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April 15, 2005

Mr. Norman Shopay
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Geology and Corrective Action Branch
700 Heinz Avenue
Berkeley, California 94710

Subject: Draft Performance Monitoring Plan for Interim Measures in the Floodplain Area
Pacific Gas and Electric Company, Topock Project

Dear Mr. Shopay:

This letter transmits the *Draft Performance Monitoring Plan for Interim Measures in the Floodplain Area* for the Pacific Gas and Electric Company (PG&E) Topock site. This plan document has been prepared in compliance with Enclosure C, Action Item 1 (Interim Measures Floodplain Monitoring Plan submittal) in DTSC's February 14, 2005 letter. In the letter, DTSC established the performance standards, performance criteria, and reporting and response action requirements for the Interim Measures activity in the floodplain area.

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

Sincerely,

Terri Herson
for Yvonne Meeks

Cc: Kate Burger/DTSC

Draft

Performance Monitoring Plan for Interim Measures in the Floodplain Area

PG&E Topock Compressor Station
Needles, California

Prepared for

California Department of Toxic Substances Control

on behalf of

Pacific Gas and Electric Company

April 15, 2005

CH2MHILL
155 Grand Avenue, Suite 1000
Oakland, CA 94612

Draft

Performance Monitoring Plan for Interim Measures in the Floodplain Area PG&E Topock Compressor Station Needles, California

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April 15, 2005

This work plan was prepared under supervision of a California Certified Engineering Geologist,

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Project Hydrogeologist

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Acronyms and Abbreviations

μg/L	micrograms per liter
bgs	below ground surface
BOR	United States Bureau of Reclamation
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
DTSC	Department of Toxic Substances Control
GMP	Groundwater Monitoring Program
IM	Interim Measures
PG&E	Pacific Gas and Electric Company
PMP	Performance Monitoring Program
psi	pounds per square inch
RFI	RCRA facility investigation
SOP	Standard Operating Procedure
TDS	total dissolved solids

1.0 Introduction

Pacific Gas and Electric Company (PG&E) is addressing chromium in groundwater at the Topock Compressor Station in Needles, California under the oversight of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). In February 2004, DTSC directed PG&E to initiate an Interim Measure (IM) in the floodplain area of the site to prevent movement of the chromium plume toward the Colorado River. As stated in a DTSC letter dated June 30, 2004, the goal of the Interim Measures is "hydraulic control of the plume boundaries near the Colorado River to achieve a net reversal of groundwater gradient from the Colorado River" (DTSC 2004).

The current IM involves the pumping, treatment, transport and disposal of extracted groundwater near the floodplain area. The Interim Measures activity has been operated continuously under DTSC oversight since March 2004. In a letter to PG&E dated February 14, 2005, DTSC established the performance standards, performance criteria, and reporting and response action requirements for the Interim Measures activity in the floodplain area.

This Performance Monitoring Plan for Interim Measures in the Floodplain Area has been prepared in compliance with Enclosure C, Action Item 1 (Interim Measures Floodplain Monitoring Plan submittal) in the February 14, 2005 DTSC letter. The site monitoring, data evaluation, reporting, and response actions required under this DTSC directive are collectively referred to as the IM Performance Monitoring Program (PMP) for the floodplain area.

The purposes of this monitoring plan are to:

- Describe the monitoring objectives of the PMP.
- Describe the well network and types of data and measurements collected.
- Present the proposed monitoring frequency and analytical program.
- Describe the data evaluation and monthly, quarterly, and annual performance evaluation reports.
- Describe the contingencies and response actions associated with the evaluation of the IM hydraulic control system.

As required by DTSC's February 14, 2005 directive, an associated IM *Extraction System Operation and Maintenance Plan* (in preparation) is being prepared to address the operational and contingency/response aspects of the IM extraction system.

1.1 Project Background

The Topock Compressor Station is located in eastern San Bernardino County, approximately 15 miles to the southeast of Needles, California (Figure 1-1). As directed by the DTSC under Interim Measures No. 2, PG&E is currently pumping groundwater from one deep extraction well (TW-2D) located on a bench along the station access road and above the Colorado River floodplain. The bench, referred to as the monitoring well MW-20 bench, is owned by the United States Bureau of Reclamation (BOR) and is managed by the United States Bureau of Land Management. PG&E began pumping from this location in March 2004 and is currently pumping at a rate of approximately 70 gallons per minute. The current IM and batch treatment facilities at the MW-20 bench were constructed and have operated in accordance with the *Final Interim Measures Work Plan No. 2*, dated March 2, 2004 (CH2M HILL 2004a), *Addenda to Interim Measures Work Plan No. 2* (CH2M HILL 2004b), and related project approvals.

On June 30, 2004, DTSC issued to PG&E conditional approval to implement the IM No. 3 project to expand the existing groundwater extraction and management facilities to address hydraulic control of the chromium plume at the Topock site (DTSC 2004). Under requirements of IM No. 3, the IM facilities have been expanded to include construction of a groundwater treatment plant, installation of conveyance piping, and provisions for disposal of treated water by injection wells (CH2M HILL 2004c).

As specified in the Interim Measures Work Plan, the IM system operations and performance monitoring data are presented in performance monitoring reports. The first report was issued April 15, 2004 for the March 2005 startup operations period (CH2M HILL 2004d). Beginning with the July 2004 reporting period, the performance monitoring reports have been submitted monthly (CH2M HILL 2004f). As of April 15, 2005, a total of 16 performance monitoring reports have been submitted, documenting the operations, modifications, and monitoring data for the IM groundwater extraction facilities. Refer to the February 2005 *Performance Monitoring Report No. 15* (CH2M HILL 2005a) for the status and description of the current IM system and monitoring data.

1.2 Hydrogeologic Setting of the Floodplain Area

For background to this monitoring plan, the following hydrogeologic summary has been excerpted from the *Draft RCRA Facility Investigation/Remedial Investigation Report* (Draft RFI Report), dated February 31, 2005 (CH2M HILL 2005b).

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

The water table in the Alluvial Aquifer is very flat throughout the site and typically equilibrates to an elevation within 2 to 3 feet of the river level. Due to the variable topography at the site, the depth to groundwater ranges from as shallow as 5 feet below ground surface (bgs) in floodplain wells next to the river to approximately 170 feet bgs at the upland alluvial terrace areas. The saturated thickness of the Alluvial Aquifer is about 100 feet in the floodplain and thins to the south, pinching out along the Miocene conglomerate and bedrock outcrops. For the RFI site characterization and the IM performance monitoring evaluation and reporting, the Alluvial Aquifer is subdivided into upper, middle, and lower zones.

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

A more detailed discussion of the site hydrogeology and groundwater and surface water conditions is provided in Section 2.0 of the Draft RFI Report (CH2M HILL 2005b). Background on the groundwater geochemistry and water quality characterization for the IM performance monitoring area is provided in Section 13.0 of the Draft RFI Report.

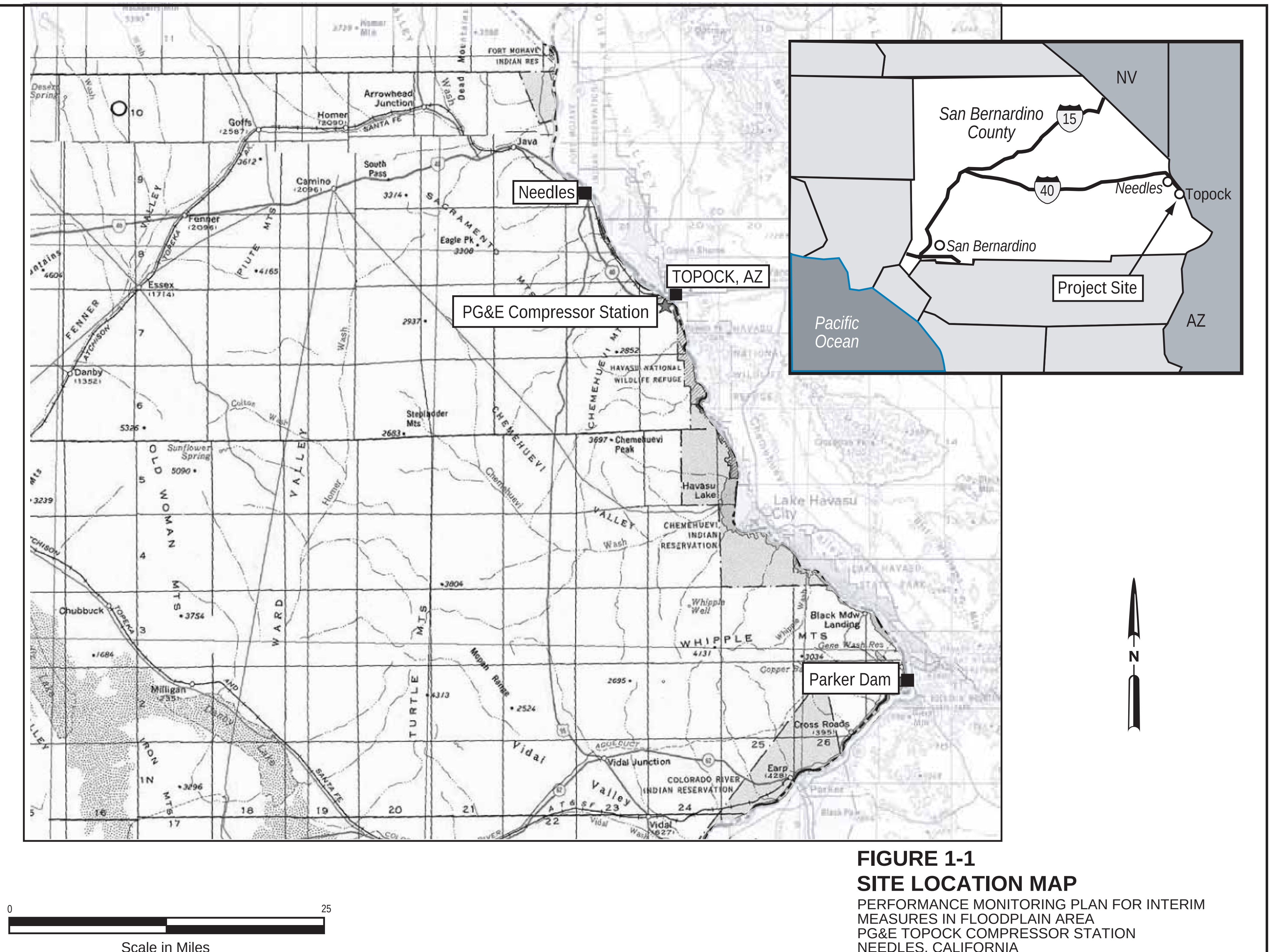

FIGURE 1-1
SITE LOCATION MAP
PERFORMANCE MONITORING PLAN FOR INTERIM MEASURES IN FLOODPLAIN AREA
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

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326128.01.07.IM_Figure 1-1 SiteLocMap_4/14/05_ccc

2.0 Performance Monitoring Objectives

The goal of the IM in the floodplain area is to hydraulically control the plume boundaries near the Colorado River to achieve a net landward groundwater gradient. This section summarizes the performance standard and terminology for the IM, and presents the objectives for the PMP.

2.1 Performance Standard

Per the February DTSC letter (DTSC 2005), groundwater pumping is required to hydraulically contain and control the plume margin in the floodplain area. The portion of the aquifer that is influenced and contained by groundwater pumping is referred to as the capture zone.

As defined by DTSC, the performance standard for this IM is to "establish and maintain a net landward hydraulic gradient, both horizontally and vertically, that ensures that hexavalent chromium concentrations at or greater than 20 micrograms per liter [μg/L] in the floodplain are contained for removal and treatment" (DTSC 2005).

2.2 Performance Monitoring Objectives

In accordance with DTSC directives, this monitoring program has been developed to measure, evaluate, and document the performance of the floodplain IM hydraulic containment system. The specific objectives of the PMP are to:

- Maintain and operate a network of pressure transducers to continuously monitor water levels and assess hydraulic gradients (horizontal and vertical) in the IM containment area.
- Continue ongoing groundwater monitoring in the floodplain wells to detect changes in the distribution of hexavalent chromium [Cr(VI)] and relevant water quality parameters.
- Establish standardized data collection, analysis, and evaluation processes for assessing hydraulic gradient and water quality conditions in the performance monitoring area.
- Document the status, operations, and performance data and evaluation of the IM.
- Define contingency and response actions in accordance with DTSC project requirements.

3.0 Interim Measures Extraction and Monitoring System

This section summarizes information on the current IM extraction and monitoring well network and the pressure transducer and groundwater sampling components of the PMP. This section also provides an introduction and overview of the monitoring and reporting program.

3.1 Description of Well Network

The network of groundwater wells used for performance monitoring include three extraction wells and 49 monitoring wells in the floodplain and adjoining site area. Figure 3-1 shows locations the IM extraction and batch treatment facilities (at MW-20 bench), the groundwater wells used for IM performance monitoring, and general sits features for the PMP area. Well completion and Cr(VI) sampling results for the extraction and monitoring wells are provided in Table 3-1. Supportive information on well elevations, well construction, and well pump installations are included in Appendix A1, Table A-1.

3.1.1 Extraction Wells

The IM groundwater extraction system consists of two extraction wells TW-2D and TW-2S located on the MW-20 bench and a third extraction well PE-1 located on the floodplain (Figure 3-1). Currently, TW-2D is the only active extraction well operated continuously (excepting temporary maintenance and operation shutdown). All three extraction wells are equipped with pressure transducers for collecting drawdown and observation hydraulic data.

Well TW-2D is completed in the lower zone of the aquifer and is currently pumping at an approximate rate of 70 gallons per minute. During the initial IM operations, three groundwater monitoring wells, located 140 feet south of the TW-2 wells (MW-20-70, MW-20-100, and MW-20-130), were equipped with pumps and used for groundwater extraction. Well TW-2S and the MW-20 monitoring wells are currently available to supplement or augment the pumping at TW-2D if needed. The MW-20 wells will not be tied into the piping of the new IM-3 treatment system. Once the IM-3 system is operational, supplemental pumping will be provided by extraction well PE-1, which was installed and tested in early March 2005. Installation of conveyance piping from PE-1 to the IM-3 system may be delayed during the spring-summer months due to endangered species constraints.

3.1.2 Groundwater Monitoring Wells

The current network of groundwater wells used for performance monitoring includes 36 monitoring wells in the floodplain, nine wells in the MW-20 bench/Park Moabi Road area, and two monitoring wells in the interior plume area (MW-10, MW-25) (Figure 3-1). The majority of the PMP wells used for hydraulic data and groundwater sampling are clusters consisting of two or three individual wells installed at one monitoring location. As noted in

Table 3-1, six individual wells were installed at the MW-36 and MW-39 clusters, and four individual wells were installed at the MW-33 cluster. Refer to Appendix A1, Table A-1 for well construction details for the groundwater monitoring wells.

3.1.3 Pressure Transducer Network

As of April 13, 2005, a total of 52 pressure transducers have been installed for hydraulic data collection for the PMP. The network of transducer locations includes:

- Thirty-six monitoring wells in the floodplain.
- Three extraction wells (TW-2D, TW-2S, PE-1).
- Nine wells in the MW-20 bench/Park Moabi Road area.
- Two river gauge stations (I-3, RRB).
- Two monitoring wells in the interior plume area (MW-10, MW-25).

The location of the PMP wells and stations equipped with transducers are shown on Figure 3-1. Table 3-1 provides a listing of the transducer-monitored wells by depth and monitoring zone in the aquifer. Refer to Appendix A1, Table A-1 for information on well elevations, typical water levels, and water columns for the wells in the transducer monitoring network.

3.2 Overview of Performance Monitoring Program

The PMP involves a variety of data collection, evaluation, and reporting activities. The types of data collected, the evaluation methods and techniques, and associated reporting and response actions conducted under the PMP are summarized in Figure 3-2.

The remainder of this monitoring plan describes the specific data collection, analysis, and evaluation of the hydraulic measurements (Section 4.0), the chemical and water quality data (Section 5.0), the reporting and notification activities (Section 6.0), and response and contingency actions.

TABLE 3-1
Extraction and Monitoring Wells in Interim Measures Area
Performance Monitoring Plan for Interim Measures in the Floodplain Area
PG&E Topock Compressor Station, Needles, California

Station ID	Well ID [1]	Monitored Zone of Alluvial Aquifer	Well / Monitoring Notes [2]		Cr(VI) Concentration [3] 2005 Sampling
					μg/L
Extraction Wells					
TW-2	TW-2S	Upper & Middle	Standby Extraction Well		5,080
	TW-2D	Lower	Active Extraction Well		6,280
PE-1	PE-1	Lower	available for pumping Fall 2005		393
Performance Monitoring Wells					
MW-20	MW-20-70	Upper			7,800
	MW-20-100	Middle			8,130
	MW-20-130	Lower		well for gradient calculation	8,600
MW-22	MW-22-10	Upper	Sentry Well		ND (< 1)
MW-27	MW-27-20	Upper	Sentry Well		ND (< 0.2)
	MW-27-60	Middle	Sentry Well		ND (< 1)
	MW-27-85	Lower	Sentry Well		ND (< 1)
MW-28	MW-28-25	Upper	Sentry Well		ND (< 0.2)
	MW-28-90	Lower	Sentry Well		ND (< 1)
MW-29	MW-29-40	Upper	Sentry Well		ND (< 2)
MW-30	MW-30-30	Upper	Sentry Well		ND (< 5)
	MW-30-50	Middle			ND (< 1)
MW-31	MW-31-60	Upper			2,910
	MW-31-135	Lower		well for gradient calculation	410
MW-32	MW-32-20	Upper	Sentry Well		ND (< 2)
	MW-32-35	Middle	Sentry Well		ND (< 1)
MW-33	MW-33-40	Upper	Sentry Well		ND (< 1)
	MW-33-90	Middle	Sentry Well	Cr(VI) trend well	20.2
	MW-33-150	Lower	Sentry Well	well for gradient calculation	ND (< 1)
	MW-33-210	Lower	sentry well		1.4
MW-34	MW-34-55	Middle	Sentry Well		ND (< 1)
	MW-34-80	Lower	Sentry Well	well for gradient calculation	ND (< 1)
	MW-34-100	Lower	Sentry Well		426
MW-35	MW-35-60	Upper			26.8
	MW-35-135	Lower			15.7

TABLE 3-1
Extraction and Monitoring Wells in Interim Measures Area
Performance Monitoring Plan for Interim Measures in the Floodplain Area
PG&E Topock Compressor Station, Needles, California

Station ID	Well ID [1]	Monitored Zone of Alluvial Aquifer	Well / Monitoring Notes [2]		Cr(VI) Concentration [3] 2005 Sampling
MW-36	MW-36-20	Upper	Sentry Well		ND (< 2)
	MW-36-40	Upper	Sentry Well		ND (< 1)
	MW-36-50	Middle	Sentry Well		ND (< 1)
	MW-36-70	Middle	Sentry Well		ND (< 1)
	MW-36-90	Lower			1,970
	MW-36-100	Lower		Cr(VI) trend well	1,380
MW-39	MW-39-40	Upper	Sentry Well		ND (< 1)
	MW-39-50	Middle			1,000
	MW-39-60	Middle			1,880
	MW-39-70	Middle			6,640
	MW-39-80	Lower			8,270
	MW-39-100	Lower			9,260
MW-42	MW-42-30	Upper	potential Sentry Well		ND (< 1)
	MW-42-55	Middle	potential Sentry Well		ND (< 1)
	MW-42-65	Middle	potential Sentry Well	well for gradient calculation	ND (< 1)
MW-43	MW-43-25	Upper	Sentry Well		ND (< 2)
	MW-43-75	Lower	Sentry Well		ND (< 1)
	MW-43-90	Lower	Sentry Well		ND (< 1)
Other Wells in Performance Monitoring Network					
MW-10	MW-10	Upper	hydraulic monitoring for interior area		1,210
MW-12	MW-10	Upper	chromium monitoring location		1,390
MW-19	MW-19	Upper			796
MW-21	MW-19	Upper	chromium monitoring location		ND (< 1)
MW-25	MW-25	Upper	hydraulic monitoring for interior area		1,970
MW-26	MW-26	Upper			3,790

NOTES:

[1] The last field in monitoring well ID indicates the approximate base depth of well screen (feet below ground surfac
Pressure transducers are installed in all wells listed (except MW-12 and MW-21)
and at river locations I-3 and RRB (see Figure 3-1)

[2] Sentry Well and Gradient Well Pair designations from DTSC 2/14/05 letter (DTSC 2005)
DTSC proposed Well Pairs: MW-20-130 & MW-34-80, MW-20-130 & MW-42-65, MW-31-135 & MW-33-150

[3] Cr(VI) results are maximum concentrations, in micrograms per liter (µg/L), detected in 2005 sampling.
Sampling results for wells outside of floodplain from Dec.and Sept. 2004 quarterly monitoring.

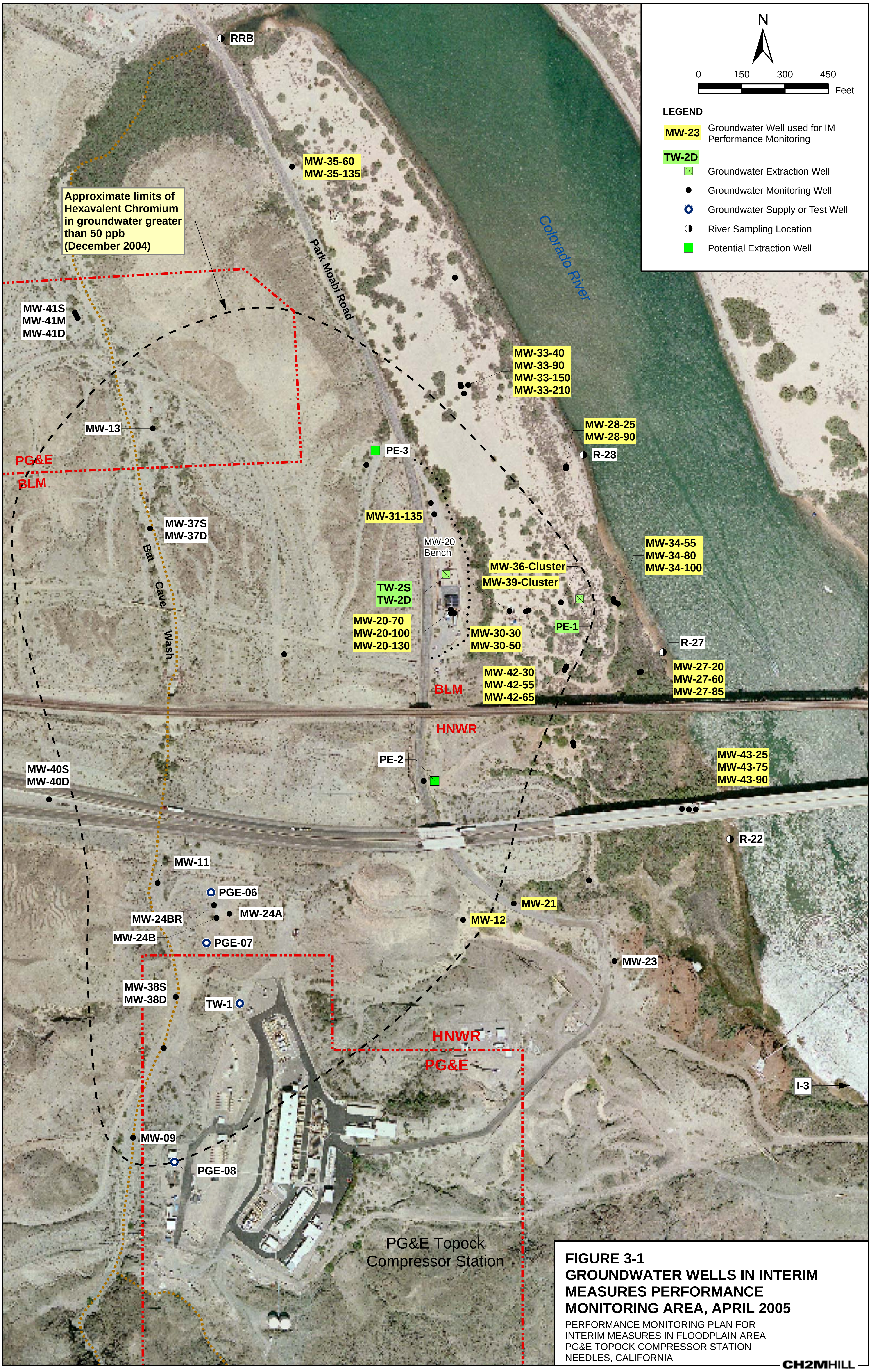


FIGURE 3-1
GROUNDWATER WELLS IN INTERIM MEASURES PERFORMANCE MONITORING AREA, APRIL 2005
PERFORMANCE MONITORING PLAN FOR INTERIM MEASURES IN FLOODPLAIN AREA
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

4.0 Hydraulic Data Collection and Evaluation

This section describes the collection, analysis, and evaluation approach and procedures for the hydraulic measurements for PMP. All hydraulic data collection activities will be performed in accordance with the procedures, methods, and Standard Operating Procedures (SOPs) for the Topock program, as described in the *Sampling, Analysis, and Field Procedures Manual* (Procedures Manual) *(*CH2M HILL 2005c).

Groundwater levels at the Topock site fluctuate in response to changes in river level. Wells closer to the river generally exhibit larger fluctuations that are nearly in-sync with the rivers cycles. Wells further from the river exhibit smaller fluctuations which are lagged in time from the rivers cycles. Because of this complex and nearly continuous fluctuation in groundwater levels, it is not possible to accurately measure gradients at this site from a single round of water level measurements. In order to resolve accurate gradients at the Topock site it was necessary to equip wells with transducers and data loggers. The data loggers are synchronized to collect water level measurements at frequent (30 minute) intervals. The resulting set of water levels from each well is averaged over a period of time to determine the average gradient. A monthly averaging period has been established for performance monitoring.

The PMP hydraulic data collection and evaluation activities consist of:

- **Use of dedicated pressure transducers** in 47 monitoring wells, two river locations, and three extraction wells for continuous measurement of water levels and temperature.
- **Manual water level monitoring** at the monitoring wells, river locations, and extraction wells to calibrate and supplement the pressure transducer data.
- **Performing salinity adjustment** of the raw pressure transducer record to obtain water level elevation data that is normalized to a freshwater head.

4.1 Groundwater Elevations from Pressure Transducers

This section describes the field procedures for collecting data to calculate groundwater elevations.

4.1.1 Groundwater Level Measurements

Groundwater levels are monitored manually using water level sounding tapes and automatically with pressure transducers at all wells in the PMP. Manual water levels are measured at least biweekly during transducer downloads and by PG&E's Groundwater and Surface Water Monitoring Program (GMP) staff during sampling events. The pressure transducers currently measure and store a water level every 30 minutes. Data may be stored on more frequent intervals (e.g., 1- or 5-minute intervals) during hydraulic testing activities.

Standard operating procedures (SOP) for the transducers (e.g., installation, programming, downloads, maintenance, etc.) and manually measuring water levels have been submitted as Appendices A and C in the Procedures Manual (CH2M HILL 2005c).

4.1.2 Salinity and Temperature Measurements

Field instruments are used to measure specific conductance and temperature at all PMP wells during routine GMP sampling. The field instruments also provide readings of salinity and total dissolved solids based on the specific conductance measurement. Groundwater samples are also submitted for laboratory analyses including specific conductance. The routine GMP sampling occurs weekly to quarterly. The field and laboratory data are stored in the chemistry tables within the Topock project database.

Pressure transducers installed in all the PMP wells measure temperature at the same interval as water levels. Six wells have also been fitted with multi-parameter transducers that measure specific conductance along with pressure and temperature. The wells selected for the multi-parameter installations are the wells that will or may be used for hydraulic gradient evaluations are (including a temporary seventh multi-parameter transducer):

- MW-20-130
- MW-27-85
- MW-31-135
- MW-33-150
- MW-34-80
- MW-34-100
- MW-42-65

The location of the multi-parameter transducers will be evaluated on an ongoing basis and in response to gradient pair requirements.

Transducer data, including pressure (i.e., water level), temperature and salinity, if available, are stored within the transducer table within the Topock project database.

4.1.3 Groundwater Elevation Calculations and Adjustments

The temperatures and salinity of surface and groundwater are highly variable across the site. In general, the colder and lower salinity groundwater is found in shallow wells closest to the river and deep wells farther from the river are warmer with higher salinity. Historically, groundwater temperatures have ranged from 62°F to over 100°F. The salinity of groundwater ranges from <0.1 percent to 4 percent.

Groundwater levels are measured at each well and groundwater elevations are calculated. The groundwater elevations or hydraulic heads are interpreted to determine hydraulic gradients and groundwater flow directions. The typical calculation of hydraulic heads used at most groundwater investigation sites assumes that all groundwater has the same density, typically that of freshwater (1 g/cm^3 or 1 kg/L). Assuming freshwater, 1 foot of standing water in a well is equivalent to 2.309 pounds per square inch (psi). For example, a well with 23 feet of water above the screen has a pressure head of 53.1 psi at the screen (where the well is open to the aquifer). However, if a well contains saline water that is denser than freshwater, the pressure head at the screen may be more than 53.1 psi. These density differences due to salinity and temperature are, at most sites, not significant. At Topock, however, the large range in salinity and temperature and the importance of accurately determining hydraulic gradients necessitate adjusting groundwater elevations for these density effects.

Density adjustments for temperature and salinity have been incorporated into the Topock project database for both manually measured and transducer water level data (both the unadjusted and density-corrected groundwater elevations are stored). The density adjustment for salinity and temperature has been implemented as follows:

- Prior to 2003, reported data were not corrected for salinity and temperature. In December 2002, all legacy data (prior to 2003) were retroactively adjusted for salinity and temperature using the best available data.
- From 2003 till August 2004, all reported groundwater elevations were adjusted for salinity using date-specific salinity data when ever possible (e.g., water level and salinity measured on same or similar dates). Subsequently, all groundwater elevations have also been retroactively adjusted for temperature using historical average well-specific temperatures.
- Following August 2004, well-specific average salinity and the best-available temperature data have been used to adjust the groundwater elevation data. The salinity data for each well are routinely evaluated to ensure no trends in salinity or changes in the average salinity have occurred. The best temperature data are daily average temperature from pressure transducers. If transducer temperature data are not available, then temperature data from groundwater sampling are used.

The methodology to adjust groundwater elevations for differences in density due to salinity and temperature are further described in Appendix B.

4.1.4 Transducer Operation and Maintenance

Transducer operations, including installation, programming, and downloads, are conducted by field staff specially trained in transducer operations. Transducer downloads typically occur biweekly to meet data evaluation and reporting requirements.

Maintenance of transducers consists of routine and periodic inspection and maintenance. Routine inspection and maintenance is conducted during all routine visits to a well by a transducer-trained staff. Periodic inspection and maintenance is conducted at specified intervals as outlined in the SOPs.

The transducer operation and maintenance is further described in the Procedures Manual (Section 6.0 and Appendix C SOPs, CH2M HILL 2005c).

4.2 Hydraulic Gradient Evaluation

Evaluation of the hydraulic data and calculation of hydraulic gradients are conducted monthly in fulfillment of the IM work plan (CH2M HILL 2004a) and the DTSC February 2005 directive (DTSC 2005). The natural vertical gradient at the site is upward but because pumping is occurring from a well screened in the lower portion of the aquifer, induced gradients near the pumping well are downward. Because of this complex nature of the gradient at the site, it is necessary to consider both vertical and horizontal gradients when evaluating groundwater flow directions.

4.2.1 Horizontal Gradient Calculation and Presentation

Groundwater elevations (adjusted to equivalent fresh water heads with salinity and temperature) from transducer data are evaluated monthly. The daily minimum, daily maximum, and monthly average groundwater elevations are calculated at each monitoring location, and these data are posted on plan view maps. The three plan view maps contain the monitoring wells separated into Upper, Middle, and Lower zones of the Alluvial Aquifer. The monthly average groundwater elevation data posted onto each map are then contoured to assist with evaluation of the groundwater extraction and interpretation of the hydraulic gradient and inferred flow direction.

4.2.2 Vertical Gradient Calculation and Presentation

The monthly-average groundwater elevation data posted on the plan view maps is also posted and contoured on an east-west cross-section comprised of the MW-34, MW-36, MW-30, MW-39, and MW-20 well clusters. This is the most well-monitored section between the extraction area and the Colorado River, with an abundance of wells and screens at up to six different levels of the Alluvial Aquifer. The evaluation of these data in cross-section also assists with the evaluation of the groundwater extraction and interpretation of both vertical and horizontal components of the hydraulic gradient.

4.2.3 Horizontal Gradients Measured at Well Pairs

As mandated by DTSC (DTSC 2005), three well pairs have been selected to be monitored for horizontal gradient calculation: MW-33-150/MW-31-135, MW-34-80/MW-20-130, and MW-42-65/MW-20-130. The well pairs are highlighted on Figure 4-1. The wells were selected from approximately equivalent screened elevations in the Lower Aquifer. The objective behind selecting these well pairs is to provide a clear, quantitative metric for assessing the monthly success of IM extraction in the Lower Aquifer. The pairs represent southward, westward, and northward directions, respectively, of flow toward the MW-20 bench during extraction. DTSC has specified the average monthly gradients are to be at least 0.001 ft/ft in the direction of the MW-20 bench (i.e., towards wells MW-31-135 and MW-20-130) to account for uncertainty in gradient measurement (see Section 4.2.4).

Gradients between the wells in the pairs will be calculated each month on the basis of average monthly heads in each well. The average groundwater elevation in each well will be calculated as equivalent fresh water head using the methods described above. It is anticipated that gradients will vary throughout each month, and in fact will vary throughout each day.

4.2.4 Hydraulic Gradient Measurement Error Analysis

The process of measuring groundwater levels at the Topock site is complicated by the frequent fluctuations of groundwater levels in response to changes in river stage and by variations in salinity of the groundwater, particularly between wells completed at different depths. By recording groundwater levels every half hour using sensitive water level transducers and data loggers in all floodplain wells, the problem of obtaining accurate measurements of groundwater level fluctuations due to frequent changes in river stage has been addressed. The precision of the transducers is less than a millimeter. Once calibrated to a measured water level in a well, the transducers provide a very accurate record of water level fluctuations in that well.

Because of salinity variations both horizontally and vertically in the floodplain aquifer, it is necessary to adjust the water levels from the different wells to "equivalent fresh water heads." The amount of the adjustment applied depends on the salinity and the depth of the water column in the well. Water density increases with salinity. The adjustment to an equivalent freshwater head accounts for the differences in density and provides what amounts to a common frame of reference in which to compare groundwater levels between wells of differing salinity. The salinity adjustment is the largest source of uncertainty in the water level measurements. Other sources of uncertainty include variations in temperature which, at the Topock site, has very minor effects on water density in comparison to salinity.

Salinity is currently measured in the field each time the wells are sampled. To avoid the influence of random fluctuations among individual salinity measurements, the salinity adjustment factor for each well is based on the average of salinity measurements in that well over the preceding year. Thus, the equivalent freshwater head for each well is calculated using the long-term average salinity in that well. This calculation is performed automatically in the database and applied to each transducer measurement.

An example of error analysis of salinity adjustment may be made with MW-34-80 and MW-20-130, one of the well pairs to be used for gradient evaluation. For the MW-34-80 salinity measurements made during 2004, the average is 0.870 percent with a standard deviation of 0.183 percent. A salinity change of 0.183 percent results in a change in equivalent freshwater head of about 0.10 foot in MW-34-80 and about 0.11 foot in MW-20-130. The distance between MW-34-80 and MW-20-130 is 565 feet. Thus, a one-standard deviation uncertainty (plus or minus) in the water level in either MW-34-80 or MW-20-130 results in a possible uncertainty in the gradient of 0.11/565 which is less than 2×10^{-4}. The DTSC-proposed minimum gradient of 1×10^{-3} is more than four times the expected level of uncertainty of the current water level measurement technique.

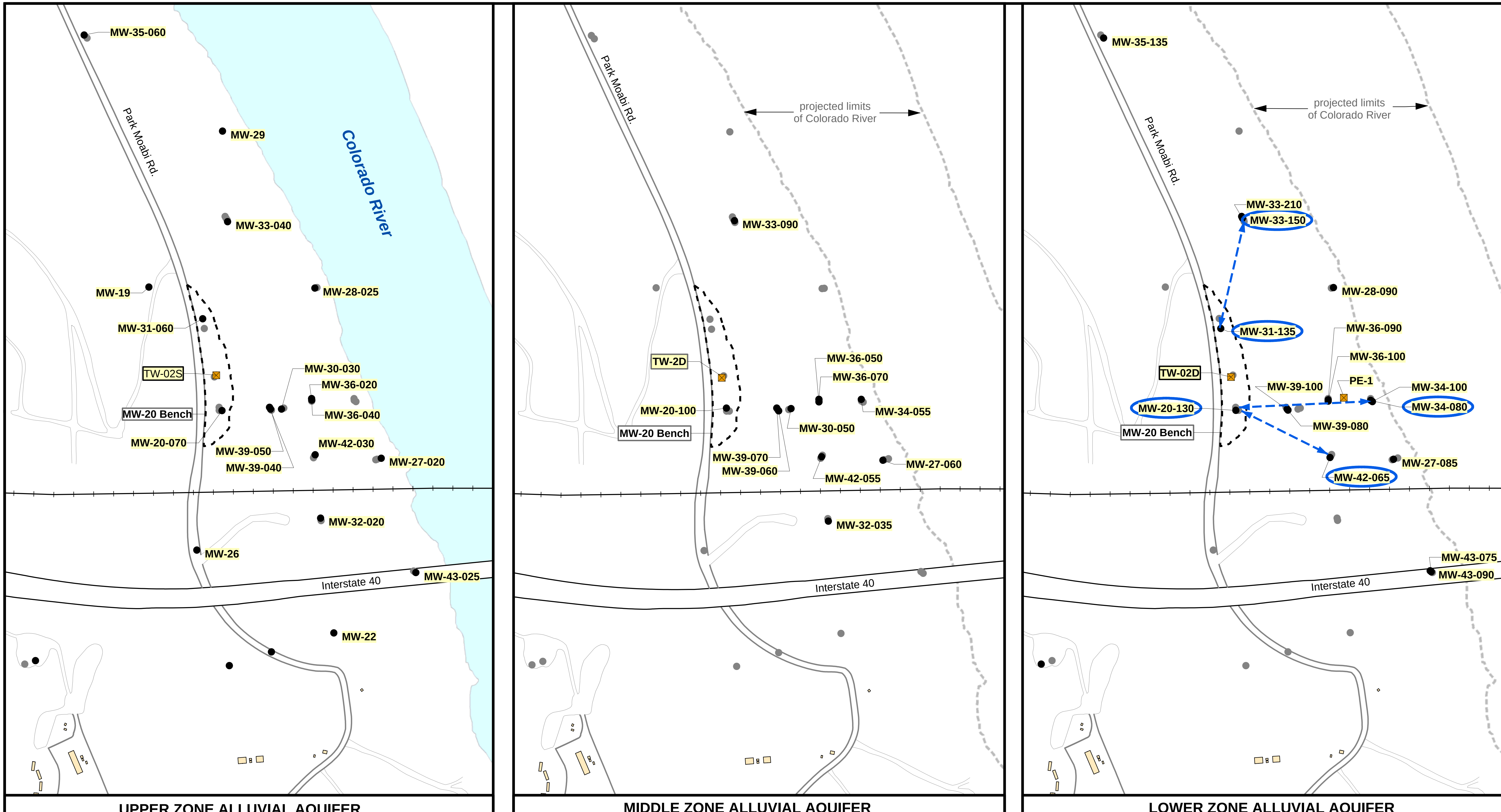
The level of uncertainty in average salinity and, therefore, in calculated water levels will be reduced by obtaining more frequent and more accurate measurements of salinity in the key well pairs. This will be accomplished by two actions. One is to install data loggers that measure salinity, temperature, and water levels simultaneously at regular intervals, currently set for every half hour, in each of the three key well pairs. The second action is to maintain vertical homogeneity in salinity and temperature by moving the sample pumps to the upper part of the water column. Pumping during sampling events will therefore pull water from the screened interval to near the top of the water column, eliminating stagnation and the formation of a significant salinity or temperature gradient. The combination of these two actions will allow more accurate calculation of equivalent freshwater heads for each water level measurement in the data set and will provide measurements that are sensitive to changes in salinity over the course of each month. PG&E is currently implementing these actions, and both should be completed in the current month.

Uncertainty analysis of gradient under the new system will be conducted by checking calibration of the data loggers each month for both water level and salinity. Any drift or offset will be recorded and used to calculate gradient uncertainty.

4.2.5 Groundwater Modeling to Support Interim Measures

The groundwater model is being used to help estimate pumping requirements at different times of the year based on the U.S. Bureau of Reclamation (BOR)-projected Davis Dam releases. The estimate is made by simulating groundwater flow conditions for each month of the year. Both river level and evapotranspiration rates are adjusted for each month in the simulations. Future river levels are estimated from the relationship between historic average monthly river levels at the I-3 river level monitoring station and the combination of: (1) historical average monthly Davis Dam release rates and (2) historical average Lake Havasu elevations. BOR projects future releases and lake elevations on a monthly basis for 2 years from the current month. The average slope of the river gradient at the site is calculated from transducer data from I-3 and Red Rock Bridge stations. Future I-3 levels are estimated from projected Davis Dam releases and Lake Havasu elevations, and the river slope is used to extrapolate river levels between the upstream and downstream boundaries of the model domain for each month’s simulation.

The model is run to simulate a selected number of future months. Simulated flux of groundwater into the river from beneath the plume footprint is calculated for each future month. These simulations represent ambient conditions without IM No. 2 pumping. The amount of pumping required to reverse the groundwater flux is estimated as twice the calculated ambient flux. This multiplier is used for planning contingency, driven by factors including uncertainty in BOR estimates, river level estimates, model assumptions, and the fact that extraction well(s) will necessarily pump some water originating outside of the plume area.



LEGEND

IM Extraction Well

Monitoring Well

Notes:
See Section 4 text for pressure transducer network and gradient calculation descriptions.

MW-20-70 Well with pressure transducer for hydraulic gradient evaluation

MW-39-80 Well pair for calculating hydraulic gradients in Lower Zone of Alluvial Aquifer for performance demonstration

N

0 400 800 Feet

1 inch equals 400 feet

FIGURE 4-1
LOCATIONS OF WELLS USED FOR HYDRAULIC GRADIENT CALCULATION

PERFORMANCE MONITORNG PLAN FOR
INTERIM MEASURES IN FLOODPLAIN AREA
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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5.0 Water Quality Data Collection and Evaluation

This section describes the collection, analysis, and evaluation procedures for the groundwater chemical monitoring data used for the PMP. All groundwater sampling and analysis activities will be performed as part of the GMP in accordance with the procedures, methods, and SOPs for the Topock program, as described in the Procedures Manual (CH2M HILL 2005c).

The groundwater chemical monitoring data to be collected and evaluated for the PMP include:

- **Monthly and biweekly Cr(VI) and dissolved total chromium [Cr(T)] groundwater analyses** collected under the GMP floodplain well sampling programs.
- **Quarterly Cr(VI), Cr(T), and specific conductance and pH groundwater analyses** collected in the floodplain wells and other site areas under the GMP quarterly monitoring activity.
- **Quarterly general chemistry parameter analyses** from selected wells in the PMP area for evaluating potential water changes in the PMP area under pumping conditions.
- **Measurement of field water quality parameters** during quarterly, monthly, and biweekly groundwater sampling activities.
- **Biweekly Cr(VI), Cr(T), and TDS groundwater analyses** collected from the active extraction well(s) for IM operations reporting.

Additionally, Cr(VI) and Cr(T) sampling may be performed at selected sentry wells in the floodplain under contingency sampling plans, as directed by DTSC.

5.1 Water Quality Monitoring and Analyses

Groundwater samples collected from the PMP monitoring network will be analyzed for field and laboratory parameters, as described below.

5.1.1 Field Water Quality Parameters

A flow-through cell will be used to measure water quality parameters during well purging and sampling of all groundwater monitoring wells. The field parameters to be measured include specific conductance, temperature, pH, turbidity, oxidation-reduction potential, and dissolved oxygen. These parameters are used to assess the geochemical conditions of groundwater and to evaluate potential changes in water chemistry due to IM pumping. Procedures for measurement of field water quality parameter are provided in the Procedures Manual (CH2M HILL 2005c).

5.1.2 Laboratory Analytical Parameters

Per the Procedures Manual and the GMP Sampling and Analysis Plan (CH2M HILL 2004e), Cr(VI) and Cr(T) are analyzed in groundwater samples collected in the quarterly, monthly, and biweekly sampling programs using the following analytical methods:

- Method SW 7196A is used for samples collected from monitoring wells where prior monitoring has detected Cr(VI) concentrations above 50 μg/L. The minimum reporting limit for Method 7196A for undiluted samples is 10 μg/L.
- 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 50 μg/L. The minimum reporting limit for Cr(VI) using Method SW 7199 is 0.2 μg/L for undiluted samples.
- Dissolved Cr(T) is analyzed using Method SW 6010B (reporting limit of 1 μg/L for undiluted samples).

The suite of general chemistry and stable isotope parameters used for chemical performance evaluation in the floodplain area include:

- TDS
- Chloride, sulfate, and nitrate
- Dissolved calcium, magnesium, potassium, sodium, bromide, and boron
- Alkalinity
- Oxygen 18 and deuterium (stable isotopes)

Analytical methods, sample volumes and containers, sample preservation requirements, and quality control sample requirements are provided in the Procedures Manual (CH2M HILL 2005c). Data validation and management will be conducted in accordance with the Quality Assurance Project Plan, provided as Appendix D of the Procedures Manual.

5.2 Groundwater Monitoring Frequency

The proposed sampling frequency for the performance monitoring wells is based on the site hydrogeologic model and the extensive set of water quality data collected in the PMP area under the GMP since January 2004.

During the period February through August 2004, at the DTSC's request, PG&E conducted weekly sampling for Cr(VI) and Cr(T) in selected floodplain wells. Since August 2004, a biweekly sampling activity replaced the weekly well sampling. Since November 2003, monthly sampling has been conducted at 24 wells in the floodplain area. During January and February 2005, new groundwater monitoring wells were installed in the floodplain area of the site under the IM investigation program. In late February 2005, weekly sampling of selected floodplain monitoring wells and river sampling locations was resumed at DTSC direction.

The results of prior sampling data and new investigation were reviewed and evaluated as part preparation of a revised and updated Monitoring Plan for the GMP (CH2M HILL 2005d). Accordingly, the sampling frequency and analytical parameters proposed in the Draft Monitoring Plan for the GMP is incorporated into this Draft Monitoring Plan for the PMP.

Table 5-1 presents the proposed scope of analyses and sampling frequencies for all wells in the PMP. The Cr(VI) and Cr(T) monitoring program includes **biweekly sampling** of four selected sentry wells, **monthly sampling** of 30 floodplain wells, and **quarterly sampling** of 13 additional monitoring wells in adjoining areas. The emphasis of the PMP chemical monitoring is the monthly sampling activity which is considered an appropriate sampling frequency for sentry monitoring and the performance evaluations required for the IM floodplain area.

Table 5-1 also identifies the proposed sampling locations and frequency for the IM extraction wells and the selected wells to be sampled for the suite of chemical performance evaluation parameters. Figure 5-1 summarizes the locations where the quarterly, monthly, and biweekly Cr(VI) data will be collected for the wells in the performance monitoring area.

5.3 Cr(VI) Distribution and Water Quality Trends

The results of groundwater analyses collected in the floodplain area will be reviewed, validated, and evaluated as part of IM performance monitoring. The focus of evaluation will be the distribution of Cr(VI), both horizontal and vertical, in the Alluvial Aquifer in floodplain area. In addition, temporal data trends in Cr(VI) concentrations and other water quality parameters will be examined as part of the PMP.

5.3.1 Distribution of Cr(VI)

The horizontal and vertical distribution of Cr(VI) in the upper, middle and lower portions of the Alluvial Aquifer in the PMP area will be displayed for each monthly monitoring period. As required by DTSC, the sampling results will be contoured at 50 and 20 µg/L. The Cr(VI) distribution maps will also be depicted in the floodplain groundwater elevation maps as part of the capture zone analysis. Using sampling data from well clusters, the vertical distribution of Cr(VI) in the aquifer will be shown on the floodplain hydrogeologic cross-section. Examples of the Cr(VI) distribution maps and cross section to be generated for the PMP are included in previously submitted Performance Monitoring Reports (CH2M HILL 2005a).

5.3.2 Water Quality Concentration Trends

Graphs of Cr(VI) concentrations over time will be prepared for evaluating water quality data trends in the IM performance area. Time versus concentration graphs have been prepared and evaluated during the current IM performance review, and declining concentration trends have been observed and documented in a number of floodplain well locations. The graphical format developed for the chemical concentration displays include groundwater and river hydrographs. Examples of the Cr(VI) concentration graphs that will be used for the ongoing PMP are included in previously submitted Performance Monitoring Reports (CH2M HILL 2005a).

TABLE 5-1
Proposed Analyses and Sampling Frequency for Chemical Performance Monitoring
Performance Monitoring Plan for Interim Measures in the Floodplain Area
PG&E Topock Compressor Station, Needles, California

Well ID[1]		Proposed Analytical Parameters and Sampling Frequency[2] (start May 2005)					
		Cr(VI)	**Cr(T)**	**Field Water Quality Parameters[3]**	**SC and pH** laboratory	**Chemical Evaluation Suite[4]**	**Remarks**
Extraction Wells							
TW-2S		**Q**	**Q**	**Q**	**Q**	--	TW-2D scope applies if active
TW-2D		BW	BW	**Q**	**Q**	TDS only - BW	
PE-1		**Q**	**Q**	**Q**	**Q**	--	TW-2D scope applies if active
Performance Monitoring Wells							
MW-20-70		Q	Q	Q	Q	Q	
MW-20-100		Q	Q	Q	Q	Q	
MW-20-130		Q	Q	Q	Q	Q	
MW-22-10		Q	Q	Q	Q	--	secondary sentry well
MW-27-20		Q	Q	Q	Q	Q	secondary sentry well
MW-27-60	*	**M**	**M**	**M**	**Q**	--	primary sentry well
MW-27-85	*	**BW**	**BW**	**BW**	**Q**	--	primary sentry well
MW-28-25		M	M	M	Q	Q	secondary sentry well
MW-28-90		**M**	**M**	**M**	**Q**	--	primary sentry well water quality trend established; monthly sampling sufficient
MW-29-40		M	M	M	Q	--	secondary sentry well
MW-30-30		M	M	M	Q	Q	secondary sentry well
MW-30-50		M	M	M	Q	Q	
MW-31-60		Q	Q	Q	Q	--	
MW-31-135		Q	Q	Q	Q	--	
MW-32-20		M	M	M	Q	Q	secondary sentry well
MW-32-35		M	M	M	Q	Q	secondary sentry well
MW-33-40		M	M	M	Q	--	secondary sentry well
MW-33-90		**M**	**M**	**M**	**Q**	--	primary sentry well water quality trend established; monthly sampling sufficient
MW-33-150		**M**	**M**	**M**	**Q**	--	primary sentry well
MW-33-210		**M**	**M**	**M**	**Q**	--	secondary sentry well
MW-34-55		M	M	M	Q	Q	secondary sentry well
MW-34-80	*	BW	BW	BW	Q	Q	primary sentry well
MW-34-100	*	**BW**	**BW**	**BW**	**Q**	**Q**	primary sentry well add chemical evaluation suite
MW-35-60		Q	Q	Q	Q	--	
MW-35-135		Q	Q	Q	Q	--	

TABLE 5-1

Proposed Analyses and Sampling Frequency for Chemical Performance Monitoring

Performance Monitoring Plan for Interim Measures in the Floodplain Area

PG&E Topock Compressor Station, Needles, California

	Proposed Analytical Parameters and Sampling Frequency [2] (start May 2005)					
Well ID [1]	**Cr(VI)**	**Cr(T)**	**Field Water Quality Parameters [3]**	**SC and pH** laboratory	**Chemical Evaluation Suite [4]**	**Remarks**
MW-36-20	M	M	M	Q	--	secondary sentry well
MW-36-40	M	M	M	Q	--	secondary sentry well
MW-36-50	M	M	M	Q	--	secondary sentry well
MW-36-70	M	M	M	Q	--	secondary sentry well
MW-36-90	M	M	M	Q	--	
MW-36-100	BW	BW	BW	Q	**Q**	Cr(VI) trend well
MW-39-40	M	M	M	Q	--	secondary sentry well
MW-39-50	M	M	M	Q	--	
MW-39-60	M	M	M	Q	--	
MW-39-70	M	M	M	Q	--	
MW-39-80	M	M	M	Q	--	
MW-39-100	M	M	M	Q	--	
MW-42-30	**M**	**M**	**M**	**Q**	--	secondary sentry well
MW-42-55	**M**	**M**	**M**	**Q**	--	secondary sentry well
MW-42-65	**M**	**M**	**M**	**Q**	--	secondary sentry well
MW-43-25	**M**	**M**	**M**	**Q**	--	secondary sentry well
MW-43-75	**M**	**M**	**M**	**Q**	--	secondary sentry well
MW-43-90	**M**	**M**	**M**	**Q**	--	secondary sentry well
Other Wells in Performance Monitoring Network						
MW-10	Q	Q	Q	Q	--	
MW-12	Q	Q	Q	Q	--	
MW-19	Q	Q	Q	Q	--	
MW-21	Q	Q	Q	Q	--	
MW-25	Q	Q	Q	Q	Q	
MW-26	Q	Q	Q	Q	Q	

NOTES:

1. The last field in monitoring well ID indicates the approximate base depth of well screen (feet below ground surface)
2. Sampling frequency: quarterly (Q), monthly (M), biweekly (BW).
   Hexavalent chromium [Cr(VI)], dissolved total chromium [Cr(T)]
   Bold denotes changes or additions to the current GMP and IM monitoring programs
   * denotes wells sampled on Weekly schedule, starting Feb 22, 2005 under DTSC direction
3. Field water quality parameters: temperature, pH, specific conductance (SC), salinity, oxygen reduction potential (ORP), dissolved oxygen
4. Chemical evaluation parameters: total dissolved solids (TDS), chloride, sulfate, nitrate, alkalinity, stable isotopes (oxygen-18 & deuterium), calcium, potassium, magnesium, sodium, bromide, boron

UPPER ZONE ALLUVIAL AQUIFER

MIDDLE ZONE ALLUVIAL AQUIFER

LOWER ZONE ALLUVIAL AQUIFER

Legend

IM Extraction Well

Monitoring Well

Notes:
See Table 5-2 for chemical parameters monitored in Quarterly, Monthly and Biweekly sampling programs

Proposed Groundwater Monitoring Frequency - Starting May 1, 2005

MW-20-70 Quarterly only

MW-39-80 Monthly and Quarterly

MW-34-80 Bi-weekly and Quarterly

N

Feet
0 400 800
1 inch equals 400 feet

FIGURE 5-1
SAMPLING FREQUENCY FOR WELLS IN PERFOMANCE MONITORING AREA
PERFORMANCE MONITORNG PLAN FOR
INTERIM MEASURES IN FLOODPLAIN AREA
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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6.0 Reporting

Item VI in the February 14, 2005 DTSC letter (DTSC 2005) outlines the following reporting requirements for the PMP:

- Notification to DTSC of any new Cr(VI) detection in a sentry well, or increasing trend in a sentry well.
- Notification to DTSC of the determination that the IM is not providing hydraulic containment of the Cr(VI) plume.
- Submittal of monthly reports, which evaluate the performance of the IM for monthly reporting periods.
- Submittal of quarterly reports, which evaluate the performance of the IM for quarterly reporting periods.
- Submittal of annual reports, which evaluate the performance of the IM for annual reporting periods.

The PMP has incorporated these reporting provisions for the continued operation of the IM in the floodplain area (Figure 3-2). Figure 6-1 presents a generalized schedule of the data collection activities, the performance evaluation periods, and monthly, quarterly, and annual reports required by DTSC for the PMP. The proposed format and content of the performance monitoring reports are described below.

6.1 Monthly Performance Reports

Monthly reports will document IM system operations and the performance monitoring data and evaluation completed for monthly reporting periods. The monthly reports will follow the general format used for IM performance monitoring conducted in 2004 to present, and will be submitted 15 days after the monthly reporting period. Eight monthly reports will be prepared each calendar year for the months of February, March, May, June, August, September, November and December. The proposed outline and content of the Monthly Performance Reports is included in Appendix C1.

6.2 Quarterly Performance Reports

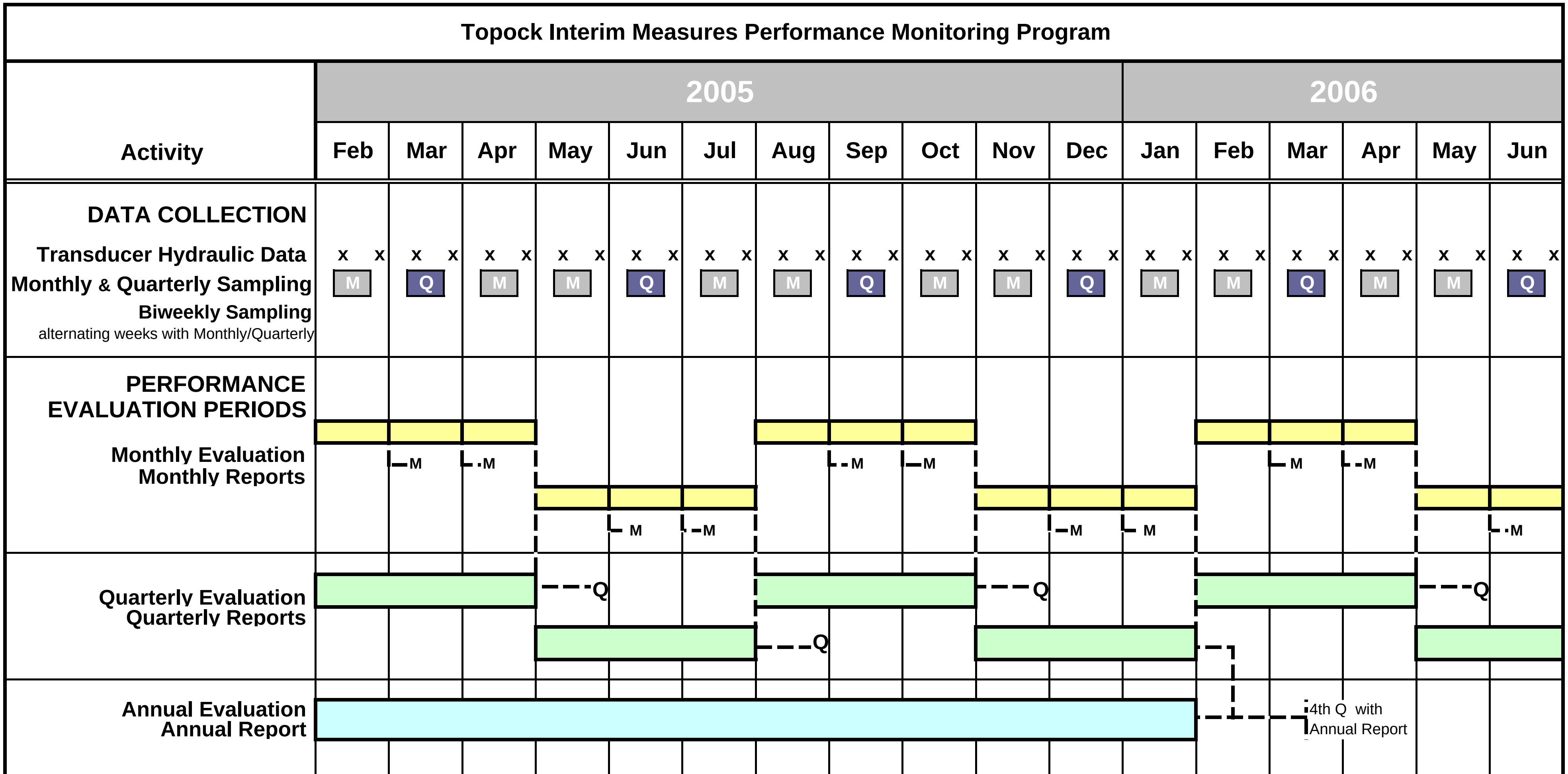
Quarterly reports will document IM system operations and the performance monitoring data and evaluation completed for quarterly reporting periods. The quarterly performance demonstration periods for the IM are established by DTSC as February through April, May through July, August through October, and November through January. The quarterly performance reports will be submitted within 30 days after the quarterly reporting period. Three quarterly reports will be prepared each calendar year for the periods February through April, May through July, and August through October. Appendix C2 provides the proposed outline and content of the Quarterly Performance Reports.

Prior to submitting the first quarterly report, PG&E will submit example graphical summaries to DTSC for review and approval at least 30 days prior to submittal.

6.3 Annual Performance Evaluation Report

Annual reports will document IM system operations and the performance monitoring data and evaluation completed for annual operations periods. Per DTSC, the annual reporting period for each year will begin on February 1 and end on January 31 of the following year (Figure 6-1). The annual performance evaluation reports will be submitted by March 15 (45 days after the annual reporting period). The proposed outline and content of the Annual Performance Evaluation Reports is included in Appendix C3.

Prior to submitting the first annual report, PG&E will submit example graphical summaries to DTSC for review and approval at least 30 days prior to submittal.



NOTE : The Quarterly report and 3rd Month reports are proposed to be combined into single submittals.
The Annual report and 4th Quarter report are proposed to be combined into a single submittal.

LEGEND - - - M Monthly Report

- - - Q Quarterly Evaluation Report

FIGURE 6-1

SCHEDULE FOR PERFORMANCE EVALUATION AND REPORTING

PERFORMANCE MONITORING PLAN FOR INTERIM MEASURES IN THE FLOODPLAIN AREA
PG&E TOPOCK COMPRESSOR STATION
NEEEDLES, CALIFORNIA

7.0 Contingency Plan and Response Actions

The performance of the IM will be continuously monitored and evaluated to ensure that the hydraulic containment objective in the floodplain area is met and appropriate and timely adjustments can be made to the extraction system. DTSC's February 14, 2005 direction letter, Item V (DTSC 2005) identifies the following contingency plan and response action requirements for the PMP:

- Implement the approved contingency plan(s) if new Cr(VI) detections or increasing trends are observed in the sentry monitoring wells.
- Implement, with DTSC approval, increases to the pumping from existing extraction wells (TW-2D and TW-2S).
- Install one or both of the potential extraction wells (PE-2 or PE-3) if additional extraction capacity is needed.
- If additional extraction capacity is needed beyond what can be provided by PE-2 and PE-3, propose and submit work plans for the installation of additional extraction wells for the IM system.
- Install additional monitoring wells as necessary to define the chromium plume limits in the floodplain, monitor potential plume movement, and assess the extent of the capture zone.

The PMP has incorporated these contingency and response actions for the continued operation of the IM in the floodplain area (Figure 3-2).

7.1 Contingency Plan for Sentry Well Monitoring

Figure 7-1 presents the approved Contingency Planning for Sentry Well Groundwater Monitoring (DTSC 2005). This decision chart outlines the criteria and notification procedures when new Cr(VI) detections, or significant increasing concentrations, are observed in the floodplain sentry wells. The contingency plan includes provisions for verification sampling and initiating response actions for the IM extraction system.

7.2 Modifications and Improvements to the Extraction System

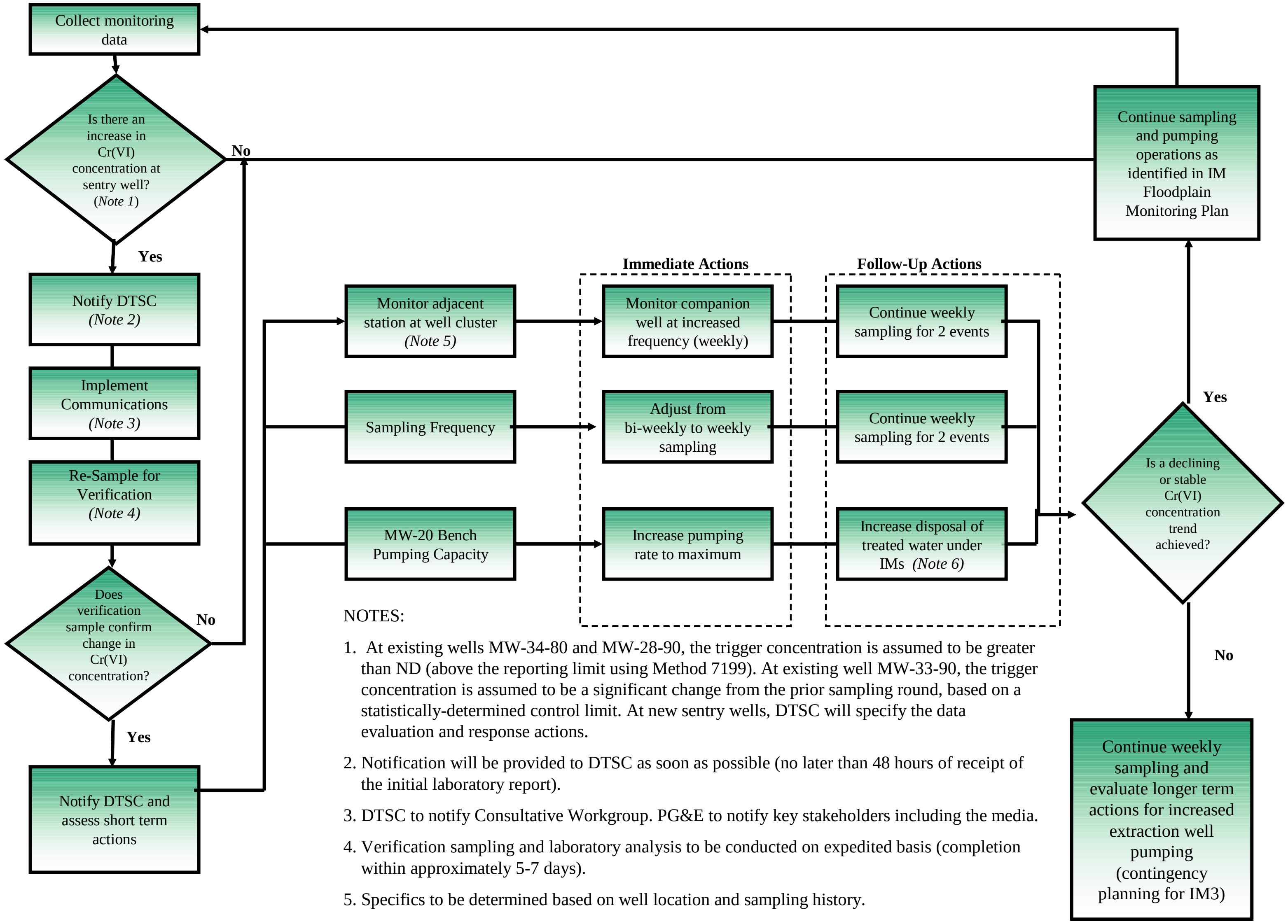
Per DTSC requirements, the first contingency response action will be to increase pumping from the existing extraction wells. The adjustments to extraction rates will be implemented, following DTSC approval, according to procedures described in the IM extraction system operation and maintenance plan (CH2M HILL, in preparation).

If it becomes apparent through water level monitoring or increasing concentrations of Cr(VI) in key wells that there are areas of the plume not being adequately captured by the higher pumping rates at existing wells, PG&E is prepared at the direction of DTSC to quickly add one or more additional extraction wells. These response actions will be implemented according to procedures and schedules described in the IM extraction system operation and maintenance plan (CH2M HILL, in preparation).

7.3 Installation of Additional Monitoring Wells

If additional wells are needed for sentry monitoring or hydraulic measurement in the PMP area, drilling access permission and permits will be obtained and work plans will be prepared and submitted to DTSC. All drilling activities will be coordinated with state and federal agencies regarding cultural and biological resource surveys, site clearance, and approvals for installation of new monitoring wells in the floodplain area. The drilling and well installation will be conducted in accordance with approved work plans and all applicable permits.

The objectives, procedures, and specifications for the drilling and installation of additional monitoring wells for the IM will be addressed in project-specific work plans following the format used for the Phase 2 Monitoring Well Installation Work Plan (CH2M HILL 2005e). Drilling, hydrogeologic logging, monitoring well installation, and development procedures are described in detail in the Procedures Manual (Section 5 and Appendix B SOPs, CH2M HILL 2005c).



NOTES:

1. At existing wells MW-34-80 and MW-28-90, the trigger concentration is assumed to be greater than ND (above the reporting limit using Method 7199). At existing well MW-33-90, the trigger concentration is assumed to be a significant change from the prior sampling round, based on a statistically-determined control limit. At new sentry wells, DTSC will specify the data evaluation and response actions.
2. Notification will be provided to DTSC as soon as possible (no later than 48 hours of receipt of the initial laboratory report).
3. DTSC to notify Consultative Workgroup. PG&E to notify key stakeholders including the media.
4. Verification sampling and laboratory analysis to be conducted on expedited basis (completion within approximately 5-7 days).
5. Specifics to be determined based on well location and sampling history.
6. Disposal under the Interim Measures involves offsite trucking (IM2) and disposal by injection (IM3).

FIGURE 7-1
CONTINGENCY PLANNING FOR SENTRY WELL GROUNDWATER MONITORING
PERFORMANCE MONITORING PLAN FOR INTERIM MEASURES IN FLOODPLAIN AREA
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

Source: Contingency Planning diagram (Final Rev-0), dated February 2005, approved for Interim Measures

CH2MHILL

326128.01.07.IM_Fig 7-1_4/11/05_ccc_sfo

8.0 References

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