratory. It will be performed on an analytical batch basis using the summary results of calibration and laboratory QC, as well as those of the associated field samples. Data packages will be reviewed for all contaminants of concern. Raw data will be reviewed when deemed necessary by the Project Chemist. Data validation procedures will include:

- Review of the data package for completeness.
- Review of chain-of-custody records for discrepancies that might degrade data quality.
- Review for compliance with holding time and QC frequency requirements.
- Evaluation of all calibration and QC summary results against the project requirements.
- Verification of analyte identification and calculations for at least 10 percent of the data.
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations.
- Initiation of corrective actions, as necessary, based on the data review findings.

Data validation will be patterned after the USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, July 2002 substituting the calibration and QC requirements specified in this QAPP for those specified in the guidelines. The flagging criteria in Tables 8-2 and 8-3 will be used. The qualifier flags are defined in Table 8-4.

Qualifier flags, if required, will be applied to the electronic sample results. If multiple flags are required for a result, the most severe flag will be applied to the electronic result. The hierarchy of flags from the most severe to the least severe will be as follows: R, UJ, U, J.

A validation report will be generated for each method and sample delivery group. A copy of the validation report will be submitted to the project management, and a copy will be retained with the data package in the project file. Any significant data quality problems will be brought to the attention of the Project Chemist.

TABLE 8-2
Flagging Conventions–Minimum Data Evaluation Criteria for Inorganic Methods
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| Holding Time | Holding time exceeded for extraction, digestion, or analysis | J positive results; R non-detects for mercury; UJ non-detects for all other analytes | Sample |
| | Holding time for digestion or analysis exceeded by a factor of 2 | J positive results; R non-detects | |
| Sample Preservation | Sample preservation requirements not met (If sample preservation was not done in the field, but was performed at the laboratory upon sample receipt, no flagging is required) | J positive results; R non-detects | Sample |
| Temperature | > 6°C | J positive results; UJ non-detects | Samples in same cooler |
| Initial Calibration (Multi-point only) | Correlation coefficient $\leq$ 0.995 | J positive; UJ non-detects | All associated samples in analytical batch |
| Calibration verification (initial calibration verification, continuing calibration verification) | %R > UT | J positive results | All associated samples in analytical batch |
| | %R < LT | J positive results, UJ non-detects | |
| Interference check sample (SW6010B/SW6020 only) | %R > UT | J positive results | All associated samples in analytical batch |
| | %R < LT | J positive results; UJ non-detects | |
| Laboratory Control Sample | %R > UT | J positive results | All samples in preparation batch |
| | %R < LT | J positive results; UJ non-detects | |
| Calibration Blank (ICB,CCB)<br>Method Blank | Multiply the highest blank concentration by 5 | U positive sample results < 5x highest blank concentration | All samples in preparation batch or analytical batch, whichever one applies, associated with method blank or calibration blank |
| Equipment Blank | | | All samples, same site, matrix and date |
| Matrix Spikes | %R > UT | J positive results | All samples from same site as parent sample |
| | %R < LT | J positive results<br>UJ non-detects | |
| | RPD > UT | J positive results | |

TABLE 8-2
Flagging Conventions–Minimum Data Evaluation Criteria for Inorganic Methods
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| MS Dilute and Spike (see Section 5.3.3.1) | Spike recovery 85-115% and peak within RT window. If criteria are not met, the laboratory is required to dilute two aliquots 1:5, spike one with 1 µg/L of hexavalent chromium and analyze the other unspiked. Continue the aforementioned procedure using successively greater dilutions of two aliquots until RT and recovery criteria are met. | Choose the dilution where the RT/recovery criteria are met.<br>If RT/recovery criteria are met at a 1:1 dilution, data qualification is not required for detected or non detected results.<br>If RT/recovery criteria met at dilution greater than a 1:1, elevate the RL for non detected results and qualify the data U at a level equal to the RL multiplied by the dilution factor of the acceptable analysis (apply ValAdj validation reason).<br>If RT/recovery criteria are not met:<br>a) Analysis performed only at a 1:1dilution :<br>J positive results (apply LabA&P validation reason)<br>UJ or R non-detects determined in conjunction with Project Chemist (apply LabA&P validation reason)<br>b) Analysis performed at subsequent dilutions and criteria are still not met:<br>J flag positive apply LabA&P validation reason)<br>Elevate RL -UJ or R non-detects, determined in conjunction with Project Chemist (apply LabA&P validation reason) | Sample |

TABLE 8-2
Flagging Conventions–Minimum Data Evaluation Criteria for Inorganic Methods
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Quality Control Check | Evaluation | Flag | Samples Affected |
|---|---|---|---|
| Dilution Test | If concentration is >25 times the reporting limit and percent difference >UT | J positive results<br>UJ non-detects | All samples from same site as parent sample if analytical spike not performed |
| Post-digestion Spikes/Recovery Test (Metals only) | Spike results indicate performance of MSA required, but MSA not done. | | All samples in digestion batch if MSA not performed |
| | %R > UT | J positive | |
| | %R < LT | J positive results, UJ non-detects | |
| MSA (GFAA only) for samples where post-digestion spike (performed as a result of unacceptable serial dilution) fails | r < 0.995 | J positive results | Sample |
| Field Duplicates<br>Laboratory Sample Duplicates | Concentration of reported analytes are > 5 times the reporting limit in either sample and RPD > 20% | J positive results | Field duplicate pair |
| | One or both sample results < 5 times the reporting limit and a difference of ±2 times the reporting limit | J positive results<br>UJ non-detects | |

Notes:

All QA/QC criteria are included in Tables 5-3 through 5-11and will be used for validation criteria.

Spike recovery limits do not apply when sample concentration exceeds the spike concentration by a factor of 4 or more.

CCB = Continuing calibration blank.
ICB = Initial calibration blank.
LT = Lower tolerance.
MB = Method blank.
UT = Upper tolerance.
MDL = Method detection limit.
MSA = Method of standard addition.
RPD = Relative percent difference.
%R = Percent recovery.
ValAdj = Value reported by laboratory adjusted due to matrix issues.

LabA&P = Laboratory accuracy and precision criteria not met

TABLE 8-3
Qualifier Flag Definitions
*Quality Assurance Project Plan Addendum, Topock Compressor Station, Needles, California*

| Flag | Definition |
|---|---|
| J | Analyte was present but reported value may not be accurate or precise. |
| R | This result has been rejected. |
| U | This analyte was analyzed for but not detected at the specified detection limit. |
| UJ | The analyte was not detected above the detection limit objective. However, the reported detection limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample |

# 9.0 Performance Evaluations

The Program QAPP specifies requirements to assess sample and data collection procedures, conductance of performance evaluations and will consist of technical systems audits and performance audits. Technical systems audits include field audit (project specific field audit requirements are addressed in the SAP) and laboratory audits. Performance audits consist of laboratory performance evaluations, external laboratory audits, and internal laboratory audits. The results of the of performance evaluations will be summarized and reported in the quarterly groundwater monitoring reports.

# 10.0 Preventive Maintenance

The Program QAPP outlines the requirements for the preventive maintenance program required for the laboratory and field operations. The primary objective of a preventive maintenance program is to promote the timely and effective completion of a measurement effort. The maintenance program should be designed to minimize the downtime of crucial sampling and/or analytical equipment from expected or unexpected component failure. In implementing this program, efforts should be focused in three primary areas:

- Establishing maintenance responsibilities.
- Establishing maintenance schedules for major and/or critical instrumentation and apparatus.
- Establishing an adequate inventory of critical spare parts and equipment.

# 11.0 Corrective Action

Corrective action may be required as a result of deviations from field or analytical procedures. Deficiencies identified in audits and data quality evaluations may also call for corrective action. All project personnel have the responsibility, as part of the normal work duties, to identify, report, and solicit approval of corrective actions for conditions adverse to data quality.

The QAPP has specified the corrective action to be taken when deviations from calibration and QC acceptance criteria occur. These are listed in Tables 5-6 through 5-11. Field and laboratory staff may encounter conditions that require immediate corrective action that are not addressed in the SAP or QAPP. These personnel will document conditions and the results of corrective actions in a field logbook or laboratory non conformance report and communicate their actions as soon as feasible to the field team leader, laboratory supervisor, and if necessary, the Project Chemist for immediate input. A mechanism must be in place to allow for supervisory review and/or client input for all deviations or deficiencies. A corrective action reporting system that requires immediate documentation of deviations or deficiencies and for supervisory review of the actions taken to correct them will be established. At a minimum, the corrective action report should include:

- The type of deviation or deficiency.
- The date of occurrence.
- The impact of the deviation or deficiency, such as samples affected.
- The corrective action taken.
- Documentation that the process has been returned to control.

The only time that a corrective action report may be waived is when a deviation or deficiency is immediately corrected and its impact is precluded. An example would be an unacceptable initial calibration that is repeated before samples are analyzed.

Each corrective action report must be reviewed and approved by a person of authority, such as the field team leader or laboratory supervisor. The ultimate responsibility for the laboratory corrective action process is the laboratory’s Quality Assurance Officer, who must ensure that proper documentation, approval, and close out of all out-of-control or non-conformance events is performed. A non-conformance report will summarize each non-conformance condition. Corrective action reports that could potentially affect data quality must be brought to the attention of the Project Chemist. Report disposition will be the responsibility of the Project Chemist. The Project Manager may be notified about a particular report at the Project Chemist ‘s discretion. Copies of corrective action reports must be maintained in the laboratory or field project files.

# 12.0 Quality Assurance Reports

A QA report will be submitted by the Project Chemist to the Project Manager at the end of each sampling interval. The report will summarize the results of the data validation and the data assessment. Any significant quality problems and recommended solutions will be included in the report. Limitations on data usability that were identified during data validation should be highlighted. The results of data assessment should be reconciled with the project objectives.

# 13.0 References

CH2M HILL. 2004. *Draft Sampling and Analysis Plan, Groundwater and Surface Water Monitoring, PG&E Topock Compressor Station.* June 15.

United States Environmental Protection Agency (USEPA). 1995. "Good Laboratory Practices" in Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations.

_________. 1996. *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, 3rd Edition, Update III, Section 1.* December.

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# Appendix C
# Standard Operating Procedures and Field Forms

# SOP-1

## Standard Operating Procedures, PG&E Topock Project
## Calibration of Field Instruments

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**Required Documents**

1) Equipment Manufacturers' Manual
2) Event specific SAP
3) Previous Calibration Records
4) Field Equipment Binder (documents equipment servicing, calibration, etc..)
5) Blank Calibration Sheets

**Preparation and Setup**

1) Initiate field log sampling book for activity.
2) Inspect all equipment necessary to carry out activities detailed in event-specific SAP.
3) Always use fresh solutions for calibration.
4) Calibration should be performed prior to initiating sampling each day and values checked against standards at the completion of every day.
5) Review Field Equipment Binder equipment servicing records to anticipate next service.
6) Note: all equipment and solutions are stored in an air-conditioned office onsite to maintain the integrity. Due to extreme temperature at the site, all calibrations are performed within this office.

*Horiba U-23 – Equipment List:*

-autocal solution
-Level II solution
-Spare batteries
-DI water

*Orion pH/ORP Meter – Equipment List*

-pH 7 and 10 calibration standards
-Zobell's ORP check solution
-DI water
-Spare batteries

*Hach Turbidity Meter – Equipment List*

-Hach DI water, NTU =0
-Gell standard solutions, NTU= 10 and NTU=100
-Spare Batteries

## Calibration Procedures

### *Horiba U-23*

1) Fill Horiba calibration cup to fill line with fresh autocal solution.
2) Remove storage cap (containing DI water) from probes and place probes into the calibration cup.
3) Allow 10 minutes for probe stabilization.
4) Follow procedures in Horiba U-22 manual for auto-calibration using autocal solution.
5) Once auto-calibration is complete, check the accuracy by recording all parameters in the measurement mode. Record Horiba serial number, measured parameters, date, and time on the calibration sheet.
6) If measured parameters are not within acceptable limits (+/-0.1 pH units and +/-10% for specific conductance), repeat procedure as needed and investigate equipment malfunction. Note temperature as standard values are expected at $25^0$C.
7) Discard used auto-cal solution.
8) Rinse calibration cup and probes with DI water.
9) Fill calibration cup to fill line with Level II solution.
10) Place probes in calibration cup.
11) Allow 10 minutes to equilibrate.
12) Operate Horiba in read mode and record field parameter measurements on the calibration sheet.
13) If measured parameters are not within acceptable limits (+/-0.1 pH units and +/-10% for specific conductance), perform manual calibration of each parameter standard to match Level II solution. Note temperature as standard values are expected at $25^0$C.
14) Operate Horiba in read mode and record field parameter measurements on the calibration sheet.
15) Discard used Level II solution.
16) Rinse probes with DI water.
17) Cap probes with transfer cup containing DI water.
18) Proceed with field measurements as needed while noting:

-probes must be rinsed thoroughly with DI water after each well.
-probes must always be submersed in liquid (DI water when not in use).
–absolutely no air bubbles nor leaks should be present in the flow-through cell, repair and/or replace as needed.
–ensure all readings have stabilized prior to recording a measurement.
–all field parameters must be compared with previous data and documented on the field data sheet.

### *Orion pH/ORP Meter*

1) Inspect electrode for scratches, cracks, salt crystal build-up, or membrane/junction deposits.
2) Rinse off any salt build-up with DI water. Follow manufacturer cleaning procedures if needed.

pH probe

1) Attach the pH probe to the Orion meter.
2) Rinse electrode with DI water.
3) Place electrode into fresh container of pH 7 and wait until reading stabilizes.
4) Record reading, time, and date on field calibration sheet.
5) Rinse electrode with DI water and then pH 10 buffer.
6) Place electrode in container of pH 10 buffer and wait until reading stabilizes.
7) Set meter to the actual pH value of the buffer.
8) Record reading, time, and date on field calibration sheet.
9) If the slope is between 92 and 102% or < +/- 0.1 pH units, proceed with pH measurements. If values are not within this range, troubleshoot and repeat as needed.

ORP probe

1) Mix a fresh bottle of Zobell's solution using DI water as per manufacturer's instructions.
2) Attach the ORP probe to the Orion meter.
3) Rinse electrode with DI water.
4) Place electrode into fresh container of Zobell's, wait at least 10-15 minutes until reading stabilizes.
5) Record ORP, temperature, time, and date on field calibration sheet.
6) Use the temperature/ORP table to determine the standard and compare.
7) If ORP is within 25 mV proceed with ORP measurements. If ORP is not +/- 25 mV, troubleshoot and repeat as needed.

### *Hach Turbidity Meter*

1) Perform a check as per manufacturer's instructions with Hach DI water and standard solutions.
2) Record reading, time, and date on calibration sheet for both DI water and standard solution.
3) If the readings are within 10%, proceed with turbidity measurements; If not within this range, troubleshoot and repeat as needed.

### *Water-level Meters*

When using multiple water-level meters at the site it is necessary to calibrate each against each-other using the following procedure:

1. At a well with shallow depth to water, without dedicated tubing, piping, pump, or transducer lower all water level meters into the well and record the reading to the nearest hundredth of a foot on the calibration sheet along with water-level meter number, time, and date.

## Horiba U-22, ORION, and Turbidity Meter Calibration Sheet
## Project Site: Topock GMP

Updated: 6/15/04

**Calibrate each sampling day in the morning and after the first 3 locations sampled following SOP-1.**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **U-22 instrument serial #** | | | | | | | | | | | | |
| **Auto Calibration Performed: Y / N** | **Units** | **Date/Time** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** |
| **Auto Calibration solution reading:** | | | | | | | | | | | | |
| pH | pH | | 4.00 | | 4.00 | | 4.00 | | 4.00 | | 4.00 | |
| Conductivity | mS/cm | | 4.49 | | 4.49 | | 4.49 | | 4.49 | | 4.49 | |
| Turbidity | ntu | | | | | | | | | | | |
| DO | mg/L | | | | | | | | | | | |
| Temperature | celsius | | 25.00 | | 25.00 | | 25.00 | | 25.00 | | 25.00 | |
| Salinity | % | | | | | | | | | | | |
| TDS | g/L | | | | | | | | | | | |
| ORP | mV (Ag/AgCl) | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Manual Calibration Performed: Y / N** | | | | | | | | | | | | |
| **Readings (Auto Calibration solution)** | | | | | | | | | | | | |
| pH | pH | | | | | | | | | | | |
| Conductivity | mS/cm | | | | | | | | | | | |
| Turbidity | ntu | | | | | | | | | | | |
| DO | mg/L | | | | | | | | | | | |
| Temperature | celsius | | | | | | | | | | | |
| Salinity | % | | | | | | | | | | | |
| TDS | g/L | | | | | | | | | | | |
| ORP | mV (Ag/AgCl) | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Level II Solution Readings** | | | | | | | | | | | | |
| pH | pH | | 6.68 | | 6.68 | | 6.68 | | 6.68 | | 6.68 | |
| Conductivity | mS/cm | | 53.00 | | 53.00 | | 53.00 | | 53.00 | | 53.00 | |
| Turbidity | ntu | | 10 or 100 | | 10 or 100 | | 10 or 100 | | 10 or 100 | | 10 or 100 | |
| DO | mg/L | | | | | | | | | | | |
| Temperature | celsius | | | | | | | | | | | |
| Salinity | % | | | | | | | | | | | |
| TDS | g/L | | | | | | | | | | | |
| ORP | mV (Ag/AgCl) | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Manual Calibration Performed: Y / N** | | | | | | | | | | | | |
| **Readings (Level II solution)** | | | | | | | | | | | | |
| pH | pH | | | | | | | | | | | |
| Conductivity | mS/cm | | | | | | | | | | | |
| Turbidity | ntu | | | | | | | | | | | |
| DO | mg/L | | | | | | | | | | | |
| Temperature | celsius | | | | | | | | | | | |
| Salinity | % | | | | | | | | | | | |
| TDS | g/L | | | | | | | | | | | |
| ORP | mV (Ag/AgCl) | | | | | | | | | | | |

| **Auto Calibration Performed: Y / N** | **Units** | **Date/Time** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Auto Calibration solution reading:** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **ORION Serial #** | | | | | | | | | | | | |
| pH 7 calibrated: Y / N | | | | | | | | | | | | |
| pH 7 solution reading | | | | | | | | | | | | |
| pH 10 Calibrated: Y / N | | | | | | | | | | | | |
| pH 10 Solution Reading | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **ORP - Zobell's Check Only** | | | | | | | | | | | | |
| pH | pH | | | | | | | | | | | |
| Conductivity | mS/cm | | | | | | | | | | | |
| Turbidity | ntu | | | | | | | | | | | |
| DO | mg/L | | | | | | | | | | | |
| Temperature | celsius | | | | | | | | | | | |
| Salinity | % | | | | | | | | | | | |
| TDS | g/L | | | | | | | | | | | |
| ORP | mV (Ag/AgCl) | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Within 25 mV of ORP standard? Y / N** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Turbidity meter serial #** | | | | | | | | | | | | |
| | **Units** | | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** | **Standard** | **Measured** |
| | | | | | | | | | | | | |
| Hach DI water reading | NTU | | 0 | | | | | | | | | |
| Standard Solution Reading | NTU | | 10 or 100 | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | **DTW at one site well** | | | | | | | | | |
| Water Level Meter ID | | | | | | | | | | | | |
| Water Level Meter ID | | | | | | | | | | | | |
| Water Level Meter ID | | | | | | | | | | | | |
| | | | | | | | | | | | | |

Notes: * From the measured temperature value, find the closest standard temperature from the Zobell table and use the corresponding ORP standard.

## Zobell solution-Temp/ORP Table

| Temp in deg C | ORP (Ag/AgCl) (4M KCl) mV | Temp in deg C | ORP (Ag/AgCl) (4M KCl) mV |
|---|---|---|---|
| -5 | 270.0 | 23 | 233.6 |
| -4 | 268.7 | 24 | 232.3 |
| -3 | 267.4 | 25 | 231.0 |
| -2 | 266.1 | 26 | 229.7 |
| -1 | 264.8 | 27 | 228.4 |
| 0 | 263.5 | 28 | 227.1 |
| 1 | 262.2 | 29 | 225.8 |
| 2 | 260.9 | 30 | 224.5 |
| 3 | 259.6 | 31 | 223.2 |
| 4 | 258.3 | 32 | 221.9 |
| 5 | 257.0 | 33 | 220.6 |
| 6 | 255.7 | 34 | 219.3 |
| 7 | 254.4 | 35 | 218.0 |
| 8 | 253.1 | 36 | 216.7 |
| 9 | 251.8 | 37 | 215.4 |
| 10 | 250.5 | 38 | 214.1 |
| 11 | 249.2 | 39 | 212.8 |
| 12 | 247.9 | 40 | 211.5 |
| 13 | 246.6 | 41 | 210.2 |
| 14 | 245.3 | 42 | 208.9 |
| 15 | 244.0 | 43 | 207.6 |
| 16 | 242.7 | 44 | 206.3 |
| 17 | 241.4 | 45 | 205.0 |
| 18 | 240.1 | 46 | 203.7 |
| 19 | 238.8 | 47 | 202.4 |
| 20 | 237.5 | 48 | 201.1 |
| 21 | 236.2 | 49 | 199.8 |
| 22 | 234.9 | 50 | 198.5 |

# SOP-2

## Standard Operating Procedures, PG&E Topock Project
## Temporary Removal and Replacement of Pressure Transducers

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This standard operating procedure (SOP) addresses the procedures and equipment to be used for the temporary removal and reinstallation of pressure transducers during the sampling of groundwater monitoring wells at the Topock site.

Transducers measure the pressure head, or the height of water above a pressure sensor, which is converted to a groundwater elevation. Groundwater elevations often vary only by a tenth of a foot or less between wells and it is therefore important to maintain the correct transducer installation setup and to **avoid movement of the transducers**. If it is necessary to remove the transducers for groundwater sampling, the following procedures should be followed.

### REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan
2) SAP/QAPP
3) HSP
4) Well construction logs/specifications
5) Previous sampling logs and water level data
6) Blank sampling logs and field notebook

### PREPARATION & SETUP

1) Review event-specific sampling and analysis plan, previous field data, SAP, QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Inspect all equipment and calibrate water level meters if multiple meters are being used according to SOP-1, *Calibration of Field Instruments*.
4) Calibrate wrist-watch to satellite time using cellular phone or satellite clock.

### MEASUREMENT PROCEDURES

1) Open well protection lid and inspect transducer installation hardware. The transducer mounting bracket should be perfectly flush against the well casing. The nuts holding the mounting bracket together should be inside the well casing for the 2″ and 4″ wells. The 1″ wells will have the nuts resting directly on top of the well casing. Describe the transducer setup and condition in the transducer comments section of the sampling field data sheet. If the transducer is incorrectly installed, inform the field team manager.

2) Before removing the transducer, measure the depth to water below top of casing (DTW BTOC) according to SOP-3, *Water Level Measurements.* Record the exact time to the nearest minute and the DTW BTOC in the transducer section of the sampling form (use attached form dated June 2004).

3) Remove the transducer, coil cable and store in a manner to prevent contamination of the cable and probe. Record the time of removal on the sampling field data sheet.

4) When groundwater sampling is completed, reinstall the transducer and maintain the correct setup of the transducer mounting hardware as described in Step 1. Record the time of reinstallation on the sampling field data sheet. If the installation setup of the transducer has changed, notify the field team manager.

5) Measure the depth to water below top of casing at least five minutes after reinstalling the transducer according to SOP-3, *Water Level Measurements.* Record the time and DTW BTOC on the sampling form.

The above procedures are for removal and replacement of transducers during groundwater sampling. For transducer downloading and maintenance procedures contact the field manager and refer to *Pressure Transducer Download and Maintenance SOP, PG&E Topock.*

# SOP-3

# Standard Operating Procedures, PG&E Topock Project Water Level Measurements

---

## REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan
2) SAP/QAPP
3) HSP
4) Well construction logs/specifications
5) Previous water level data
6) Blank sampling logs and field notebook

## PREPARATION & SETUP

1) Review event-specific sampling and analysis plan, previous field data, SAP, QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Inspect all equipment and calibrate water level meters if multiple meters are being used according to SOP-1, *Calibration of Field Instruments*.
4) If a transducer is present in the well and it is necessary to remove transducer to allow well access, refer to SOP-2, *Temporary Removal and Replacement of Transducers.*
5) Calibrate wrist-watch to satellite time using cellular phone or satellite clock.

## MEASUREMENT PROCEDURES

1) Prepare groundwater sampling log (use attached form dated June 2004).
2) Place water level probe into well or from surface water monitoring point and lower until sensor sounds. Shake the line to remove any retained water. Note depth to water (DTW) measurement to mark on well casing, if there is no mark on casing measure to the north. Repeat 3 times and record final DTW to the nearest hundredth of a foot on the sampling log. Record well identification, time, date, DTW, and water level meter number.
3) Compare DTW measurement with previous data and note discrepancies on the sampling form. Repeat step #2 if an unexpected discrepancy is noted.
4) Decontaminate the lower five feet of measuring tape following the SAP procedures for equipment decontamination.

# SOP-4

# Standard Operating Procedures, PG&E Topock Project
# Purging & Sampling of Groundwater Monitoring Wells
# Well-Volume Method

---

This standard operating procedure (SOP) addresses the procedures and equipment to be used for purging and sampling all groundwater monitoring wells at the Topock site with casing diameters in excess of 1-inch.  A well-volume based purging and sampling method will be used for these wells.

## REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan
2) SAP/QAPP
3) HSP
4) Well construction logs/specifications
5) Previous sampling logs
6) Blank sampling logs and field notebook

## PREPARATION & SETUP

1) Review event-specific sampling and analysis plan, previous sampling logs, SAP, QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Inspect all equipment and calibrate field water quality (WQ) meters according to SOP-1, *Calibration of Field Instruments*.
4) Inventory sample bottles, required analyses, and lab courier schedule.
5) Field-check and setup sampling equipment: water level (WL) meter, WQ meters, flow-through cell, pump control and power supply, pump discharge/sampling tubing, etc.
6) If well is equipped with a transducer, remove transducer from the well according to SOP-2, *Temporary Removal and Replacement of Transducers*.
7) If well is not equipped with a dedicated sampling system, install at pump same intake/sampling depth used in prior events and record intake depth.  If the well has not been previously sampled, install the pump with the intake in the middle of the screened interval or at the depth proscribed by the PM or FTM

## PURGING AND SAMPLING PROCEDURES

1) Prepare groundwater sampling log (use attached form dated June 2004).

2) Open well protection lid and measure initial static WL according to SOP-3, *Water level Measurements*. Record WL value on sampling log.

3) Calculate 3-casing volumes.

4) Start purging, measure WL, and calculate purge rate.

5) Continue purging and measuring WL, and field indicator parameters every 2-3 minutes; recheck purge-rate periodically. <u>Record time for all measurements collected</u>. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problem.

6) Observations on sample appearance and clarity during purging and at sampling are required. For standardization, use a glass jar to collect and record observations of discharge water appearance during purging. Also note characteristics of any odors associated with discharge.

7) Continue purging until <u>**3-casing volumes**</u> have been purged <u>**and**</u> field parameters stabilize. Indicator parameters are considered stabilized when 3 consecutive readings made several minutes apart fall within the following EPA stabilization criteria:

| | | |
|---|---|---|
| • pH | +/- | 0.1 pH units |
| • Specific conductance | +/- | 3% |
| • ORP | +/- | 10 millivolts |
| • Turbidity | +/- | 10% NTU units (when turbidity is >10 NTUs) |
| • Dissolved oxygen | +/- | 0.3 mg/L |

8) Collect samples for analyses according to event-specific sampling and analysis plan. Sample containers are to be filled by transferring water directly from the pump discharge to the appropriate sample container.

9) Record sample information, final WL, and purge volume data on field log.

10) If well was equipped with a transducer, replace transducer according to SOP-2, *Temporary Removal and Replacement of Transducers*.

11) Close and secure well protection lid.

12) Follow SAP procedures for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management.

**Project Name** Topock GMP **Sampling Event** ____________

Job Number 316363.GM.02 **Date** ____________

Field Team ____________ Field Conditions ____________ Page ____ of ____

**Well/Sample Number** ____________ **QC Sample ID** ____________ QC Sample Time ____________

Purge Start Time ____________ Purge Method: ____________ Ded. Pump ____________

Flow Cell: Y / N Min. Purge Volume (gal)/(L) ____________ Purge Rate (gpm)/(mLpm) ____________

| Water Level | Time | Vol. Purged gallons / liters | pH | Conductivity mS/cm | Turbidity NTU | Diss. Oxygen mg/L | Temp. °C | Salinity % | TDS g/L | Eh / ORP mv | Comments (See descriptors below) |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| **Parameter Stabilization Criteria:** | | | +/- 0.1 pH units | +/- 3% | +/- 10% NTU units when >10 NTUs | +/- 0.3 mg/L | NA | NA | NA | +/- 10 mV | |
| Did Parameters Stabilize prior to sampling? | | | | | | | NA | | | | |
| Are measurements consistent with previous? | | | | | | | NA | | | | |

Sample Time ____________ Sample Location: pump tubing ____ well port ____ spigot ____ bailer ____ other ____________

Comments: ____________

Remarks ____________

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Initial Depth to Water (ft BTOC): ____________ Measure Point: Well TOC Steel Casing

WD (Well Depth - from table) ft btoc: ____________

SWH (Standing Water Height) = WD-Initial Depth ____________

D (Volume as per diameter) 2" = 0.17, 4"= 0.66, 1" = 0.041 ____________

One Casing Volume = D*SWH ____________

Three Casing Volumes = ____________

**TRANSDUCER**

| Before Removal | | Approx. 5 min After Reinstallation | |
|---|---|---|---|
| Time | DTW | Time | DTW |
| | | | |

Time of Removal ____________

Time of Reinstallation ____________

Comments:

**Color**: clear, grey, yellow, brown, black, cloudy, green **Odor**: none, sulphur, organic, other **Solids**: Trace, Small Qu, Med Qu, Large Qu, Particulate, Silt, Sand

# SOP-5

## Standard Operating Procedures, PG&E Topock Project
## Purging & Sampling of 1-inch Diameter Groundwater Monitoring Wells
## Modified Well-Volume Method

---

### REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan
2) SAP/QAPP
3) HSP
4) Well construction details
5) Previous field data
6) Blank sampling logs and field notebook

### PREPARATION & SETUP

1) Review event-specific sampling and analysis plan, previous sampling logs, SAP, QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Inspect all equipment and calibrate field water quality (WQ) meters according to SOP-1, *Calibration of Field Instruments*.
4) Inventory sample bottles, required analyses, and lab courier schedule.
5) Field-check and setup sampling equipment: water level (WL) meter, WQ meters, flow-through cell, pump control and power supply, pump discharge/sampling tubing, etc.
6) If well is equipped with a transducer, remove transducer from the well according to SOP-2, *Temporary Removal and Replacement of Transducers*.
7) If well is not equipped with a dedicated sampling system, install at pump same intake/sampling depth used in prior events and record intake depth. If the well has not been previously sampled, install the pump with the intake in the middle of the screened interval or at the depth proscribed by the PM or FTM

### PURGING AND SAMPLING PROCEDURES

1) Prepare groundwater sampling log (use attached form dated June 2004).
2) Open well protection lid and measure initial static WL according to SOP-3, *Water level Measurements*. Record WL value on sampling log.
3) Calculate 1- system volume for the installed purge pump system.
4) Start purging and measure WL and calculate purge rate every 2 minutes during start of purging. After 1-system volume purged, start recording field indicator parameters per sampling sheet.

5) Continue purging and measuring WL and parameters every 2-3 minutes; recheck purge-rate periodically. Record time for all measurements collected. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problem.

6) Observations on sample appearance and clarity during purging and at sampling are required. For standardization, use a glass jar or white bucket to collect and record observations of discharge water appearance during purging. Also note characteristics of any odors associated with discharge.

7) Continue purging until **3-casing volumes** have been purged **and** field parameters stabilize. For 1-inch wells the total volume purged is typically 4-6 casing volumes. Indicator parameters are considered stabilized when 3 consecutive readings made several minutes apart fall within the following EPA stabilization criteria:

   - pH +/- 0.1 pH units
   - Specific conductance +/- 3%
   - ORP +/- 10 millivolts
   - Turbidity +/- 10% NTU units (when turbidity is >10 NTUs)
   - Dissolved oxygen +/- 0.3 mg/L

8) Collect samples for analyses according to event-specific sampling and analysis plan. Sample containers are to be filled by transferring water directly from the pump discharge to the appropriate sample container.

9) Record sample information, final WL, and purge volume data on field log.

10) If well was equipped with a transducer, replace transducer according to SOP-2, *Temporary Removal and Replacement of Transducers*.

11) Close and secure well protection lid.

12) Follow SAP procedures for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management.

**Project Name** Topock GMP
Job Number 316363.GM.02
Field Team ____________ Field Conditions ____________

**Sampling Event** ____________
**Date** ____________
Page _____ of _____

**Well/Sample Number** ____________
**QC Sample ID** ____________
QC Sample Time ____________
Purge Start Time ____________
Purge Method: ____________
Ded. Pump ____________
Flow Cell: Y / N
Min. Purge Volume (gal)/(L) ____________
Purge Rate (gpm)/(mLpm) ____________

| Water Level | Time | Vol. Purged gallons / liters | pH | Conductivity mS/cm | Turbidity NTU | Diss. Oxygen mg/L | Temp. °C | Salinity % | TDS g/L | Eh / ORP mv | Comments (See descriptors below) |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| **Parameter Stabilization Criteria:** | | | +/- 0.1 pH units | +/- 3% | +/- 10% NTU units when >10 NTUs | +/- 0.3 mg/L | NA | NA | NA | +/- 10 mV | |
| Did Parameters Stabilize prior to sampling? | | | | | | | NA | | | | |
| Are measurements consistent with previous? | | | | | | | NA | | | | |

Sample Time ____________ Sample Location: pump tubing _____ well port _____ spigot _____ bailer _______ other ____________

Comments: ____________

Remarks ____________

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Initial Depth to Water (ft BTOC): ____________
WD (Well Depth - from table) ft btoc: ____________
SWH (Standing Water Height) = WD-Initial Depth ____________
D (Volume as per diameter) 2" = 0.17, 4"= 0.66, 1" = 0.041 ____________
One Casing Volume = D*SWH ____________
Three Casing Volumes = ____________

Measure Point: Well TOC Steel Casing

**TRANSDUCER**

| Before Removal | | Approx. 5 min After Reinstallation | | |
|---|---|---|---|---|
| Time | DTW | Time | DTW | Time of Removal ____________<br>Time of Reinstallation ____________ |
| | | | | |
| Comments: | | | | |

**Color**: clear, grey, yellow, brown, black, cloudy, green **Odor**: none, sulphur, organic, other **Solids**: Trace, Small Qu, Med Qu, Large Qu, Particulate, Silt, Sand

# SOP-6

## Standard Operating Procedures, PG&E Topock Project
## Surface Water Sampling

---

### REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan
2) SAP/QAPP
3) HSP
4) Well construction logs/specifications
5) Previous sampling logs
6) Blank sampling logs and field notebook

### PREPARATION & SETUP

1) Review event-specific sampling and analysis plan, previous sampling logs, SAP, QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Inspect all equipment and calibrate field water quality (WQ) meters (WQ) according to SOP-1, *Calibration of Field Instruments*.
4) Inventory sample bottles, required analyses, and lab courier schedule.
5) Field-check and setup sampling equipment: WQ meters, sampler, etc.

### SAMPLING PROCEDURES

1) Prepare surface water sampling log (use attached form dated June 2004).
2) If sampling at locations RRB, A-Dock, or I-3 (or any other river station where water levels are required), measure river WL according to SOP-3, *Water level Measurements*. Record WL value on sampling log.

   RRB: Water level measurement will be taken at the "X" on the bridge.

   A-Dock. Water level elevation is recorded from the 4 foot water level mark on the water level elevation pole.

   I-3: There is a bolt and nut in the metal bridge, water level is recorded to the base of the nut.

3) Place probes in the Colorado River at a secure place near-shore for 5 minutes to allow for temperature stabilization prior to reading field parameters from sample.
4) Collect samples for analyses according to event-specific sampling and analysis plan.

| | |
|---|---|
| RRB and I-3: | Samples are collected using a disposable bailer and directly filling the sample bottles. |
| All other locations: | Samples are collected using a surface water sampling pole that is extended 4 to 5 feet from the shoreline and the sample collected 6 to 12 inches below the surface. Sampling containers are filled from the bottle attached to the sampling pole. |

5) Record sample information on field log.

6) Follow SAP procedures for sample handing and management, equipment decontamination, and investigation-derived waste (IDW) management.

7) Fill a clean bucket with Colorado River water collected 6 to 12 inches below surface using a bailer or by directly filling the bucket. Where possible (all locations except RRB), flowing water is collected for field parameters.

8) Measure field parameters by inserting the Horiba and Orion probes directly into the bucket. The Hach vial shall be filled from the bucket. Record all parameters on the field sheet. <u>Record time for all measurements collected</u>. Note and provide qualifying remarks if parameter readings are anomalous or unstable due to instrument problem.

Surface Water Sampling Log Updated: June 2004

**Project Name** Topock GMP

Job Number 316363.GM.02

Field Team

Field Conditions

**Sampling Event**

**Date**

Page _____ of _____

**Sample Location / Number**

Start Time

Depth to Water: _________ Time: ______ Measure Point: ______________

**Duplicate Sample No.**

Dupl. Time

| Water Level | Time | | pH | Conductivity mS/cm | Turbidity NTU | Diss. Oxygen mg/L | Temp. °C | Salinity % | TDS g/L | Eh / ORP mv | Comments (See descriptors below) |
|---|---|---|---|---|---|---|---|---|---|---|---|
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Sample Time _______________ Sample Location: ______________

Final Water Level: __________ Time: __________ Comment:

Remarks

**Color**: clear, grey, yellow, brown, black, cloudy, green **Odor**: none, sulphur, organic, other **Solids**: Trace, Small Qu, Med Qu, Large Qu, Particulate, Silt, Sand

**Sample Location / Number**

Start Time

Depth to Water: _________ Time: ______ Measure Point: ______________

**Duplicate Sample No.**

Dupl. Time

| Water Level | Time | | pH | Conductivity mS/cm | Turbidity NTU | Diss. Oxygen mg/L | Temp. °C | Salinity % | TDS g/L | Eh / ORP mv | Comments (See descriptors below) |
|---|---|---|---|---|---|---|---|---|---|---|---|
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Sample Time _______________ Sample Location: ______________

Final Water Level: __________ Time: __________ Comment:

Remarks

**Color**: clear, grey, yellow, brown, black, cloudy, green **Odor**: none, sulphur, organic, other **Solids**: Trace, Small Qu, Med Qu, Large Qu, Particulate, Silt, Sand

# SOP-7

## Standard Operating Procedures, PG&E Topock Project
## Sample Field Filtration and Preservation for Metals Analyses

---

This standard operating procedure (SOP) addresses the procedures and equipment to be used for collecting groundwater / surface water samples for metals analyses at the Topock site. Refer to SOP 4 or 5 for specific groundwater and surface water sampling methods, respectively.

### REQUIRED DOCUMENTS

1) Event-specific sampling and analysis plan
2) SAP/QAPP
3) HSP
4) Previous sampling logs
5) Blank sampling logs and field notebook

### PREPARATION & SETUP

1) Review event-specific sampling and analysis plan, previous sampling logs, SAP, QAPP, and HSP.
2) Initiate field logbook for sampling activity.
3) Inventory sample bottles, required analyses, and lab courier schedule.
4) Field-check and setup sampling equipment: field filters, buffering solution, and sample bottles.

### GROUNDWATER PURGING AND PRE-SAMPLING PROCEDURES

1) Follow SOPs 4, and 5.

### SAMPLE COLLECTION

2) Once parameters are stabilized and a minimum 3-casing volumes has been removed from the well, disconnect the tubing from the flow-through cell and connect the inline 0.45 micron filter.
3) Sample containers are to be filled by transferring water directly from the filter discharge to the appropriate sample container.

*Total Chromium and Title 26 Metals Method 6010B*

(i) Fill the sample bottle, 250 mL poly with $HNO_3$ preservative, to the top of the bottle neck. CARE MUST BE TAKEN NOT TO OVERFILL THE BOTTLE.

(ii) Test the pH of the sample with laboratory provided pH paper.

(iii) If the pH of the sample is greater than 2, add 10 drops of $HNO_3$. Close the bottle, shake, test pH. Continue adding $HNO_3$ in 10-drop increments until the pH is less than 2.

(iv) Record the total amount of $HNO_3$ added to the sample on the chain of custody and field form. Seal, label, and place the sample on ice.

*Hexavalent Chromium Method 7199 or 7196A – Note: this method will be field tested and modified as needed.*
The sample must be buffered to a pH between 9-9.5. Buffering solution is ammonium sulfate/ammonium hydroxide
(i) Fill the sample bottle for hexavalent chromium (250 mL poly with no preservative) to approximately 235 mL, leaving headspace for the addition of buffer solution.

(ii) Add 5 mL of laboratory provided buffer solution using a pipette. Place the lid on the sample bottle and shake gently. Test the pH using laboratory provided pH strips.

(iii) If the pH is less than 9, add ten drops (0.5 mL) of buffer solution, close bottle and shake gently. Test pH using laboratory provided pH strips. If the pH is less than 9, continue adding the buffer solution in 10-drop increments until the pH is between 9 and 9.5 or until 12.5 mL of buffer solution is added.

(iv) If the pH is less than 9 and 12.5 mL of buffer solution has been added, add one drop of 20% $NH_4OH$, close bottle, gently shake, test pH. Continue until the pH is between 9 and 9.5.

(v) When the pH of the sample is between 9 and 9.5, record the total amount of pH buffer and 20% $NH_4OH$ added to the sample on the chain of custody and field form. Seal, label, and place the sample on ice.

4) Discard used pH paper(s) and filter.

5) Record sample information, final WL, and purge volume data on field log.

## SURFACE WATER PRE-SAMPLING PROCEDURES

6) Follow SOP 6.

## SAMPLE COLLECTION

7) Using a peristaltic pump, pump collected surface water from the container through an inline 0.45 micron filter into the sample bottle.

8) Sample containers are to be filled by transferring water directly from the filter discharge to the appropriate sample container.

*Total Chromium and Title 26 Metals Method 6010B*

(i) Fill the sample bottle, 250 mL poly with $HNO_3$ preservative, to the top of the bottle neck. CARE MUST BE TAKEN NOT TO OVERFILL THE BOTTLE.

(ii) Test the pH of the sample with laboratory provided pH paper.

(iii) If the pH of the sample is greater than 2, add 10 drops of $HNO_3$. Close the bottle, shake, test pH. Continue adding $HNO_3$ in 10-drop increments until the pH is less than 2.

(iv) Record the total amount of $HNO_3$ added to the sample on the chain of custody and field form. Seal, label, and place the sample on ice.

*Hexavalent Chromium Method 7199 or 7196A – Note: this method will be field tested and modified as needed.*
The sample must be buffered to a pH between 9-9.5. Buffering solution is ammonium sulfate/ammonium hydroxide
(i) Fill the sample bottle for hexavalent chromium (250 mL poly with no preservative) to approximately 235 mL, leaving headspace for the addition of buffer solution.

(ii) Add 5 mL of laboratory provided buffer solution using a pipette. Place the lid on the sample bottle and shake gently. Test the pH using laboratory provided pH strips.

(iii) If the pH is less than 9, add ten drops (0.5 mL) of buffer solution, close bottle and shake gently. Test pH using laboratory provided pH strips. If the pH is less than 9, continue adding the buffer solution in 10-drop increments until the pH is between 9 and 9.5 or until 12.5 mL of buffer solution is added.

(iv) If the pH is less than 9 and 12.5 mL of buffer solution has been added, add one drop of 20% $NH_4OH$, close bottle, gently shake, test pH. Continue until the pH is between 9 and 9.5.

(v) When the pH of the sample is between 9 and 9.5, record the total amount of pH buffer and 20% $NH_4OH$ added to the sample on the chain of custody and field form. Seal, label, and place the sample on ice.

9) Discard used pH paper(s) and filter.

10) Record sample information and field parameters on the field log.

# Appendix D
# Samples of Data Reports for GMP

# Table 1
# Groundwater Sampling Results
# September 2002 through March 2004
# PG&E Topock Groundwater Monitoring Program

| LocID | Sample Date | Hexavalent Chromium (mg/L) | Total Chromium (mg/L) | Copper (mg/L) | Nickel (mg/L) | Zinc (mg/L) | Specific Conductance (µS/cm) | pH |
|---|---|---|---|---|---|---|---|---|
| **MW-09** | 17-Sep-02 | 0.36 | 0.401 | ND <0.0555 | ND <0.0056 | 0.248 | --- | --- |
| | 10-Dec-02 | 0.402 | 0.428 | ND <0.02 | ND <0.0278 | 0.255 | --- | --- |
| | 18-Mar-03 | 0.368 | 0.357 | 0.015 | ND <0.0278 | 0.363 | --- | --- |
| | 12-Jun-03 | 0.343 | 0.349 | ND <0.01 | 0.03 | 0.361 | 3,690 | 7.65 |
| | 11-Sep-03 | 0.376 | 0.34 | 0.017 | ND <0.0261 | 0.14 | 3,260 | 7.49 |
| | 12-Dec-03 | 0.357 | 0.46 | ND <0.01 | ND <0.02 | 0.025 | 3,490 | 7.56 |
| | 16-Mar-04 | 0.342 | 0.297 | 0.014 | ND <0.02 | 0.072 | 3,150 | 7.5 |
| **MW-10** | 17-Sep-02 | 2.07 | 2.33 | ND <0.02 | 0.014 | 0.177 | --- | --- |
| | 10-Dec-02 | 1.93 | 2.15 | ND <0.02 | ND <0.0278 | 0.119 J | --- | --- |
| | 10-Dec-02 FD | 1.97 | 1.79 | ND <0.02 | ND <0.0278 | 0.2 J | --- | --- |
| | 18-Mar-03 | 1.64 | 1.47 | ND <0.011 | ND <0.0278 | 0.637 | --- | --- |
| | 12-Jun-03 | 1.65 | 1.75 | ND <0.01 | ND <0.0261 | 0.445 | 4,280 | 7.75 |
| | 11-Sep-03 | 1.92 | 1.75 | ND <0.011 | ND <0.0261 | 0.093 | 3,330 | 7.6 |
| | 12-Dec-03 | 1.92 | 4.2 | ND <0.01 | ND <0.02 | 0.025 | 3,260 | 7.68 |
| | 16-Mar-04 | 1.35 | 1.11 | ND <0.01 | ND <0.02 | 0.064 | 3,700 | 7.79 |
| **MW-11** | 17-Sep-02 | 0.408 | 0.483 | ND <0.0278 | 0.016 | 0.443 J | --- | --- |
| | 17-Sep-02 FD | 0.409 | 0.467 | ND <0.0278 | ND <0.0056 | 0.208 J | --- | --- |
| | 10-Dec-02 | 0.584 | 0.696 | ND <0.02 | ND <0.0278 | 0.176 | --- | --- |
| | 18-Mar-03 | 0.463 | 0.452 | ND <0.011 | ND <0.0278 | 0.329 | --- | --- |
| | 12-Jun-03 | 0.429 | 0.453 | ND <0.01 | 0.0203 J | 0.399 | 2,930 | 7.93 |
| | 12-Jun-03 FD | 0.415 | 0.435 | ND <0.01 | ND <0.0261 | 0.45 | 2,670 | 7.62 |
| | 11-Sep-03 | 0.412 | 0.376 | ND <0.011 | ND <0.0261 | 0.063 | 2,440 | 7.52 |
| | 12-Dec-03 | 0.566 | 0.772 | ND <0.01 | ND <0.02 | ND <0.02 | 2,450 | 7.51 |
| | 16-Mar-04 | 0.432 | 0.358 | ND <0.01 | ND <0.02 | 0.069 | 2,520 | 7.48 |
| **MW-12** | 18-Sep-02 | 1.16 | 1.31 | ND <0.0278 | ND <0.0056 | 0.085 | --- | --- |
| | 11-Dec-02 | 1.25 | 1.61 | ND <0.02 | ND <0.0278 | 0.069 | --- | --- |
| | 20-Mar-03 | 1.28 | 1.1 | ND <0.011 | ND <0.0278 | 0.54 J | --- | --- |
| | 20-Mar-03 FD | 1.26 | 1.19 | ND <0.011 | ND <0.0278 | 0.284 J | --- | --- |
| | 11-Jun-03 | 1.28 | 1.08 | ND <0.01 | ND <0.0261 | 0.121 | 4,250 | 8.42 |
| | 09-Sep-03 | 1.31 | 1.24 | ND <0.011 | ND <0.0261 | ND <0.0261 | 4,040 | 8.34 |
| | 10-Dec-03 | 1.39 | 1.72 | ND <0.01 | ND <0.02 | ND <0.02 | 4,130 | 8.39 |
| | 16-Mar-04 | 1.33 | 1.24 | ND <0.01 | ND <0.02 | 0.095 | 4,270 | 8.4 |

# Table 1
## Topock Floodplain Wells Monitoring Program
## Groundwater Sampling Results - March 2003 through April 29, 2004

| Well No. | Event | Sample Date | Sample Time | **Hexavalent Chromium** mg/L | **Total Dissolved Chromium** mg/L | Sampling Method | Selected Field Parameters: ORP mv | Selected Field Parameters: Dissolved Oxygen mg/L | Selected Field Parameters: Specific Conductance uS/cm | Groundwater and River Elevations at Sampling Time: Groundwater Elevation in Monitoring Well (salinity-adjusted) feet MSL | Groundwater and River Elevations at Sampling Time: River Elevation at Downstream I-3 Gage Station feet MSL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-34-80** | W | 29-Jan-04 FD | 15:28 | 0.102 | 0.111 | LF | -145 | 1.6 | 11,500 | 452.4 | 451.7 |
| | W | 05-Feb-04 | 9:35 | 0.0102 | 0.0124 | LF | -179 | 2.2 | 13,200 | 454.4 | 454.0 |
| | W | 05-Feb-04 FD | 9:35 | 0.0129 | 0.0152 | LF | -179 | 2.2 | 13,200 | 454.4 | 454.0 |
| | W | 12-Feb-04 | 9:32 | ND <0.0002 R | ND <0.001 | LF | -184 | 2.1 | 12,300 | 454.1 | 453.2 |
| | W | 12-Feb-04 FD | 9:32 | ND <0.0002 R | ND <0.001 | LF | -184 | 2.1 | 12,300 | 454.1 | 453.2 |
| | M | 18-Feb-04 | 12:15 | ND <0.0002 R | ND <0.001 | LF | -125 | 0.6 | 15,400 | 454.3 | 453.3 |
| | M | 18-Feb-04 FD | 15:10 | 0.0204 | 0.0165 | WV | -259 | 0.0 | 14,700 | 453.5 | 454.0 |
| | W | 26-Feb-04 | 12:03 | 0.0662 J | 0.0625 | LF | -40 | 2.9 | --- | 452.9 | 451.7 |
| | W | 26-Feb-04 FD | 12:03 | 0.0920 | 0.0567 | LF | -40 | 2.9 | --- | 452.9 | 451.7 |
| | W | 05-Mar-04 | 10:10 | 0.0256 | 0.0256 | WV | --- | 1.4 | --- | 453.5 | 454.2 |
| | W | 11-Mar-04 | 13:16 | 0.0050 | 0.0071 | WV | -63 | 1.0 | --- | 463.5 | 455.0 |
| | W | 11-Mar-04 FD | 13:30 | 0.0073 | 0.0072 | WV | -63 | 1.0 | --- | 456.0 | 455.0 |
| | Q | 17-Mar-04 | 14:52 | 0.0057 | 0.0060 | WV | -112 | 0.0 | 15,500 | 454.5 | 453.3 |
| | W | 25-Mar-04 | 11:20 | 0.0034 J | 0.0092 J | WV | -135 | 2.5 | 15,300 | 455.9 | 454.0 |
| | W | 25-Mar-04 FD | 11:45 | 0.0037 | 0.0049 J | WV | -135 | 2.5 | 15,300 | 455.9 | 453.8 |
| | W | 01-Apr-04 | 10:42 | 0.0022 J | 0.0037 | WV | -77 | 2.4 | 14,000 | 455.8 | 454.8 |
| | W | 08-Apr-04 | 9:05 | 0.0020 J | 0.0025 | WV | -31 | --- | --- | 455.6 | 455.3 |
| | M | 16-Apr-04 | 10:07 | 0.00086 | 0.0016 | WV | -83 | 2.2 | 13,400 | 456.6 | 455.6 |
| | W | 22-Apr-04 | 12:45 | 0.00084 | 0.0013 | WV | -81 | 2.1 | 14,400 | 455.9 | 454.7 |
| | W | 22-Apr-04 FD | 13:00 | 0.00087 | 0.0013 | WV | -81 | 2.1 | 14,400 | 455.9 | 454.6 |
| | W | 29-Apr-04 | 11:10 | ND <0.002 | ND <0.001 J | WV | -101 | 2.0 | 15,400 | --- | --- |

Refer to table footnotes for data qualifier explanation

# Table 1
## Topock Floodplain Wells Monitoring Program
## Groundwater Sampling Results - March 2003 through April 29, 2004

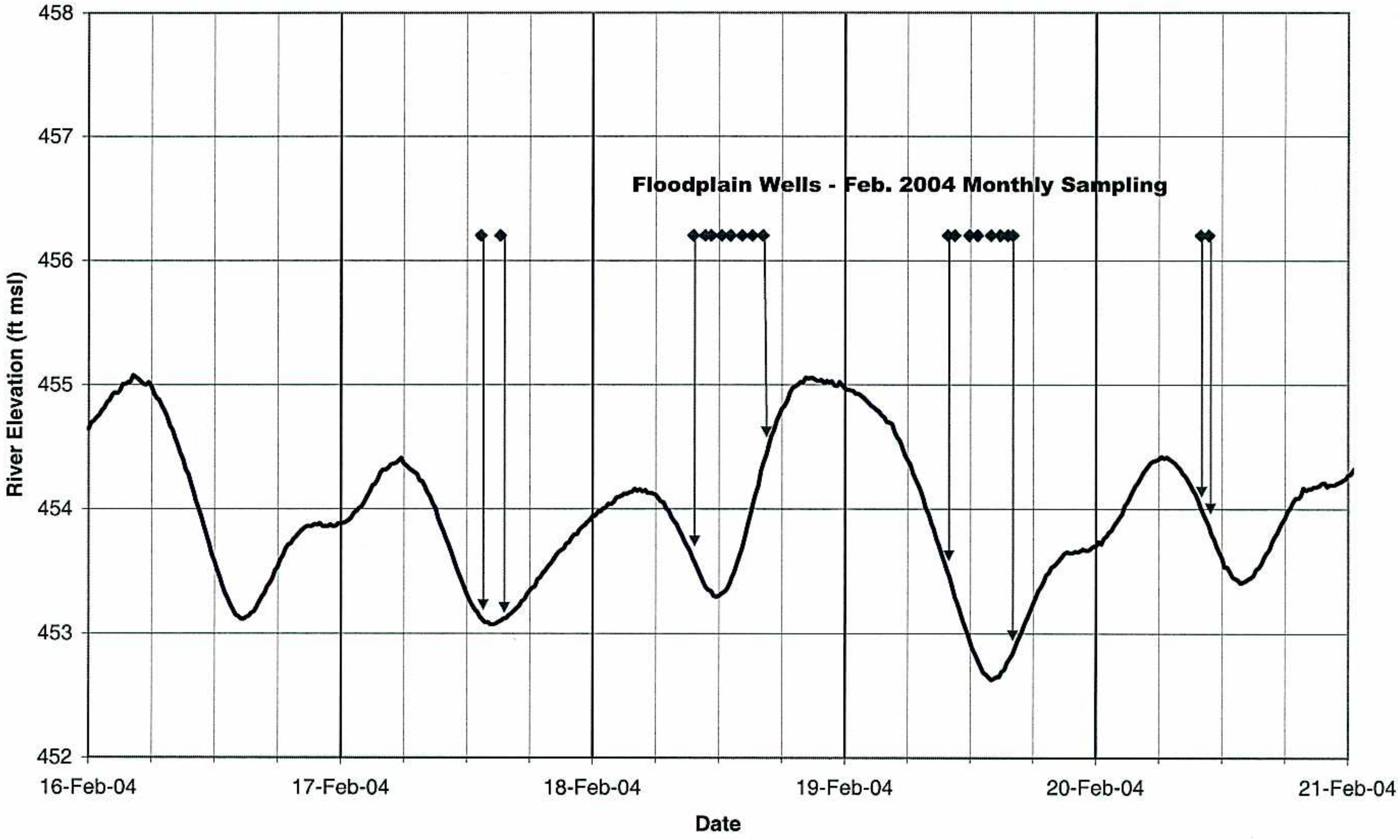
| Well No. | Event | Sample Date | Sample Time | **Hexavalent Chromium** mg/L | **Total Dissolved Chromium** mg/L | Sampling Method | Selected Field Parameters | | | Groundwater and River Elevations at Sampling Time | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ORP mv | Dissolved Oxygen mg/L | Specific Conductance uS/cm | Groundwater Elevation in Monitoring Well (salinity-adjusted) feet MSL | River Elevation at Downstream I-3 Gage Station feet MSL |
| **MW-21** | Q | 21-Mar-03 | 10:10 | ND <0.01 | 0.0106 | WV | -230 | 0.3 | 15,600 | 454.3 | 455.7 |
| | Q | 12-Jun-03 | 13:40 | ND <0.01 | 0.0023 J | WV | -192 | 0.1 | 13,900 | 455.8 | 454.7 |
| | Q | 10-Sep-03 | 14:35 | ND <0.0002 * | ND <0.001 | WV | -69 | 3.9 | 14,400 | 455.6 | 453.2 |
| | M | 04-Nov-03 | 8:55 | ND <0.0002 * | ND <0.001 | WV | 219 | 5.9 | 16,900 | 455.0 | 453.2 |
| | Q | 11-Dec-03 | 8:30 | ND <0.0002 * | 0.0033 | WV | -105 | 3.8 | 15,800 | 454.2 | 453.9 |
| | M | 14-Jan-04 | 9:00 | ND <0.0002 * | ND <0.001 | WV | -101 | 4.1 | 18,200 | 454.3 | 453.7 |
| | M | 26-Feb-04 | 10:07 | ND <0.001 J | ND <0.001 | WV | -95 | 4.2 | 22,300 | 455.0 | 451.8 |
| | Q | 16-Mar-04 | 9:50 | ND <0.0002 J | ND <0.001 | WV | -157 | 2.7 | 14,900 | --- | --- |
| | M | 14-Apr-04 | 15:00 | ND <0.0015 | ND <0.008 | WV | --- | --- | --- | 456.2 | 454.8 |

**NOTES:**

1. Monitoring events: quarterly (Q), monthly (M), weekly (W). Groundwater sampling methods: low-flow purging (LF), well-volume purging (WV)
   Low-recharge well MW-21 is purged dry after approximately 1-casing volume is removed and is sampled the following day
   MW-21 groundwater elevations and field parameters are measurements from first day purging. FD = field duplicate sample.
2. Analytical results are validated. Hexavalent chromium by Method SW 7199, except for samples collected March and June 2003 (analyzed by Method SW 7196A).
   Total dissolved chromium by Method SW 6010B, except for samples collected March and June 2003 (analyzed by Method SW 6020A).
3. Analytical results in milligrams per liter (mg/L), oxidation-reduction potential (ORP), millivolts (mv), microSiemens per centimeter (uS/cm),
   dissolved oxygen data rounded-off to 0.1 mg/L
4. ND = not detected at listed reporting limit
5. J = concentration or reporting limit estimated by laboratory or data validation
   R = result exceeded analytical criteria for precision and accuracy and should not be used for project decision-making
6. * flag indicates the reporting limit (RL) for hexavalent chromium is estimated and might be as high as the total chromium RL
7. Groundwater and river elevations in feet above mean sea level (MSL) rounded-off to 0.1-foot. River elevations from pressure transducer record at I-3 station.
   (---) denotes data not available or compiled
8. The RLs for certain hexavalent chromium results from Method 7199 analyses have been elevated above the standard RL of 0.0002 mg/L due to required sample dilutior
   to accommodate matrix interferences

Refer to table footnotes for data qualifier explanation

## River Elevation at I-3 Station, PG&E Topock



# Table 2
# General Chemistry Analytical Results, 2003-2004
# Topock Groundwater Monitoring Program

| Location | Sample Date | Total Dissolved Solids | Oxygen 18 | Deuterium | Chloride (Cl) | Sulfate (SO4) | Alkalinity (Alk.) | Bicarb. (HCO3) | Carbon. (CaCO3) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Iron (Fe) | Manganese (Mn) | Nitrate (NO3) | Fluoride (Fl) | Boron (B) | Bromide (Br) | Total Organic Carbon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface Water Stations** | | | | | | | | | | | | | | | | | | | | |
| CON | 11-Jun-03 | 583 | --- | --- | 79.7 | 234 | 137 | 167 | ND (1) | 77.0 | 27.9 | 86.1 | 5.54 | ND (0.5) | 27.9 | 0.37 | 0.37 | --- | --- | 3.30 |
| I-3 | 10-Jun-03 | 602 | --- | --- | 78.8 | 222 | 137 | 167 | ND (1) | 75.2 | 28.0 | 114 | 5.89 | ND (0.5) | 28.0 | 0.36 | 0.34 | --- | --- | 3.20 |
| R-27 | 10-Jun-03 | 595 | --- | --- | 80.7 | 222 | 137 | 167 | ND (1) | 71.7 | 26.8 | 88.5 | 5.31 | ND (0.5) | 26.8 | 0.35 | 0.35 | --- | --- | 3.30 |
| | 03-Mar-04 | 630 | -11.4 | -86.0 | 87.0 | 250 | 140 | --- | --- | 77.0 | 28.0 | 94.0 | 4.40 | --- | 28.0 | ND (0.4) | --- | ND (0.2) | ND (0.5) | --- |
| R-28 | 10-Jun-03 | 603 | --- | --- | 80.2 | 223 | 137 | 167 | ND (1) | 77.8 | 28.6 | 95.7 | 5.82 | ND (0.5) | 28.6 | 0.35 | 0.38 | --- | --- | 3.90 |
| | 03-Mar-04 | 670 | -11.3 | -90.0 | 87.0 | 250 | 140 | --- | --- | 78.0 | 28.0 | 93.0 | 4.40 | --- | 28.0 | 0.50 | --- | ND (0.2) | ND (0.5) | --- |
| **Monitoring Wells** | | | | | | | | | | | | | | | | | | | | |
| MW-09 | 12-Jun-03 | 1,940 | --- | --- | 592 | 238 | 121 | 148 | ND (1) | 235 | 61.4 | 397 | 17.8 | ND (0.5) | 61.4 | 8.60 | ND (0.2) | --- | --- | 1.00 |
| MW-10 | 12-Jun-03 | 2,250 | --- | --- | 732 | 433 | 253 | 309 | ND (1) | 120 | 19.7 | 773 | 15.5 | ND (0.5) | 19.7 | 16.1 | 11.7 | --- | --- | 4.70 |
| MW-11 | 12-Jun-03 | 1,540 | --- | --- | 418 | 344 | 103 | 126 | ND (1) | 172 | 22.2 | 305 | 11.6 | ND (0.5) | 22.2 | 8.60 | 0.73 | --- | --- | ND (0.5) |
| | 12-Jun-03 FD | 1,490 | --- | --- | 468 | 343 | 103 | 126 | ND (1) | 174 | 21.0 | 346 | 11.3 | ND (0.5) | 21.0 | 8.70 | 0.69 | --- | --- | 0.56 |
| MW-12 | 11-Jun-03 | 2,340 | --- | --- | 1,050 | 251 | 222 | 264 | 3.60 | 9.1 | 2.05 | 910 | 7.62 | ND (0.5) | 2.05 | 4.30 | 2.90 | --- | --- | 1.10 |
| MW-13 | 12-Jun-03 | 1,220 | --- | --- | 500 | 166 | 80.0 | 97.6 | ND (1) | 112 | 14.6 | 311 | 10.0 | ND (0.5) | 14.6 | 4.20 | 1.20 | --- | --- | 0.77 |
| MW-14 | 12-Jun-03 | 934 | --- | --- | 340 | 142 | 87.0 | 106 | ND (1) | 64.1 | 9.8 | 210 | 10.2 | ND (0.5) | 9.8 | 5.60 | 2.00 | --- | --- | 2.20 |
| MW-15 | 12-Jun-03 | 877 | --- | --- | 333 | 111 | 87.0 | 106 | ND (1) | 89.4 | 20.7 | 179 | 10.4 | ND (0.5) | 20.7 | 4.80 | 0.80 | --- | --- | 2.40 |
| MW-16 | 12-Jun-03 | 665 | --- | --- | 248 | 150 | 109 | 133 | ND (1) | 29.3 | 5.22 | 215 | 5.37 | ND (0.5) | 5.22 | 3.30 | 2.50 | --- | --- | 3.10 |
| MW-18 | 12-Jun-03 | 814 | --- | --- | 327 | 84.6 | 85.0 | 104 | ND (1) | 88.7 | 13.3 | 160 | 9.9 | ND (0.5) | 13.3 | 3.90 | 0.71 | --- | --- | 0.54 |
| MW-19 | 11-Jun-03 | 1,360 | --- | --- | 574 | 181 | 82.0 | 100 | ND (1) | 125 | 18.9 | 345 | 9.6 | ND (0.5) | 18.9 | 4.80 | 2.50 | --- | --- | ND (0.5) |
| MW-20-070 | 11-Jun-03 | 2,220 | --- | --- | 909 | 430 | 73.0 | 89.1 | ND (1) | 245 | 60.6 | 462 | 14.0 | ND (0.5) | 60.6 | 8.80 | 1.90 | --- | --- | 0.98 |
| | 03-Mar-04 | 2,300 | -6.5 | -39.0 | 890 | 440 | 75.0 | --- | --- | 230 | 52.0 | 480 | 11.0 | --- | 52.0 | 9.7 | --- | 0.30 | 0.60 | --- |
| | 03-Mar-04 FD | 2,300 | -6.5 | -53.0 | 890 | 440 | 72.0 | --- | --- | 220 | 51.0 | 460 | 11.0 | --- | 51.0 | 9.7 | --- | 0.30 | 0.60 | --- |
| MW-20-100 | 11-Jun-03 | 3,440 | --- | --- | 1,360 | 726 | 80.0 | 97.6 | ND (1) | 165 | 20.7 | 1,050 | 15.6 | ND (0.5) | 20.7 | 9.3 | 1.90 | --- | --- | 0.52 |
| | 03-Mar-04 | 3,400 | -4.2 | -38.0 | 1,300 | 740 | 82.0 | --- | --- | 170 | 20.0 | 1,100 | 11.0 | --- | 20.0 | 9.6 | --- | 1.00 | 0.70 | --- |
| MW-20-130 | 11-Jun-03 | 10,700 | --- | --- | 5,790 | 967 | 47.0 | 57.3 | ND (1) | 418 | 19.8 | 3,630 | 54.2 | ND (0.5) | 19.8 | 6.10 | 3.60 | --- | --- | 1.00 |
| | 03-Mar-04 | 11,000 | -6.6 | -60.0 | 6,200 | 960 | 45.0 | --- | --- | 400 | 19.0 | 3,500 | 35.0 | --- | 19.0 | 6.20 | --- | 1.70 | ND (2.5) | --- |
| MW-21 | 12-Jun-03 | 8,880 | --- | --- | 2,270 | 2,500 | 456 | 556 | ND (1) | 432 | 119 | 2,330 | 24.1 | ND (0.5) | 119 | 0.35 | 2.30 | --- | --- | 8.70 |

# Table 2
# General Chemistry Analytical Results, 2003-2004
## Topock Groundwater Monitoring Program

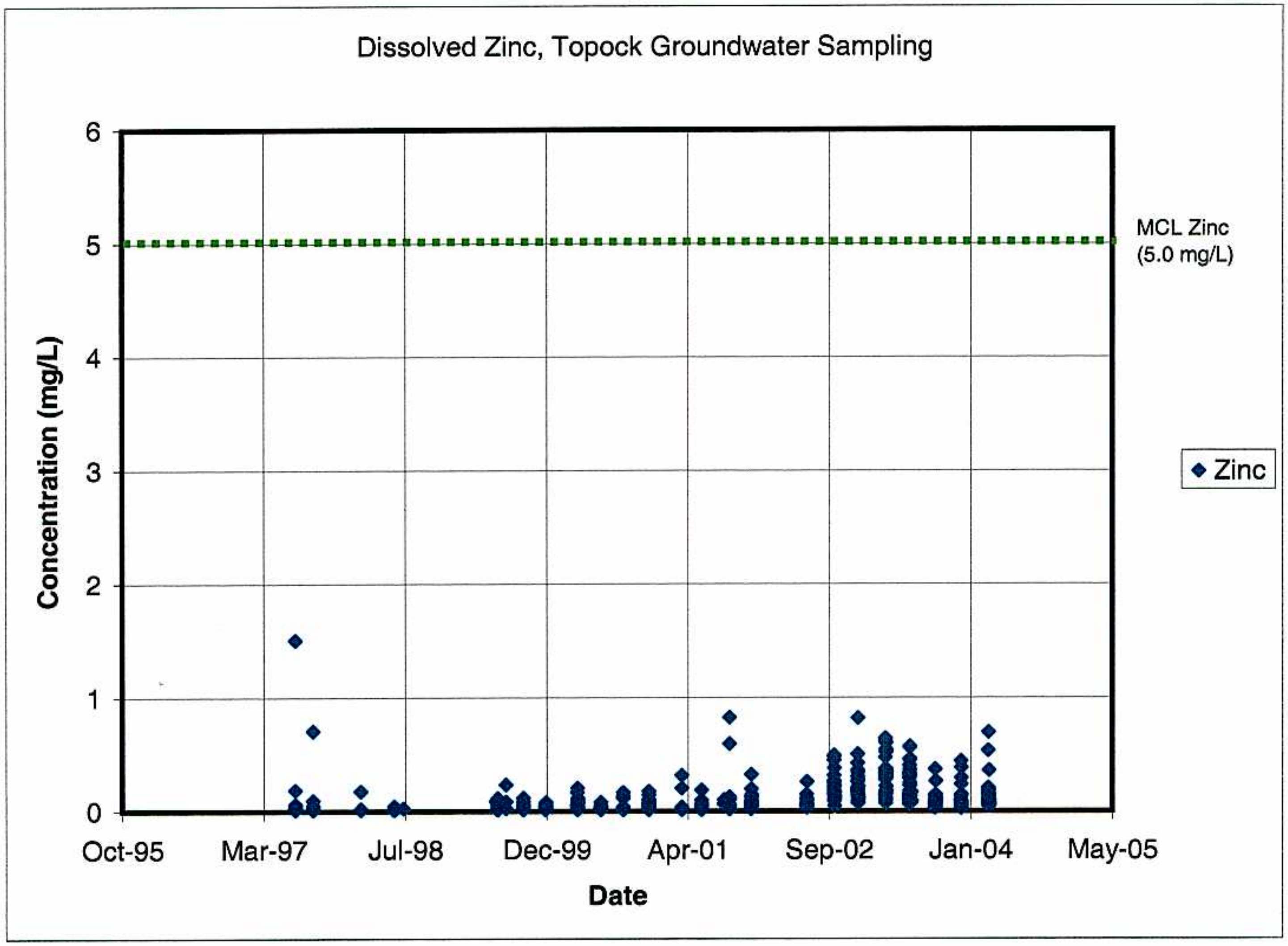
| Location | Sample Date | Total Dissolved Solids | Oxygen 18 | Deuterium | Chloride (Cl) | Sulfate (SO4) | Alkalinity (Alk.) | Bicarb. (HCO3) | Carbon. (CaCO3) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Iron (Fe) | Manganese (Mn) | Nitrate (NO3) | Fluoride (Fl) | Boron (B) | Bromide (Br) | Total Organic Carbon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Wells** | | | | | | | | | | | | | | | | | | | | |
| MW-22 | 10-Jun-03 | 15,900 | --- | --- | 10,000 | 1,250 | 314 | 383 | ND (1) | 584 | 102 | 4,870 | 56.3 | 2.68 | 102 | ND (2) | 2.70 | --- | --- | 3.90 |
| MW-23 | 12-Jun-03 | 11,000 | --- | --- | 5,560 | 730 | 117 | 143 | ND (1) | 718 | 77.7 | 3,360 | 60.8 | ND (0.5) | 77.7 | 0.86 | ND (1) | --- | --- | 4.90 |
| MW-24A | 12-Jun-03 | 2,040 | --- | --- | 754 | 310 | 166 | 202 | ND (1) | 67.3 | 11.7 | 700 | 12.3 | ND (0.5) | 11.7 | 15.1 | 4.80 | --- | --- | 1.20 |
| MW-24B | 12-Jun-03 | 8,130 | --- | --- | 3,350 | 1,270 | 52.0 | 63.4 | ND (1) | 213 | 5.87 | 2,840 | 48.4 | ND (0.5) | 5.87 | 15.7 | 2.70 | --- | --- | 1.10 |
| MW-24BR | 13-Jun-03 | 8,470 | --- | --- | 4,590 | 409 | 93.0 | 114 | ND (1) | 110 | 3.55 | 2,830 | 36.4 | ND (0.5) | 3.55 | ND (2) | 5.20 | --- | --- | 6.14 |
| MW-25 | 12-Jun-03 | 1,090 | --- | --- | 346 | 217 | 124 | 151 | ND (1) | 92.0 | 17.0 | 257 | 10.3 | ND (0.5) | 17.0 | 4.20 | 1.20 | --- | --- | 1.70 |
| | 12-Jun-03 FD | 1,070 | --- | --- | 349 | 216 | 124 | 151 | ND (1) | 113 | 18.9 | 270 | 11.3 | ND (0.5) | 18.9 | 4.20 | 1.30 | --- | --- | 1.50 |
| | 03-Mar-04 | 970 | -7.7 | -56.0 | 300 | 220 | 140 | --- | --- | 92.0 | 18.0 | 230 | 7.80 | --- | 18.0 | 4.20 | --- | 0.40 | ND (0.5) | --- |
| MW-26 | 11-Jun-03 | 2,100 | --- | --- | 852 | 423 | 113 | 138 | ND (1) | 183 | 47.1 | 528 | 14.7 | ND (0.5) | 47.1 | 5.00 | 0.32 | --- | --- | 0.64 |
| | 03-Mar-04 | 1,900 | -6.7 | -54.0 | 770 | 400 | 110 | --- | --- | 170 | 40.0 | 470 | 12.0 | --- | 40.0 | 4.60 | --- | 0.50 | ND (0.5) | --- |
| MW-27 | 10-Jun-03 | 587 | --- | --- | 114 | 160 | 221 | 270 | ND (1) | 77.1 | 24.8 | 92.8 | 5.57 | ND (0.5) | 24.8 | ND (0.2) | 0.46 | --- | --- | 3.10 |
| | 03-Mar-04 | 640 | -11.7 | -100.0 | 74.0 | 200 | 180 | --- | --- | 79.0 | 26.0 | 84.0 | 4.00 | --- | 26.0 | ND (0.4) | --- | ND (0.2) | ND (0.5) | --- |
| MW-28-25 | 10-Jun-03 | 1,120 | --- | --- | 294 | 250 | 271 | 331 | ND (1) | 122 | 33.2 | 254 | 6.92 | ND (0.5) | 33.2 | ND (0.2) | 0.68 | --- | --- | 2.60 |
| | 04-Mar-04 | 1,000 | -11.3 | -95.0 | 220 | 290 | 260 | --- | --- | 120 | 33.0 | 210 | 3.80 | --- | 33.0 | ND (0.4) | --- | 0.20 | ND (0.5) | --- |
| MW-29 | 11-Jun-03 | 4,170 | --- | --- | 948 | 1,130 | 489 | 597 | ND (1) | 240 | 143 | 900 | 12.2 | ND (0.5) | 143 | ND (0.2) | 0.42 | --- | --- | 17.8 |
| MW-30-30 | 10-Jun-03 | 26,200 | --- | --- | 12,100 | 2,800 | 612 | 747 | ND (1) | 851 | 801 | 7,280 | 85.2 | ND (0.5) | 801 | ND (2) | ND (2) | --- | --- | 38.6 |
| | 04-Mar-04 | 36,000 | -9.0 | -76.0 | 19,000 | 4,100 | 570 | --- | --- | 1,000 | 1,000 | 9,600 | 50.0 | --- | 1,000 | ND (4) | --- | 3.60 | 5.20 | --- |
| MW-30-50 | 10-Jun-03 | 5,800 | --- | --- | 2,810 | 716 | 130 | 159 | ND (1) | 277 | 89.9 | 1,800 | 23.5 | ND (0.5) | 89.9 | 3.70 | ND (13.4) | --- | --- | 2.30 |
| | 10-Jun-03 FD | 5,790 | --- | --- | 2,760 | 726 | 131 | 160 | ND (1) | 267 | 85.1 | 1,990 | 23.9 | ND (0.5) | 85.1 | 3.70 | ND (13.8) | --- | --- | 2.40 |
| | 05-Mar-04 | 6,100 | -6.4 | -58.0 | 3,000 | 750 | 280 | --- | --- | 280 | 120 | 1,600 | 16.0 | --- | 120 | 1.20 | --- | 0.90 | ND (5) | --- |
| | 05-Mar-04 FD | 5,900 | -6.6 | -56.0 | 2,900 | 730 | 280 | --- | --- | 290 | 120 | 1,600 | 15.0 | --- | 120 | 1.20 | --- | 0.90 | ND (5) | --- |
| MW-31-060 | 11-Jun-03 | 1,780 | --- | --- | 760 | 267 | 74.0 | 90.3 | ND (1) | 176 | 24.4 | 459 | 10.4 | ND (0.5) | 24.4 | 5.80 | 2.00 | --- | --- | 0.83 |
| | 03-Mar-04 | 1,700 | -8.1 | -60.0 | 750 | 280 | 72.0 | --- | --- | 160 | 22.0 | 420 | 7.90 | --- | 22.0 | 6.20 | --- | 0.40 | ND (0.5) | --- |
| MW-32-20 | 10-Jun-03 | 3,600 | --- | --- | 1,980 | 17.9 | 578 | 705 | ND (1) | 310 | 154 | 867 | 21.2 | 6.08 | 154 | ND (0.2) | ND (0.2) | --- | --- | 14.2 |
| | 04-Mar-04 | 6,200 | -8.0 | -64.0 | 2,900 | 540 | 570 | --- | --- | 520 | 180 | 1,500 | 13.0 | --- | 180 | ND (0.4) | --- | 1.10 | ND (5) | --- |
| MW-32-35 | 10-Jun-03 | 4,590 | --- | --- | 2,320 | 421 | 308 | 376 | ND (1) | 325 | 89.6 | 1,140 | 20.9 | 2.25 | 89.6 | ND (0.2) | ND (0.2) | --- | --- | 4.20 |
| | 04-Mar-04 | 4,200 | -8.0 | -65.0 | 1,900 | 470 | 310 | --- | --- | 340 | 99.0 | 1,100 | 13.0 | --- | 99.0 | ND (0.4) | --- | 1.00 | ND (5) | --- |

# Table 2
## General Chemistry Analytical Results, 2003-2004
## Topock Groundwater Monitoring Program

| Location | Sample Date | Total Dissolved Solids | Oxygen 18 | Deuterium | Chloride (Cl) | Sulfate (SO4) | Alkalinity (Alk.) | Bicarb. (HCO3) | Carbon. (CaCO3) | Calcium (Ca) | Magnesium (Mg) | Sodium (Na) | Potassium (K) | Iron (Fe) | Manganese (Mn) | Nitrate (NO3) | Fluoride (Fl) | Boron (B) | Bromide (Br) | Total Organic Carbon |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monitoring Wells** | | | | | | | | | | | | | | | | | | | | |
| MW-33-40 | 11-Jun-03 | 2,170 | --- | --- | 1,030 | 233 | 161 | 184 | 6.00 | 7.74 | 4.21 | 846 | 3.34 | ND (0.5) | 4.21 | 0.57 | 8.20 | --- | --- | 1.40 |
| MW-33-90 | 11-Jun-03 | 4,760 | --- | --- | 2,590 | 394 | 64.0 | 75.6 | 1.20 | 233 | 25.0 | 1,610 | 19.8 | ND (0.5) | 25.0 | ND (0.2) | 3.40 | --- | --- | 5.00 |
| MW-34-55 | 16-Jun-03 | 6,280 | --- | --- | 2,740 | 821 | 274 | 334 | ND (1) | 377 | 95.9 | 1,750 | 30.0 | 2.68 | 95.9 | ND (0.2) | 1.30 | --- | --- | 4.30 |
| | 04-Mar-04 | 6,700 | -9.6 | -77.0 | 3,200 | 850 | 270 | --- | --- | 360 | 97.0 | 2,000 | 13.0 | --- | 97.0 | ND (0.4) | --- | 1.20 | ND (5) | --- |
| MW-34-80 | 16-Jun-03 | 8,490 | --- | --- | 3,830 | 1,000 | 272 | 332 | ND (1) | 404 | 58.9 | 2,430 | 43.1 | ND (0.5) | 58.9 | ND (1) | 1.40 | --- | --- | 4.20 |
| | 05-Mar-04 | 8,800 | -8.9 | -75.0 | 4,700 | 1,000 | 180 | --- | --- | 280 | 24.0 | 2,600 | 25.0 | --- | 24.0 | ND (0.4) | --- | 1.70 | ND (5) | --- |

**NOTES:**

1. Validated results.
2. Results in milligrams per liter (mg/L), except Oxygen-18 and Deuterium, which are expressed as differences from global standards in parts per thousand. Alkalinity is expressed as CaCO3. Nitrate is expressed as Nitrogen (N).
3. ND - not detected at the listed reporting limit.
4. FD - field duplicate sample


Dissolved Zinc, Topock Groundwater Sampling
Concentration (mg/L)
6
5
4
3
2
1
0
MCL Zinc
(5.0 mg/L)
◆ Zinc
Oct-95
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Date