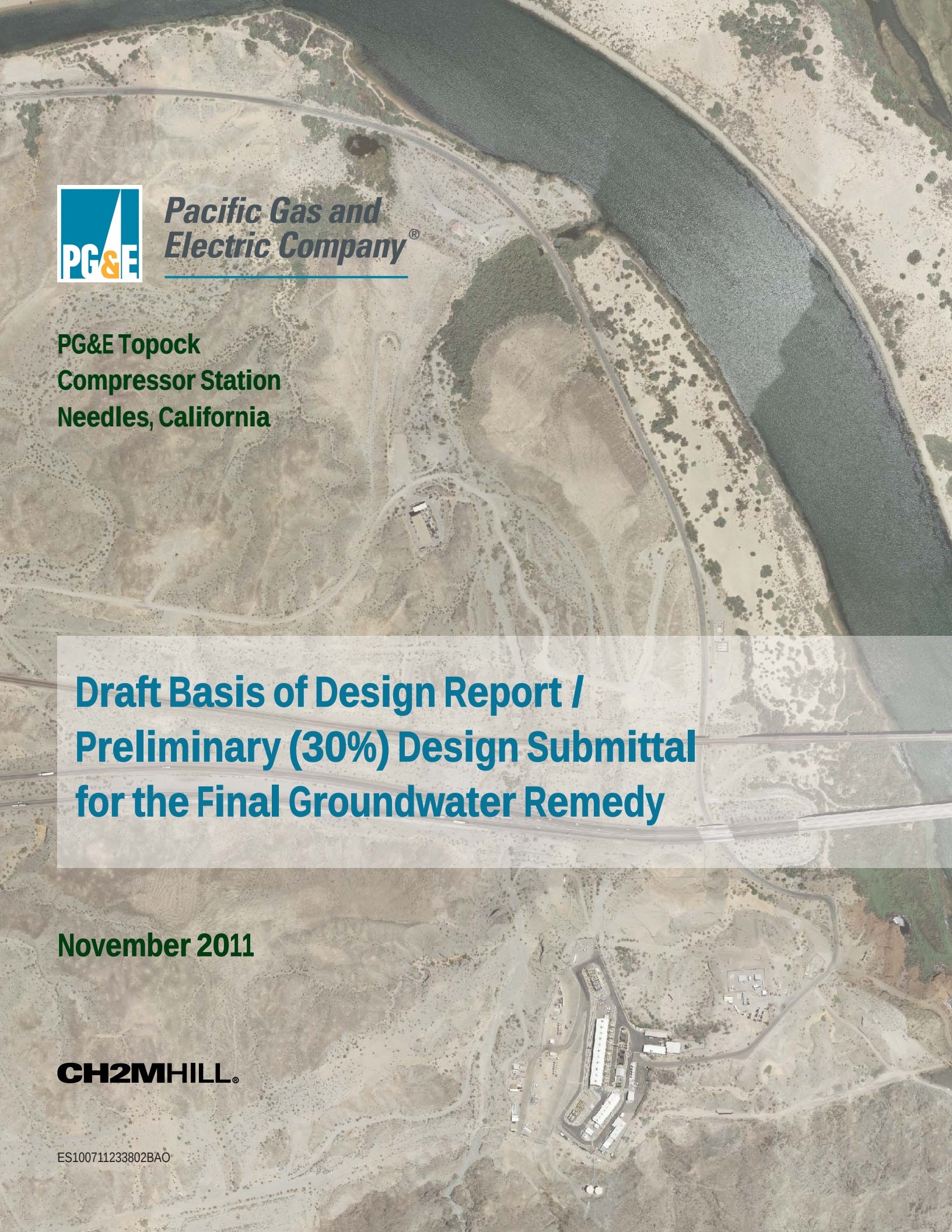

Pacific Gas and Electric Company®

PG&E Topock
Compressor Station
Needles, California

Draft Basis of Design Report / Preliminary (30%) Design Submittal for the Final Groundwater Remedy

November 2011

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ES100711233802BAO

Topock Project Executive Abstract

Document Title: Draft Basis of Design Report/Preliminary (30%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California

Submitting Agency: DTSC, DOI

Final Document? ☐ Yes ☒ No

Date of Document: 11/18/2011

Who Created this Document?: (i.e. PG&E, DTSC, DOI, Other)

PG&E

Priority Status: ☒ HIGH ☐ MED ☐ LOW

Is this time critical? ☒ Yes ☐ No

Action Required:

☐ Information Only ☒ Review & Comment

Type of Document:

☒ Draft ☐ Report ☐ Letter ☐ Memo

☐ Other / Explain:

Return to: N/A

By Date: As specified by DTSC and DOI

☐ Other / Explain:

What does this information pertain to?

☐ Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)/Preliminary Assessment (PA)

☐ RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment)

☐ Corrective Measures Study (CMS)/Feasibility Study (FS)

☒ Corrective Measures Implementation (CMI)/Remedial Action (RA)

☐ California Environmental Quality Act (CEQA)/Environmental Impact Report (EIR)

☐ Interim Measures

☐ Other / Explain:

Is this a Regulatory Requirement?

☒ Yes

☐ No

If no, why is the document needed?

What is the consequence of NOT doing this item? What is the consequence of DOING this item?

This submittal is required for compliance with the 1996 Corrective Action Consent Agreement, the 2009 CERCLA Remedial Design/Remedial Action Model Consent Decree, and the Corrective Measure Implementation/Remedial Design (CMI/RD) Work Plan.

Other Justification/s:

☐ Permit ☐ Other / Explain:

Brief Summary of attached document:

This Draft Basis of Design Report/Preliminary (30%) Design submittal presents the preliminary design basis, design criteria, drawings, and list of specifications as well as additional information required for the final groundwater remedy at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station. This preliminary design submittal builds on the framework established in the Revised Corrective Measures Implementation/ Remedial Design (CMI/RD) Work Plan for Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1 and AOC 10. The Revised CMI/RD Work Plan was approved by the U.S. Department of the Interior (DOI) on November 3, 2011 for use in development of the groundwater remedy design documents and associated plans.

Written by: Pacific Gas and Electric Company

Recommendations:

Provide review comments to DTSC and DOI.

How is this information related to the Final Remedy or Regulatory Requirements:

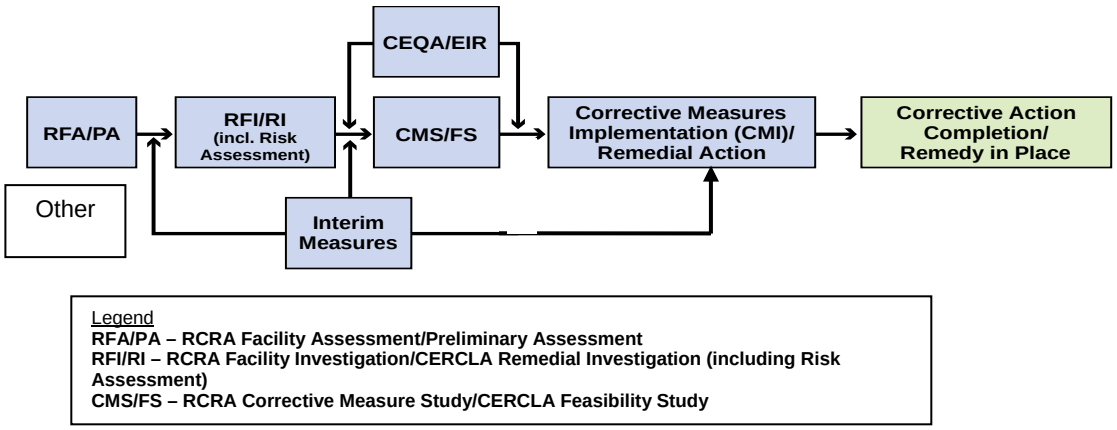
This submittal presents the preliminary design basis, design criteria, list of specifications, and additional information required for the final groundwater remedy.

Other requirements of this information?

None.

Related Reports and Documents:

Click any boxes in the Regulatory Road Map (below) to be linked to the Documents Library on the DTSC Topock Web Site (www.dtsc-topock.com).



Legend
RFA/PA – RCRA Facility Assessment/Preliminary Assessment
RFI/RI – RCRA Facility Investigation/CERCLA Remedial Investigation (including Risk Assessment)
CMS/FS – RCRA Corrective Measure Study/CERCLA Feasibility Study

Version 9

Pacific Gas and Electric Company

Yvonne J. Meeks
Manager

Environmental Remediation

Mailing Address
4325 South Higuera Street
San Luis Obispo, CA 93401

Location
6588 Ontario Road
San Luis Obispo, CA 93405

805.234.2257
Fax: 805.546.5232
E-Mail: yjm1@pge.com

November 18, 2011

Mr. Aaron Yue
California Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630

Ms. Pamela Innis
U.S. Department of the Interior, Office of Environmental Policy and Compliance
P.O. Box 25007 (D-108)
Denver Federal Facility Building 56
Denver, Colorado 80225-0007

Subject: Draft Basis of Design Report/Preliminary (30%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California

Dear Mr. Yue and Ms. Innis:

In compliance with the 1996 Corrective Action Consent Agreement between the California Department of Toxic Substances Control (DTSC) and Pacific Gas and Electric Company (PG&E) and the 2009 CERCLA Remedial Design/Remedial Action Model Consent Decree, this letter transmits the *Draft Basis of Design Report/Preliminary (30%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California*. PG&E looks forward to the opportunity to review the preliminary remedy pipeline alignment/design features with the Agencies, interested Tribes, and Stakeholders during the December 14, 2011 site walk.

Please contact me at (805) 234-2257 if you have any questions or comments regarding this submittal.

Sincerely,

Yvonne Meeks

Yvonne Meeks
Topock Project Manager

cc: Karen Baker/DTSC

Draft Report

Draft Basis of Design Report/ Preliminary (30%) Design Submittal for the Final Groundwater Remedy

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas & Electric Company

November 2011

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155 Grand Avenue
Suite 800
Oakland, CA 94612

Certification Page

The certification page will be provided with the Final Basis of Design Report and Design Submittal.

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Acronyms and Abbreviations

µg/L	micrograms per liter
ADOT	Arizona Department of Transportation
AOC	Area of Concern
APE	Area of Potential Effect
APN	Assessor's Parcel Number
ARARs	applicable or relevant and appropriate requirements
As(III)	trivalent arsenic
As(V)	pentavalent arsenic
AST	aboveground storage tank
bgs	below ground surface
BLM	U.S. Bureau of Land Management
BNSF	Burlington Northern Santa Fe
BOR	U.S. Bureau of Reclamation
CACA	Corrective Action Consent Agreement
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
cfs	cubic feet per second
CHPMP	Cultural and Historic Properties Management Plan
CIP	Clean In Place
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
COPC	constituent of potential concern
Cr(III)	trivalent chromium
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
CRIT	Colorado River Indian Tribes
DOI	United States Department of the Interior
DTSC	California Department of Toxic Substances Control
EIR	environmental impact report

EPNG	El Paso National Gas Company
ESA	federal Endangered Species Act
Fe(II)	ferrous iron
Fe(III)	ferric iron
FMIT	Fort Mojave Indian Tribe
fps	feet per second
FS	Feasibility Study
ft w.c.	feet of water column
gpd	gallons per day
gpm	gallons per minute
HMI	human/machine interface
HNWR	Havasu National Wildlife Refuge
Hz	hertz
I-40	Interstate 40
ICs	institutional controls
IM	Interim Measure
IM-3	Interim Measure No. 3
IRZ	In-situ Reactive Zone
ISPT	In-situ pilot test
kVA	kilovolt-ampere
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
MCL	maximum contaminant level
mg/L	milligrams per liter
MMRP	Mitigation Monitoring and Reporting Program
MNA	monitored natural attenuation
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NTH	National Trails Highway
O&M	operation and maintenance
OHWM	ordinary high water mark
P/V	pressure/vacuum
PA	Programmatic Agreement
PBA	Programmatic Biological Assessment
PG&E	Pacific Gas and Electric Company
PLC	programmable logic controller

QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
ROW	right-of-way
RTU	remote terminal unit
SCADA	Supervisory Control and Data Acquisition
SHPO	State Historic Preservation Officer
SOB	Statement of Basis
SWMU	Solid Waste Management Unit
TCS	Topock Compressor Station
TDH	total dynamic head
TDS	total dissolved solids
TOC	total organic carbon
TRC	Technical Review Committee
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
UTL	upper tolerance limit
VAC	volts alternating current

SECTION 1

Introduction

This Basis of Design Report/Preliminary (30%) Design Submittal presents the preliminary design basis, design criteria, drawings, and list of specifications for the selected final groundwater remedy at the Pacific Gas and Electric Company (PG&E) Topock Compressor Station (TCS, or the Compressor Station) in San Bernardino County, California. This preliminary design submittal builds on the framework established in the Revised Corrective Measures Implementation/ Remedial Design (CMI/RD) Work Plan for Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1 and AOC 10 (CH2M HILL 2011f). The Revised CMI/RD Work Plan was approved by the U.S. Department of the Interior (DOI) on November 3, 2011 for use in development of the groundwater remedy design documents and associated plans (DOI 2011). The CMI/RD Work Plan and other key project documents may be reviewed on the California Department of Toxic Substances Control's (DTSC's) Topock Compressor Station web site: http://www.dtsc-topock.com.

The DTSC is the state lead agency overseeing corrective actions at the Compressor Station in accordance with the Resource Conservation and Recovery Act (RCRA) Corrective Action. In February 1996, PG&E and DTSC entered into a Corrective Action Consent Agreement (CACA) pursuant to Section 25187 of the California Health and Safety Code (DTSC 1996). The DOI is the lead federal agency overseeing response actions on or emanating from land under its jurisdiction, custody, or control near the Compressor Station pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In July 2005, PG&E and the federal agencies (DOI, U.S. Bureau of Land Management (BLM), U.S. Fish and Wildlife Services (USFWS), and U.S. Bureau of Reclamation [BOR]) entered into an Administrative Consent Agreement (DOI 2005). A Consent Decree between DOI and PG&E is forthcoming.

In a coordinated effort, DOI and DTSC selected the final groundwater remedy to address chromium in groundwater at SWMU 1/AOC 1 and AOC 10. The DOI decision is presented in the Record of Decision (ROD) (DOI 2010), and the DTSC decision is presented in a decision package that includes the certification of the Final Environmental Impact Report (EIR; AECOM 2011), the Final Statement of Basis (SOB), the Statement of Decision, and the Resolution of Approval (DTSC 2011a). The action being taken by PG&E to address chromium in groundwater near the Compressor Station is referred to in this Basis of Design Report/Preliminary (30%) Design Submittal as the "remedy," which is intended to be equivalent to the RCRA Corrective Action and CERCLA terminology of "corrective measure," "corrective action," "remedial action," or "response action." Furthermore, the action is more specifically defined as the "groundwater remedy" or "final groundwater remedy" to distinguish it from other future actions that may be selected for the soil media at the Compressor Station.

In conformance with the 1996 CACA and the CERCLA Model Remedial Design/Remedial Action (RD/RA) Consent Decree (U.S. Environmental Protection Agency [USEPA] 2009) requirements, this submittal is the preliminary (30%) design submittal that provides design detail, drawings, and a list of specifications for implementation of the remedy. As shown in the Groundwater Remedy Design, Construction, and Initial Start-Up Schedule (see Exhibit 1-1), the preliminary (30%) design will continue to be refined with input from the stakeholders, Agencies, and Tribes through the intermediate (60%), pre-final (90%) and final design (100%) stages, which are scheduled to continue through November 2012.

The following subsections provide project background information, describe the remedy and the remedial action objectives (RAOs), summarize the applicable or relevant and appropriate requirements (ARARs) and EIR Mitigation Measures, and describe the content and organization of this Basis of Design Report/Preliminary (30%) Design Submittal.

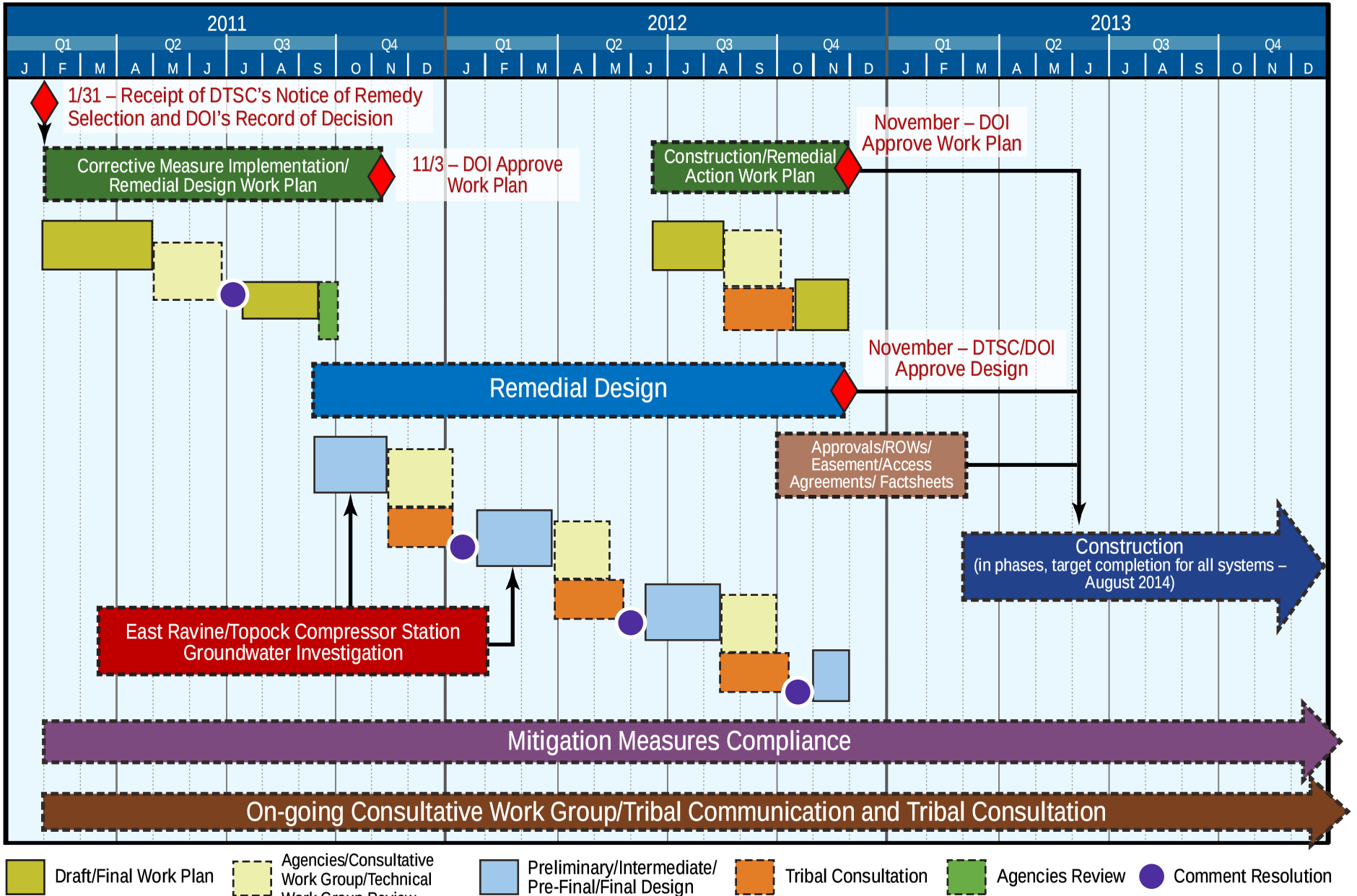


EXHIBIT 1-1
Groundwater Remedy Design, Construction, and Initial Start-Up Schedule
Basis of Design Report/Preliminary (30%) Design Submittal
PG&E Topock Compressor Station, Needles, California

1.1 Background

The Compressor Station is located adjacent to the Colorado River in eastern San Bernardino County, California, approximately 12 miles southeast of Needles, California, south of Interstate 40 (I-40), in the north end of the Chemehuevi Mountains (see Figure 1-1; all figures are located at the end of this document).

The Topock site and adjacent lands are contained within a larger geographic area that is considered sacred by the Fort Mojave Indian Tribe and by other Native American Tribes. The Tribes believe that the environmental, cultural, and spiritual resources may not be physically perceptible. DTSC has concluded within the January 2011 certified EIR that the project site "appears to qualify as a historic resource under CEQA [California Environmental Quality Act] as an area that is significant in the social and cultural annals of California," and the BLM also has determined that a traditional cultural property or property of traditional religious and cultural significance that is eligible for listing on the National Register of Historic Places exists in the area of the Topock project (AECOM 2011).

In recognition of this, all remedial activities are planned in such a way as to minimize impact to this area. Specifically, impacts to cultural resources will be minimized by implementing the mitigation measures required by the EIR. The work will be conducted in a manner that recognizes and respects these resources and the spiritual values of the area. Practices that will be implemented with this objective in mind include: minimizing additional disturbance to the area by installing facilities in previously disturbed areas where possible; minimizing the size of drilling pads and staging areas; use of all-terrain drilling and sampling equipment in areas not served by existing roadways; constructing wells with multiple well screens at different depths in a single boring where possible rather than drilling individual borings for each well depth; minimizing the amount of equipment and duration that equipment is present on site; and providing training to all site employees to ensure that they are aware of and respectful of the spiritual value of this area that is considered sacred by certain Tribes.

1.2 Selected Final Groundwater Remedy and Requirements

The selected final groundwater remedy, its objectives, and regulatory requirements are described below. The groundwater remedy includes:

- Construction of an In-situ Reactive Zone (IRZ) along National Trails Highway (NTH) using a line of wells that may be used as both injection and extraction wells to circulate groundwater and distribute an organic carbon source to promote reduction of the hexavalent chromium (Cr[VI]) to trivalent chromium (Cr[III]).
- Flushing accomplished through a combination of freshwater injection and injection of carbon-amended water in wells upgradient of the plume.
- Extraction wells near the Colorado River (referred to as the River Bank Extraction Wells) to provide hydraulic capture of the plume, accelerate cleanup of the floodplain, and enhance the flow of contaminated groundwater through the IRZ line.
- East Ravine Extraction Wells in the eastern (downgradient) end of the East Ravine to provide hydraulic capture of contaminated groundwater in bedrock. Extracted water will be treated and managed using the same active treatment system that will be used to treat and manage contaminated groundwater extracted from the alluvial aquifer.
- Institutional controls (ICs) to restrict surface land uses and prevent the use of groundwater.
- Monitored natural attenuation (MNA) as a long-term component to address residual chromium that may remain in recalcitrant portions of the aquifer after enhanced in-situ treatment and optimized system performance.

1.2.1 Remedial Action Objectives

The RAOs of the groundwater remedy are defined in the SOB (DTSC 2011) and the ROD (DOI 2010), based on the conclusions of the Groundwater Risk Assessment (ARCADIS 2009a) and ARARs identification. The RAOs for the groundwater remedy are to:

1. Prevent ingestion of groundwater as a potable water source having Cr(VI) in excess of the regional background concentration of 32 micrograms per liter (µg/L).
2. Prevent or minimize migration of total chromium (Cr[T]) and Cr(VI) in groundwater to ensure concentrations in surface water do not exceed water quality standards that support the designated beneficial uses of the Colorado River (11 µg/L Cr[VI]).
3. Reduce the mass of Cr(T) and Cr(VI) in groundwater at the site to achieve compliance with ARARs in groundwater. This RAO will be achieved through the cleanup goal of the regional background concentration of 32 µg/L of Cr(VI).
4. Ensure that the geographic location of the target remediation area does not permanently expand following completion of the remedial action.

1.2.2 Incorporation of ARARs and EIR Mitigation Measures into the Design

CERCLA remedial actions are required to comply with the substantive requirements of identified ARARs. Therefore, the design of the final groundwater remedy incorporates the requirements of ARARs documented in the ROD (DOI 2010). These ARARs include federal, California, and Arizona chemical-specific, location-specific, and action-specific ARARs. The chemical-specific ARARs have already been incorporated into the RAOs, ensuring that compliance with these ARARs will be attained when the remedy is completed (defined by attainment of the RAOs). As a component of the selected remedy, ICs will be utilized until the RAOs are achieved. The design considerations for the ICs are to limit or prohibit activities on specified property for the purposes of: 1) ensuring protection of human health and the environment until the RAOs are attained; 2) protecting the remedial facilities; and 3) providing access for continued operation and maintenance (O&M). ICs are further discussed in Section 5.

In conformance with the National Historic Preservation Act (NHPA)—an identified location-specific ARAR—the BLM, Arizona State Historic Preservation Officer (SHPO), California SHPO, and the Advisory Council on Historic Preservation have completed a Programmatic Agreement (PA) (BLM 2010) that includes policies and procedures to help guide BLM's planning and decision-making as it affects cultural and historic properties specific to the groundwater remedy. The PA also defined an Area of Potential Effect (APE) as shown on Figure 1-2. Stipulation VII of the PA requires BLM to develop a Cultural and Historic Properties Management Plan (CHPMP) that specifies how cultural and historic properties within the APE are to be treated during the groundwater remedy implementation. The CHPMP is to include a Treatment Plan that describes the mitigation measures that might be used to avoid, minimize, or mitigate adverse effects to cultural and historic properties within the APE. Other location- and action-specific ARARs are being incorporated into the design as documented in Section 7.

In conformance with CEQA, DTSC issued an EIR to evaluate the potential environmental effects of actions associated with cleanup of groundwater contamination at the Compressor Station and to identify mitigation measures to reduce the level of significance of impacts, where feasible (AECOM 2011). The project area as defined by the EIR for evaluation of impacts and assessment of remedy implementation is shown on Figure 1-2. The project area as defined by the EIR is encompassed within the APE specified in the PA. The EIR concluded that implementation of the groundwater remedy would generate significant adverse environmental impacts, and for most potential impacts, the EIR prescribes mitigation measures capable of reducing these impacts to less-than-significant levels. The EIR includes a Mitigation Monitoring and Reporting Program (MMRP) for the groundwater remedy. The mitigation measures were identified for impacts associated with various resources, including aesthetic, air quality, cultural, biological, geology and soils, hazardous materials, hydrology and water quality, noise, and water supply resources (AECOM 2011).

Identification and demonstration of how the identified ARARs and EIR mitigation measures are being incorporated into the design are discussed in Section 7 of this Basis of Design Report/Preliminary (30%) Design Submittal.

1.3 Organization and Content of Basis of Design Report/Preliminary (30%) Design Submittal

In conformance with the 1996 CACA and the 2009 CERCLA Model RD/RA Consent Decree requirements, this Basis of Design Report/Preliminary (30%) Design Submittal is organized into the following sections:

- Section 1 provides project background information; introduces the final groundwater remedy, as well as key regulatory conditions, goals, and requirements for implementation; and describes the organization and content of this Basis of Design Report/Preliminary (30%) Design Submittal.
- Section 2 describes the baseline site conditions and pre-design work including chromium plume dimensions, in-situ related compounds (by-products and others) that will require consideration, constituents of potential concern (COPCs), and other site conditions affecting design.
- Section 3 provides a summary of the design basis and assumptions used during the design process including a summary of modeling efforts, in-situ remediation design, freshwater supply, management of remedy-produced water, and other utilities and supporting facilities.
- Section 4 discusses the O&M provisions considered in the major systems (as discussed in Section 3) and presents the content of the forthcoming O&M Plan.
- Section 5 outlines the ICs required for the project and discusses applicable IC mechanisms.
- Section 6 summarizes preliminary approvals, easements, and access requirements necessary for the design to move forward.
- Section 7 summarizes how the design has complied and will continue to comply with the ARARs and EIR MMRP.
- Section 8 discusses the project delivery strategy and provides an updated project schedule.
- Section 9 includes a summary of the updated cost estimate.
- Section 10 provides reference information for the works cited in this report.
- Appendix A1 (presented on CD-ROM) contains analytical data.
- Appendix A2 contains the draft aerial map of disturbed areas.
- Appendix A3 contains technical memoranda on methodologies for mature plants survey, floristic survey, and ordinary high water mark (OHWM) identification/mapping.
- Appendix B contains the results of the groundwater modeling.
- Appendix C details the design criteria including relevant calculations.
- Appendix D (submitted under separate cover in a standalone volume) includes the Engineering Plans and Drawings, and the equipment list.
- Appendix E provides a list of specifications and sample specification format.
- Appendix F is the updated Remedy-produced Water Management Technical Memorandum and the Responses to Comments from Agencies on the draft memorandum.
- Appendix G includes an evaluation of the Arched Bridge (structural integrity and available space) to support the freshwater pipeline.
- Appendix H presents the updated cost estimate.

SECTION 2

Baseline Site Conditions and Pre-Design Work

This section provides information about site characteristics, sources of information, and additional pre-design work that was conducted to update and refine the understanding of the site during final groundwater remedy implementation. The additional information was collected for various reasons such as to further document baseline conditions prior to remedy implementation, provide information as needed for design and construction planning (especially in the East Ravine area), and provide information to evaluate remedy performance during future operational and decommissioning phases.

2.1 Site Characteristics

The geologic and hydrogeologic conditions at the site have been characterized through data collected over an approximately 14-year period since the initiation of RCRA Facility Investigation (RFI) activities in 1997. The geologic and hydrogeologic conditions of the site described below are discussed in greater detail in the Revised Final RFI/Remedial Investigation (RI) Volume 2 Report (CH2M HILL 2009a), the Final Volume 2 Addendum (CH2M HILL 2009b), the Summary of Findings Associated with the East Ravine Groundwater Investigation included in Appendix A of the Corrective Measures Study/Feasibility Study (CMS/FS) (CH2M HILL 2009d), and ongoing monitoring reports. The following sections summarize information from these reports.

2.1.1 Hydrogeologic Setting

The Topock site is situated in a basin-and-range geologic environment in the Mohave Valley. The Colorado River is the main source of water to this groundwater basin, but at the southern end where the site is located, groundwater is fed by a modest amount of local recharge from mountain runoff. The most prominent geologic structural feature in the study area is a Miocene-age, low-angle normal fault (referred to as a detachment fault) that forms the northern boundary of the Chemehuevi Mountains (Figure 2-1) found to the southeast of the study area. The surface expression of the Chemehuevi detachment fault is evident as a pronounced northeast-southwest lineament that can be traced along the northern boundary of the Chemehuevi Mountains, terminating at the abrupt bend in the Colorado River east of the Compressor Station.

The site is located at the southern (downstream) end of the Mohave Valley groundwater basin. On a regional scale, groundwater in the northern and central area of the valley is recharged primarily by the Colorado River, while under natural conditions net groundwater discharges occurs in the southern area, above where the alluvial aquifer thins near the entrance to Topock Gorge. The groundwater directly beneath the Topock site is derived mostly from the relatively small recharge from the nearby mountains. Under natural conditions, groundwater flows from west/southwest to east/northeast across the site. The Colorado River, Topock Marsh, floodplain and other surface features at the Topock site are shown on an aerial photograph on Figure 2-1. This figure also shows the locations of the PG&E Topock Compressor Station, the current Interim Measure No. 3 (IM-3) groundwater extraction area (MW-20 Bench and adjacent floodplain), and the IM-3 groundwater treatment facility and associated injection area.

The Colorado River flows along the eastern and northern boundary of the site and is very dynamic, fluctuating seasonally and daily largely due to upstream flow regulation of water releases primarily at Davis Dam, approximately 33 miles upstream. River levels at the site fluctuate by 2 to 3 feet per day, and flows vary anywhere from 4,000 to 25,000 cubic feet per second (cfs) according to the dam releases, producing a sinusoidal hydrograph each day. Locally, a floodplain borders both sides of the Colorado River, though the river no longer experiences regular spring floods due to flow regulation from upstream dams.

2.1.2 Hydrogeologic Properties

Groundwater occurs in the Tertiary and younger alluvial fan and fluvial deposits. The unconsolidated alluvial and fluvial deposits are underlain by the Miocene Conglomerate and pre-Tertiary metamorphic and igneous bedrock.

The bedrock typically has lower permeability; therefore groundwater movement occurs primarily in the overlying unconsolidated deposits. There is no evidence to indicate any sizable potential for development of ground water in the bedrock, although locally, small yields may be developed from fractures (Metzger and Loeltz 1973).

The alluvial aquifer consists of (1) alluvial sands and gravels shed from local mountain chains that ring the valley, and (2) fluvial material deposited by the Colorado River over time. Groundwater occurs under unconfined to semi-confined conditions within the alluvial fan and fluvial sediments beneath most of the site. The alluvial sediments consist primarily of clayey/silty sand and clayey gravel deposits interfingered with more permeable sand and gravel deposits. The alluvial deposits exhibit considerable variability in hydraulic conductivity between fine- and coarse-grained sequences. The fluvial sediments similarly consist of interbedded sand, sandy gravel, and silt/clay.

The water table in the alluvial aquifer is nearly flat and typically equilibrates to an elevation within 2 to 3 feet of the river level. Due to the variable topography, the depth to groundwater ranges from as shallow as 5 feet below ground surface (bgs) in the floodplain near the river to approximately 170 feet bgs in 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. In the western and northern portions of the site, where the depth to bedrock increases, the saturated alluvial aquifer is over 200 feet thick (see Figure 2-2).

Hydrogeologic features of the site are summarized below:

- Under ambient conditions in the vicinity of the site, the river recharges groundwater during the higher-flow stages in the spring and summer months, and under natural conditions groundwater discharges to the river during the months of lower river stages in fall and winter. Since 2004, the IM groundwater extraction and treatment system has maintained a consistent, year-round landward gradient in the area where the plume is present in the floodplain.

- Under natural conditions, groundwater flows from west-southwest to east-northeast across the site. Localized areas of northward flow likely occur along the mountain front to the south of the Compressor Station. Gradients are very small due to the limited recharge, with a typical value of 0.0005 foot/foot in the alluvial area. Under average conditions, groundwater velocity in the alluvial aquifer ranges from about 25 to 46 feet/year, according to numerical model estimates. Gradients are upward between bedrock and the overlying alluvial aquifer and typically, but not universally, upward within the alluvial aquifer.

- Investigation and monitoring in the East Ravine area (see Figure 2-1) shows that the groundwater in fractured bedrock is in hydraulic communication with the alluvial aquifer and equilibrates to an approximate elevation similar to the water table in the alluvial aquifer. Compared to the alluvial aquifer, the fractured rock permeabilities are very low, based on well tests in this area.

2.2 Chromium Plume Dimensions, Second Quarter 2011

The chromium plume is defined as that part of the aquifer where Cr(VI) concentrations exceed natural background levels. The calculated statistical upper tolerance limit (UTL) of natural background levels for Cr(VI) in alluvial groundwater, obtained from sampling monitoring and water supply wells surrounding the Topock site, is 31.8 µg/L (CH2M HILL 2008), which has been rounded to 32 µg/L for discussion of the extent of impacted groundwater below. The majority of the plume is located in the Alluvial Aquifer, which includes the fluvial sediments along the river. A small portion of the plume extends into the bedrock along the East Ravine.

Figures 2-3a, 2-3b, and 2-3c illustrate the extent of Cr(VI) in the Alluvial Aquifer and bedrock based on groundwater monitoring data collected in the Second Quarter 2011 (April through June). Because not all site wells were sampled during the Second Quarter 2011 event, additional data from the Fourth Quarter 2010 event were used where needed to draw the 32 µg/L contours. With the exception of data collected from the new wells installed as part of the East Ravine-TCS Groundwater Investigation, the data used to prepare these maps were previously reported in the groundwater monitoring reports (CH2M HILL 2011a-c).

Table 2-1 (all tables are located at the end of this report) is a statistical summary presenting the results for the Cr(VI), Cr(T), and other analytes (arsenic, iron, manganese, molybdenum, selenium and nitrate) from July 1997 through June 2011 and includes comparison with the calculated background UTL and chemical-specific ARARs. Appendix A1 contains a complete listing of baseline analytical data collected from July 1997 through June 2011 at the site for all analytes sampled in groundwater and surface water.

In each of the Alluvial Aquifer depth monitoring zones (i.e., shallow, mid-depth, and deep), the chromium plume follows Bat Cave Wash northward approximately 3,500 feet from the compressor station. For the shallow and mid-depth zones, the chromium plume extends west of Bat Cave Wash and eastward into the western portion of the floodplain. In the deep zone of the Alluvial Aquifer, the chromium plume extends further west of Bat Cave Wash and further eastward into the floodplain area. Since startup of the IM groundwater extraction in 2004, concentration trends in the wells located on the floodplain have been generally stable or decreasing (CH2M HILL 2011a and 2011c).

Since the submittal of the CMS/FS Report (CH2M HILL 2009), results from the East Ravine-TCS Groundwater Investigation have refined the understanding of the bedrock-alluvial interface underneath the Compressor Station and the 32 µg/L concentration limits. Though the interpretation of the southern extent of the chromium plume has expanded slightly due to new wells being installed since the CMS/FS (CH2M HILL 2009d), other parts of the plume have shrunk since that time, resulting in a slightly smaller extent overall. The Cr(VI) concentrations found underneath the TCS are consistent with previous data from this area. The lithologic data collected from these investigations have been incorporated into the groundwater model.

Based on the site characterization data to date, the existing chromium plume dimensions is approximately 150 acres, including alluvium and bedrock. The depth to groundwater in the area of the plume ranges from approximately 28 to over 135 feet bgs, and the saturated thickness of the Alluvial Aquifer in the area of the plume ranges from less than 50 feet near the bedrock interface to over 150 feet near NTH. The volume of groundwater containing Cr(VI) at concentrations above background in the Alluvial Aquifer is currently estimated to be approximately 1.50 billion gallons (approximately 4,600 acre-feet). The volume of the plume within the East Ravine bedrock formations is believed to represent less than 2 percent of the total plume. The bedrock in East Ravine has relatively few conductive fractures. Consequently, the effective porosity of the bedrock is likely much less than that of the alluvium, and therefore, the bedrock is expected to contain a relatively small volume of groundwater. The plume depth and dimensions in bedrock have yet to be fully determined, as investigations in this area are still ongoing.

2.3 Baseline Distributions of Other Compounds

2.3.1 Constituents of Potential Concern (COPCs)

As discussed in the CMS/FS Report (CH2M HILL 2009d), DTSC and DOI consider selenium, molybdenum, and nitrate as COPCs related to SWMU 1/AOC 1 activities and have directed that these constituents be monitored throughout the remediation process. Characterization data for the COPCs from 1997 through June 2011 are discussed below.

2.3.1.1 Selenium

The average groundwater selenium distribution for the baseline period of July 1997 through June 2011 is presented in Figure 2-4. TW-1 and MW-67-225 are the only well locations where the average selenium concentrations exceed the chemical-specific ARAR for selenium (50 µg/L). The ten well locations where selenium exceeds the UTL of 10.3 µg/L are MW-17, MW-20-130, MW-21, MW-24A, MW-24B, MW-26, MW-51, MW-60-125, MW-66-165, and MW-67-225. Overall, the distribution of selenium in groundwater is discontinuous across the site and appears to be elevated significantly above background levels in one localized area at well TW-1. The source of the elevated selenium around well TW-1 is unknown. Groundwater sample results from TW-1 since 2009 have all

been below the ARAR. The reducing conditions introduced by the final groundwater remedy are expected to further limit selenium mobility rather than enhance mobility (CH2M HILL 2009b).

Given the variable pattern of occurrence it is likely that selenium has only shown concentrations above reporting limits due to occasional colloid breakthrough and not from consistent dissolved concentrations in the aquifer. The frequency of UTL exceedances for selenium is 11.1% and the frequency of ARAR exceedances is 1.3% (Table 2-2).

2.3.1.2 Molybdenum

The average groundwater molybdenum distribution for the baseline period of July 1997 through June 2011 is presented in Figure 2-5. The fifteen well locations with the highest average molybdenum results (greater than 70 μg/L) include MW-10 (near the historical Cr[VI] discharge, average concentration of 129 μg/L), MW-23-080, MW-38D, MW-44-115, MW-44-125, MW-46-175, MW-57-185, MW-62-110, MW-62-190, MW-64-150, MW-64-205, MW-64-260, MW-67-260, MW-70-105 and PGE-8. Well locations where molybdenum exceeds the UTL of 36.3 μg/L occur primarily in the deep zone and in scattered shallow zone wells. The distribution of molybdenum is discontinuous in the shallow wells, while the distribution in the deep wells is consistent across the Cr(VI) plume footprint. Molybdenum has no California or federal maximum contaminant level (MCL), and therefore no chemical-specific ARAR. The frequency of UTL exceedances for molybdenum is 26.9% (Table 2-2).

2.3.1.3 Nitrate

The average groundwater nitrate distribution is presented in Figure 2-6. Nitrate is the oxidized form of nitrogen in water and is stable under approximately the same geochemical conditions where Cr(VI) is stable. Average concentrations of nitrate in most wells at the site are below the background UTL of 5.03 milligrams per liter (mg/L) (expressed as nitrogen). This is especially true in the shallow and middle-depth floodplain areas, where predominantly reducing conditions favor the reduction of nitrate to either nitrogen gas or ammonia. Concentrations elevated above the UTL and in some cases above the ARAR of 10 mg/L are found in the alluvial zone of the aquifer along the mountain front recharge areas (i.e., southern Bat Cave Wash and the New Evaporation Ponds). The frequency of UTL exceedances for nitrate is 19.3% and the frequency of ARAR exceedances is 8.5% (Table 2-2).

2.3.2 In-Situ By-Products

There is potential for natural constituents of the aquifer matrix to be released into solution by reduction reactions during implementation of in-situ methods. These transient by-products which include arsenic, manganese, and iron may exceed baseline and background concentrations during remedy implementation. Conditions that favor the existence of these species also favor the reduction of Cr(VI).

Table 2-2 summarizes the potential in-situ by-products sampling results for the period of July 1997 through June 2011. The data include in situ pilot test (ISPT) data collected prior to commencement of the ISPT studies (two sampling rounds for each ISPT study). Table 2-2 lists the primary sampling parameters of the data sets, summarizes detection frequency, and includes comparison with the calculated site background UTL and chemical-specific ARARs. Non-detect concentrations were counted as half of the analytical reporting limit in computing average concentrations. In some locations, an apparent UTL or ARAR exceedance was caused by non-detects with elevated reporting limits. The characterization for the by-products is discussed below. Analytical results are presented in Appendix A1.

2.3.2.1 Arsenic

Natural arsenic is present in the Alluvial Aquifer matrix, commonly in association with iron oxide minerals, as an adsorbed and/or coprecipitated phase. Arsenic solubility in the aerobic Alluvial Aquifer is limited by the affinity of arsenic for the iron oxides which are abundant in the aquifer matrix. In the fluvial aquifer adjacent to the Colorado River, arsenic is present in its reduced, soluble trivalent arsenic (As[III]) form. Under reducing conditions within the fluvial zone, the iron oxides have dissolved as iron is reduced from ferric iron (Fe[III]) to ferrous iron (Fe[II]),

releasing the associated pentavalent arsenic (As[V]) and partially reducing it to As(III). Wells MW-32-35 and PGE-9N/S are examples of these conditions. In a similar way, when an IRZ is formed by the injection of a carbon source, soluble arsenic is formed within the reducing zone.

The average groundwater arsenic distribution for the period of July 1997 through June 2011 is presented in Figure 2-7. As discussed in the RFI/RI Report Volume 2 (CH2M HILL 2009a) and the Volume 2 Addendum (CH2M HILL 2009b), the higher average arsenic concentrations which exceed the UTL are primarily limited to shallow wells in the southern floodplain and in the vicinity of the transportation corridors of I-40 and the Burlington Northern Santa Fe (BNSF) Railroad. Four wells have average arsenic concentrations that are greater than the UTL: MW-12, MW-32-20, MW-32-35, and MW-58-205. Average concentrations of arsenic in the vast majority of monitoring wells are below the background UTL of 24.3 µ/L. The frequency of UTL exceedances for arsenic is 6.0% (Table 2-2), which is consistent with background concentrations based on a 95% UTL, where 5% of the population samples naturally exceed the UTL. The arsenic concentration distribution shown on Figure 2-7 is consistent with the data distribution in prior groundwater RFI/RI Reports (CH2M 2009a and 2009b).

2.3.2.2 Manganese

The average groundwater manganese distribution for the period of July 1997 through June 2011 is presented in Figure 2-8. The UTL calculated from Background Study data is 1,320 µg/L. As discussed in the RFI/RI Volume 2 Report (CH2M HILL 2009a), dissolved manganese has increased solubility in groundwater under reducing conditions at the pH range (typically 7.0 - 8.5) of the Topock site. As a result, elevated manganese is found primarily in reducing zone fluvial wells. Eleven wells have average manganese concentrations that are greater than the UTL: MW-22, MW-32-35, MW-42-65, MW-53D, MW-58-115, MW-62-190, PT-1M, PT-3M, PT-5S, PT-6S, and PGE-7BR. All of these wells are located in the floodplain adjacent to the Colorado River, where reducing conditions are prevalent. The frequency of UTL exceedances for manganese is 5.5% (Table 2-2), which is consistent with background concentrations based on a 95% UTL, where 5% of the population samples naturally exceed the UTL. The manganese concentration distribution shown on Figure 2-8 is consistent with the data distribution in prior groundwater RFI/RI Reports (CH2M 2009a and 2009b).

2.3.2.3 Iron

The average groundwater iron distribution for the baseline period of July 1997 through June 2011 is presented in Figure 2-9. The UTL calculated from Background Study data is 3,930 µg/L. Similar to manganese, dissolved iron is found in the fluvial wells of the floodplain area, where reducing conditions prevail and organic carbon is more abundant. Ten wells have average iron concentrations that are greater than the UTL: MW-22, MW-32-20, MW-32-35, MW-39-40, MW-43-90, MW-52S, PT-3S, PT-6S, PTI-1S, and PGE-7BR. All of these wells are located in the floodplain area. The baseline frequency of UTL exceedances for iron is 4.8% (Table 2-2), which is consistent with background concentrations based on 95% UTL where 5% of the population samples naturally exceed the UTL. The iron concentration distribution shown on Figure 2-9 is consistent with the data distribution in prior groundwater RFI/RI Reports (CH2M 2009a and 2009b).

2.3.3 General Geochemical Indicator Parameters

Total dissolved solids (TDS) and sulfate are considered indicators of the general water quality conditions in groundwater of the Alluvial Aquifer. They are natural compounds that are abundant in the area, as evidenced by their ubiquitous concentrations in the region and across the Colorado River. There are multiple sources of dissolved salts, including geologically older groundwater upwelling across the southern portion of the Mohave basin, evaporite minerals in the aquifer matrix, and evapotranspiration associated with the more vegetated areas of the floodplain, etc. (CH2M HILL 2009a).TDS and sulfate are natural water quality indicators and their results are discussed below to establish the baseline conditions that will be compared with data collected during remedy implementation and used, in conjunction with other monitoring data, to assess system performance and guide decisions on operational optimization.

2.3.3.1 Total Dissolved Solids

The TDS of site groundwater varies considerably, ranging from as low as 280 mg/L (at MW-6) to over 40,000 mg/L (at MW-32-20). Most site monitoring wells are in the 1,000 to 15,000 mg/L range. In general, high TDS is associated with (1) bedrock wells, (2) deep alluvial/fluvial wells, and (3) a few shallow fluvial wells. Low TDS is typically found in shallow fluvial wells close to the river and in shallow alluvial wells in the western parts of the site. The distribution of TDS in groundwater at the site is provided in Figure 2-10. In general, TDS typically increases with depth, with the highest TDS concentrations found in the deepest alluvial and bedrock wells. The TDS in fluvial groundwater increases with distance away from the river and with depth, becoming similar to alluvial groundwater quality in deeper fluvial wells west of the floodplain. The exception to this is where shallow fluvial wells have been installed near areas of the floodplain that were formerly shallow pools, cut off from the river. Salts were concentrated in these stagnant pools by evaporation. The pools, which are visible in historic aerial photos, were later filled with dredge spoils, but the salts that were concentrated in them still persist in the shallow aquifer.

2.3.3.2 Sulfate

The TDS concentration at the site is mostly attributable to sodium and chloride ions, and to a lesser extent sulfate. Hence the higher concentrations of sulfate often occur in areas of higher TDS. The distribution of sulfate in groundwater at the site is provided in Figure 2-11. In strongly reducing conditions, sulfate will reduce to sulfide and precipitate out of solution. In order to reduce Cr(VI), it is not necessary to create the strongly reducing conditions needed to reduce sulfate. The carbon dosing rate for the IRZ will not be designed to create sulfate reducing conditions, however some sulfate reduction may be expected due to imperfect distribution of carbon substrate in the immediate vicinity of the Carbon-amended Injection Wells.

2.4 Other Site Conditions Affecting Design

Other existing site conditions anticipated to affect the design of the final groundwater remedy are discussed below, as well as the pre-design work conducted to date to refine or update the site condition information. Additional data needs may be identified as the design moves forward and during the process of securing access and approvals; for example, site-specific geotechnical data may be required for securing encroachment permits.

2.4.1 Land Ownership, Disturbance, and Development

Land in most areas where groundwater remedial facilities will be constructed is not owned or leased by PG&E. There are existing land uses and infrastructure in the project area that will be important factors influencing the design, construction, operation and decommissioning of the final groundwater remedy. Figure 2-12 presents updated property ownership information, resulting from a recent title search using data contained in San Bernardino and Mojave Counties databases. As shown, land overlying and near the plume is owned and/or managed by a number of government and private entities including PG&E, BOR (managed by BLM), the Havasu National Wildlife Refuge (HNWR) (managed by USFWS), San Bernardino County, BNSF Railroad, Fort Mojave Indian Tribe, and the Southern California Metropolitan Water District. In addition, several other entities have easements and/or rights-of-way (ROWs) including the California Department of Transportation (which has the Interstate 40 ROW in California), San Bernardino County (which has the ROW along NTH), Southern California Gas Company, Transwestern Pipeline Company, Mojave Pipeline Company, PG&E, City of Needles Electric, Southwest Gas Corporation, and Frontier Communications. A recent review of PG&E's own record shows that PG&E has a possessory interest on two parcels located on the Refuge, immediately north and northeast of the parcel owned by PG&E (namely Assessor's Parcel Numbers [APNs] 650-161-11 and 650-161-12, respectively). The possessory interest is a blanket easement to allow for the operation of a compressor station and associated pipelines.

Landowners/leaseholders in Arizona where the freshwater pipeline is shown on Figure 2-12 include the HNWR (managed by USFWS), El Paso National Gas Company (EPNG), BNSF Railroad, Arizona Department of Transportation (which has the I-40 ROW in Arizona), Mohave County (which has the ROW along County Highway 10), and private property owners. A known planned development near the freshwater pipeline is the Topock 66

Resort and Spa at the Topock Marina. Ownership of land beneath the Colorado River includes the California State Lands Commission and the Arizona State Lands Department.

Land owners and leaseholders will have to grant permission to access their property for construction and operation of groundwater remedy facilities or equipment. Each entity has its own process, whether it be an encroachment permit, easement, ROW, or other type of access agreement. Section 7 discusses preliminary approvals, easements, and access requirements. In addition, the groundwater remedy includes institutional controls or their equivalents to limit activities that could interfere with the remedy or the protection of human health and the environment. Section 5 discusses the objectives of ICs and parameters used to set up ICs, including defining the area(s) and properties over which the ICs should be applied. PG&E will work with affected entities to establish the requirements and complete the appropriate process or processes to allow for implementation of the remedy. Depending on the specific requirements of the agreements, there may be a need for additional information such as additional title searches or property boundary surveying and staking.

In conformance with EIR mitigation measure CUL-1a-9, an aerial map of disturbed areas has been prepared to guide project design, and specifically, to assign priority to a) previously disturbed areas in placement of new remedial facilities, and b) reuse of existing facilities (not including IM-3 facilities), where available. The draft map has been prepared by visual surveys supplemented by using aerial photographs to identify areas outside of documented archaeological site boundaries that have experienced ground disturbance. PG&E has been in communication with and is working with interested Tribes on the aerial map. A current version of the map is included in Appendix A2 of this report.

An inventory of existing infrastructure related to the project area is ongoing. The inventory will be used to determine usability of existing infrastructure relative to the infrastructure required for the final groundwater remedy. This information is being gathered through meetings, document review, and site visits. It includes information about the existing Compressor Station fresh water supply system, cooling water system, evaporation ponds, electrical power supply, and existing utilities or infrastructure, including those owned by other entities. Existing infrastructure that could interact with the groundwater remedy construction or operation has been and is being investigated to an extent such that it can be incorporated into the design. Examples of issues associated with the existing infrastructure evaluation are as follows:

- EPNG, the co-owner of the arched bridge over the Colorado River, has completed its evaluation of the ability (structural and physical space capacity) of the arched bridge to accommodate a 12-inch pipe to bring fresh water from Arizona. The results of EPNG's evaluation are included in Appendix G. PG&E is also conducting its own due diligence evaluation of the arched bridge integrity and anticipates to complete its evaluation by the end of 2011.
- The final groundwater remedy will require electrical power during construction and operation. An electrical service load was estimated and used in the design of the power supply system. To maximize reuse of the existing electrical infrastructure, the remedial design has been conducted in coordination with the Compressor Station electrical engineering/operation staff as well as the design team for the future Compressor Station emissions reduction project. Section 3.5 discusses the power supply design.
- Freshwater supply for the groundwater remedy requires certain storage capacity to minimize downtime. An initial evaluation of a shared use of the existing freshwater storage tanks for the Compressor Station was performed in coordination with Compressor Station operation staff. Section 3.3 discusses the evaluation and current design for tie-in with the existing freshwater storage tanks.
- Certain remedial facilities will be located on the Compressor Station property. To maximize reuse of existing facilities, optimize space usage, and reduce visual impacts, the remedial design incorporates the results of a coordinated effort with Compressor Station engineering and operation staff as well as the design team for the future Compressor Station emissions reduction project. Section 3 presents the current layout for remedial facilities located within the Compressor Station fenceline, at the Transwestern Meter Station Bench (also called the Transwestern Bench), and at the MW-20 Bench, respectively.

- The final groundwater remedy will produce water from maintenance of various types of wells. Additional information was gathered during the remedial design on capacities of various disposal/reuse options for remedy-produced water (including the capacity of existing evaporation ponds on an average basis and annual basis) and the makeup water quality requirement for the Compressor Station cooling towers. Section 3.4 describes the options evaluated during the design.

2.4.2 Site Topography and Surface Geology

Surface conditions and topography have a significant effect on project implementation. For example, variation in surface elevations will require installing air release valves on pipes and may require grading for storm water drainage in select areas. Infrastructure locations may be adjusted to avoid steep areas.

Following completion of recent aerial photogrammetry, the topographic map has been updated to 1-foot topographic contours. The new topographic map, which has been incorporated into the design drawings, is included as Figure 2-13. This more detailed topographic map was used in the preliminary design of the piping networks and placement of facilities. In addition, the updated aerial photo has been and is used for site survey/reconnaissance, and reporting activities being conducted through the remedial design phase.

Existing surface geology information is contained in the RFI/RI Volume 2 Report and its Addendum (CH2M HILL 2009a and 2009b) and CMS/FS (CH2M HILL 2009d). The generalized surface geologic map in the RFI/RI was compiled from literature sources including Metzger and Loetz (1973), John (1987), Howard et al. (1997), and PG&E historical reports. A geologic map of the site is included as Figure 2-14. Additional information on surface geology is not expected to be required for remedial design. The primary remedial design interface with the surface geologic mapping is the intersection of proposed subsurface infrastructure (e.g., pipeline trenches) in areas of surface bedrock (Miocene Conglomerate or Pre-Tertiary). Construction of pipeline trenches through this material will require procedures to be documented in the Construction/Remedial Action Work Plan, or alternatively pipeline corridors will be relocated to avoid bedrock outcrops or constructed aboveground similar to existing gas and fresh water pipes.

2.4.3 Soil Contamination Areas

PG&E is performing an RFI/RI for soil in areas near the Compressor Station. Investigations are being performed to collect data to meet defined data quality objectives to complete the soil RFI/RI, soil risk assessment, and soil CMS/FS. Groundwater remedy infrastructure, such as pipeline corridors, is likely to be constructed within or near soil investigation areas inside the fenceline of the Compressor Station, and within or near soil investigation areas outside the fenceline of the Compressor Station such as Bat Cave Wash (near AOC 1/SWMU 1) and in the vicinity of AOC 11 and AOC 12 (see Figure 2-15).

Existing information on soil investigation areas is contained in documents including the Draft RFI/RI Soil Investigation Work Plan Part A (CH2M HILL 2006), Draft RFI/RI Soil Investigation Work Plan Part B (CH2M HILL 2007), Soil Investigation Part A Phase 1 Data Gaps Evaluation Report (CH2M HILL 2011g), the Implementation Report for the Time-Critical Removal Action at AOC 4 (CH2M HILL 2011h), and the Draft Soil RFI/RI Work Plan (CH2M HILL 2011e). Existing information includes sample locations, sample depths, and analytical concentrations of organic and inorganic constituents, as well as descriptions of previous soil removal activities.

2.4.3.1 Coordination of RFI/RI Soil Investigation with Remedy Design and Construction

Additional soil investigation is planned to supplement the existing information to complete the RFI/RI Volume 3. The planned additional investigation activities primarily involve the collection of soil samples for laboratory analysis of inorganic and organic constituents. In addition, opportunistic soil sampling (e.g., in subsurface pits opened for maintenance activities) has been and will be conducted as opportunities arise to collect additional soil data and potentially reduce future sampling points.

The additional soil investigations and opportunistic sampling are independent of design activities for the final groundwater remedy; however, as soil data become available they will be used to guide and inform groundwater

remedy design and construction in the vicinity of the soil investigation areas. Where appropriate—considering timing, efficiency and protectiveness—construction of groundwater remedy facilities will be coordinated with soil investigation and remediation activities. For example:

- Groundwater remedy infrastructure may be relocated to avoid the contaminated soil areas.
- Where groundwater remedy facilities will intersect with soil contamination areas, the Construction/Remedial Action Work Plan will describe appropriate procedures to address health and safety, soils management, erosion and dust control during groundwater remedy construction.
- Where appropriate, the timing and scope of soil investigation activities will be coordinated to minimize interference with groundwater remedy implementation.
- Access restrictions established to protect groundwater remedy infrastructure will consider the need to access soil investigation areas for additional investigation or remediation.
- Removal actions for soil contamination, if any, may be combined with groundwater remedy construction to minimize multiple soil disturbances for both groundwater remedy construction and soil remediation.

2.4.4 Surface Water and Wetlands

Surface water and wetlands occur in areas near the groundwater remedy infrastructure and will affect design, construction, and operation of the remedy. Figure 2-16 presents an overlay of planned remedial facilities on a map of jurisdictional waters and wetlands in the project area which was based on an identification made in 2004-2005. A field survey of the jurisdictional waters and wetlands is planned for the Spring of 2012, to update the 2005 identification. In compliance with EIR mitigation measure BIO-1, the wetlands delineation findings will be documented in a report and submitted to U.S. Army Corps of Engineers (USACE) for verification and to DTSC. Verification of the jurisdictional waters and wetlands will be performed to guide remedial infrastructure design and construction to comply with EIR mitigation measure BIO-1 and the substantive requirements of the Clean Water Act that prohibit discharge of dredged or fill material in the defined waterways unless there is no practical alternative that would have less adverse impact.

To mitigate certain visual impacts, EIR mitigation measure AES-2a requires a minimum setback of 20 feet from the ordinary high water mark to prevent substantial vegetation removal along the river bank. A field effort was conducted in March 2011 to identify and map the OHWM along the river bank. Appendix A3 contains the technical memorandum on the methodology used in the mapping effort, the area mapped, and the mapping results. Figure 2-17 shows the mapped OHWM and the 20-foot setback required by AES-2a. This map was used to verify placement of remedial infrastructures (River Bank Extraction Wells and associated piping) near the bank of the Colorado River. The March 2011 OHWM mapping results will be combined with results of the planned Spring 2012 survey (described above), and included in the wetlands delineation report for verification by USACE.

The site surface water monitoring program conducted to date has yielded an extensive chemical analytical dataset. More than 1,500 surface water samples have been collected from July 1997 through June 2011. Table 2-3 provides a statistical summary of the sampling results. Figure 2-18 shows the surface water monitoring locations. All surface water samples for metals are filtered prior to analysis, so reported metals results represent the dissolved metals fraction. Unfiltered surface water data collected in 2009 to assess risk to human health in the groundwater risk assessment were not included in Table 2-3. Starting with the annual event in December 2010, in-situ byproducts (arsenic, manganese, and iron) were added to the list of analytes for the surface water monitoring program to assist with establishing baseline levels up gradient and down gradient of the site. PG&E will continue to monitor surface water quality during the implementation of the remedy and compare down gradient concentrations to up gradient concentrations.

2.4.5 Vegetation Conditions

Construction of groundwater remedy infrastructure may result in removal or displacement of vegetation in some areas. The EIR mitigation measures AES-1a and 2b require the protection and preservation of mature plants for aesthetic reasons. In compliance with these mitigation measures, a comprehensive survey for mature plant species in the EIR project area was conducted in August 2011. Appendix A3 includes the technical memorandum on the mature plants survey methodology.

Additional information on vegetation communities was collected during the November 2011 floristic survey, and more information will be collected during another floristic survey planned for the spring of 2012 (see Section 2.4.6). Together, this information will be used to guide the design and construction of the remedy as well as the scope of future revegetation efforts. Figure 2-19 is an updated vegetation communities map based on the August 2011 plant survey. This figure will be updated as appropriate with survey results from the floristic surveys.

As shown in Figure 2-19, the most common and widespread plant community in the Project Area is Creosote Bush Scrub. As the name implies, this plant community is dominated by creosote bush (*Larrea tridentata*) and is one of the most extensive plant communities found within the California Deserts (Sawyer et al. 2009). Creosote Bush Scrub is present in all upland areas of the EIR project area. In the valleys and dry washes that dissect the upland areas, the most common plant community is the Palo Verde/Ironwood alliance that is dominated by blue palo verde (*Parkinsonia florida*) and various associates including catclaw acacia (*Acacia greggii*) (Sawyer et al. 2009). This alliance takes many forms and in the Project Area it is form that lacks ironwood (*Olneya tesota*). Along the floodplain of the Colorado River, the primary vegetation type is salt cedar (*Tamarix* ssp. semi-natural shrubland) which often forms impenetrable thickets (e.g. under the railroad and Interstate I-40 bridges) of single species, *Tamarix ramosissima*, or mixtures with other species; for example honey mesquite (*Prosopis glandulosa* var. *torreyana*) (Sawyer et al. 2009). Salt cedar often interdigitates with arrow weed (*Pluchea sericea*) thickets and Mesquite Bosque on the floodplain as well. Scattered throughout the project area on the floodplain or in broad washes near the floodplain are smaller patches of shadscale and all scale scrub (*Atriplex* spp.) which grow on alkaline or saline soils (Sawyer et al. 2009). Along the Colorado River and its inlets are patches of wetlands with various marsh plants forming associations in the water such as cattail (*Typha latifolia*) and California bulrush (*Scirpus californicus*) marshes, whereas on the adjacent shores and floodplain common reed (*Phragmites australis*) marshes and occasionally great reed (*Arundo donax*) breaks are present.

2.4.6 Special Status Species

Special status species have the potential to be located in the project area and will affect the design, construction, and operation of the remedy. Certain EIR mitigation measures are prescribed to protect, avoid, and minimize the direct and indirect effects to special status species.

The EIR (Section 4.3.1.3) defined special status species as plants and animals that are legally protected or otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations including:

- Plant and wildlife species that are listed under the federal Endangered Species Act (ESA) and/or the California Endangered Species Act (CESA) as rare, threatened or endangered
- Plant and wildlife species considered candidates for listing or proposed for listing
- Wildlife species identified by the California Department of Fish and Game (CDFG) as fully protected and/or species of special concern
- Plants considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered, and
- Plants and animals covered by the Lower Colorado River Multi-Species Conservation Program (LCR MSCP)

Table 4.3-3 of the EIR lists special status species potentially occurring in the project area. Exhibit 4.3-2 of the EIR contains a map of the known locations of special-status wildlife based on the 2008 California Natural Diversity Database (CNDDB), 2010 CNPS, and the protocol surveys for desert tortoise and southwestern willow flycatcher

(SWFL) conducted by PG&E. The EIR identified the following thirteen fish and wildlife species as having the potential to occur in the project area during at least part of the year (AECOM 2011, pages 4.3-14 through 4.3-19):

Special Status Wildlife

- Southwestern willow flycatcher (*Empidonax traillii extimus)* – Federal listed and legally protected
- Mojave desert tortoise (*Gopherus agassizii)*- Federal listed and legally protected
- Yuma clapper rail (*Rallus longirostris yumanensis)* - Federal listed and legally protected

Special Status Aquatic Species

- Bonytail chub (*Gila elegans)* – Federal and State listed and legally protected
- Razorback sucker (*Xyrauchen texanus)* – Federal and State listed and fully protected
- Flannelmouth sucker (*Catostomus latipinnis*) – covers under the LCR MSCP

Other Avian Species

- Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) – Federal and State listed and legally protected
- California black rail (*Laterallus jamaicensis corturniculus*) – State listed and fully protected
- Arizona Bell's vireo (*Vireo bellii arizonae*) – State listed and legally protected, also covered under the LCR MSCP
- Western least bittern (*Ixobrychus exilis hesperis*) – California species of concern (no formal protection)
- Sonoran yellow warbler (*Dendroica petechia sonorana*) – California species of concern (no formal protection), covered under the LCR MSCP
- Yellow breasted chat (*Icteria virens*) – California species of concern (no formal protection)
- Crissal thrasher (*Toxostoma crissale*) – California species of concern (no formal protection)

Figure 2-20 shows the habitats of these wildlife species. This figure will be updated as appropriate with results from the November 2011 and the Spring 2012 floristic surveys.

Special-Status Plants

The EIR stated that based on literature and database searches and habitat suitability, no special-status plant species have the potential to occur in the project area (AECOM 2011, page 4.3-14). In compliance with the EIR mitigation measure CUL-1a-5, PG&E has initiated a floristic survey on November 1, 2011, with a second round of survey planned for the Spring of 2012. Appendix A3 includes a technical memorandum on the floristic survey methodology. To assist with establishing a comprehensive inventory of plant species in the EIR project area and identifying sensitive plant species, comprehensive transect-based protocol-level floristic surveys following the guidelines of the CDFG (2009), the USFWS (1996a), and the CNPS (2001) commenced in November 2011 and are planned for the spring of 2012. For the purpose of the survey, sensitive plants are defined as special-status plants and ethnobotanically significant plants. A plant species was considered to be special-status if it met one or more of the following criteria:

- Listed, proposed, or candidate for listing, as rare, threatened or endangered under the ESA, CESA, or California Native Plant Protection Act (USFWS 1996b, 2006, 2011; CNDDB 2011a)
- Special Plant as defined by the CNDDB (CNDDB 2011b)
- California Rare Plant Ranked (CRPR) 1, 2, 3, or 4 by the CNPS in its Online Inventory of Rare and Endangered Plants of California (CNPS 2011)
- Listed by the BLM as a Special Status Plant (BLM 2011)

- Listed by the Arizona Rare Plant Committee (2001)
- Listed under the California Desert Native Plants Act (CDNPA).

Results from the surveys described above and associated maps will be reported once completed.

2.4.7 Cultural Resources

Cultural resources occur in areas near some groundwater remedial facilities and will affect design, construction and implementation of the final groundwater remedy. In compliance with the Cultural Resources Management Plan (CRMP), cultural surveys have been conducted annually, with participation from Tribes, BLM, and PG&E. The 2011 annual cultural survey occurred on October 26, 2011. Information collected during these surveys is reported in the Annual Cultural Resources Monitoring Reports, and this information is being used to guide the design.

The activities being conducted to collect/develop additional information and/or protocols to guide the design and construction of the final groundwater remedy are described below.

Activities required by the Programmatic Agreement (PA)

Activities required by the PA are led by the BLM as the lead Federal Agency responsible for NHPA Section 106 compliance. The following activities are being performed by the BLM:

- Stipulation I(C) requires that BLM develop an Access Plan in consultation with the Tribes, PG&E, and other affected agencies, to ensure Tribal access to areas within the APE for traditional religious, cultural, or spiritual purposes. The BLM is anticipating completion of the Access Plan by November 26, 2011.
- Stipulation VII requires that BLM develop a CHPMP, in consultation with all Signatories, Tribes, and Invited Signatories to the PA, which specifies how cultural and historic properties within the APE are to be treated during implementation of the remedy. BLM held a kick-off meeting on March 18, 2011, and has led monthly meetings on the CHPMP with participants from Interested Tribes, PG&E, and the DOI attending. The draft CHPMP was submitted for Tribal, California and Arizona SHPO, the Advisory Council on Historic Preservation and PG&E review on November 1, 2011. Comments on the draft CHPMP are due December 5, 2011. The BLM is anticipating that the final CHPMP will be issued by January 20, 2012.

Activities required by the Environmental Impact Report Mitigation Monitoring and Reporting Program (EIR MMRP)

- The EIR mitigation measure CUL-1a-2 requires that an Access Plan be prepared to preserve Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes. PG&E has been in contact with the BLM who has responsibility for preparing the Access Plan required by the PA. BLM has indicated that they are planning to complete their Access Plan by end of November 2011. Given that the majority of land within the area is federal land, PG&E is waiting for BLM to complete their Access Plan in order to avoid the potential for inconsistencies. PG&E will then prepare an Access Plans for the lands not under federal management.
- The EIR mitigation measure CUL-1a-3a requires that PG&E retains a qualified cultural resources consultant (subject to approval by DTSC) to implement the MMRP and to conduct yearly inspections of identified historical resources. PG&E has retained Applied EarthWorks, Inc. to implement the MMRP, pending approval from DTSC.
- The EIR mitigation measure CUL-1b/c2 requires that a cultural resources study be conducted that may include a geoarchaeological investigation and/or non-destructive remote-sensing surveys of potentially disturbed areas to determine if a potential exists for buried historical and archaeological resources.
- The EIR mitigation measure CUL-1a-8 requires that a Cultural Impact Mitigation Plan (CIMP) be developed in coordination with Interested Tribes and the Federal Agencies with land management responsibilities in the project area. PG&E has initiated work on the CIMP in May 2011, specifically protocols for review of cultural

resource-related documents and design documents were developed and included in the CMI/RD Work Plan (CUL-1a-8c and CUL-1a-8d) (CH2M HILL 2011f).

- The EIR mitigation measure CUL-3 requires that a paleontological investigation be conducted to refine the potential impacts on unique paleontological resources within the final design area. PG&E has retained a paleontologist to conduct the investigation, and planning for this investigation is currently underway. A draft report has been prepared and is currently under review.

Information to be collected during the above forthcoming studies, investigations and inspections, in conjunction with existing information, will be used to guide design and will be incorporated into the intermediate (60%) design.

SECTION 3

Design Basis and Assumptions

This section presents the design basis and assumptions for the remedy, along with the uncertainties at this preliminary (30%) design stage. As the project progresses through the design and implementation, the level of project certainties will increase.

Central to the design process is the groundwater modeling effort which was used to refine/optimize the key remedy features. Results from the modeling effort are summarized below and in more detail in Appendix B, Groundwater Modeling. In addition, design basis and assumptions for the in-situ remediation system, freshwater supply, remedy-produced water management, power supply, and other supporting systems are also discussed below. In conjunction with the design basis and assumptions, key O&M provisions considered in the design of each major system are also presented in this section. The design criteria for all systems and select engineering calculations are presented in Appendix C. The engineering drawings and the equipment list are included in Appendix D and a list of specifications along with a proposed specification format are provided in Appendix E. Figures 3-1 and 3-2 show the system layout in California and Arizona, respectively.

3.1 Summary of Modeling

The regional groundwater flow model developed for the site and used in the 2009 CMS/FS was calibrated in 2005. The details of the model design and calibration have been described in a previous report (CH2M HILL 2005a). Some modifications were made to the 2005 model prior to the CMS/FS to incorporate findings from investigations conducted in the East Ravine area (see Appendix E in CH2M HILL 2009d). To support the design of the selected remedy, the model was further updated with lithologic and hydraulic data that have become available since the original calibration. Additional details about the updates to the groundwater flow model are provided in Appendix B.

A detailed solute transport model of the site was developed by extracting a groundwater flow submodel from the regional site model. The extent of the submodel domain was designed to incorporate the extent of the hexavalent chromium distribution, the portion of the Colorado River located adjacent to the site, and all elements of the proposed remediation system. The submodel domain boundaries honor the simulated groundwater heads and fluxes from the original regional groundwater flow model under equivalent flow conditions. Solute transport modeling was performed to evaluate the migration and fate of Cr(VI) detected in the groundwater, as well as the fate and transport of potential IRZ by-products (manganese and arsenic).

The solute transport modeling was performed using the modular three-dimensional transport model referred to as MT3D. MT3D was originally developed by Zheng (1990) at S.S. Papadopulos & Associates, Inc. for the Robert S. Kerr Environmental Research Laboratory of the USEPA. The MT3D code uses the flows computed by MODFLOW in its transport calculations. MT3D also uses the same finite-difference grid structure and boundary conditions as MODFLOW, simplifying the effort to construct the solute transport model. MT3D is regularly updated (Zheng and Wang 1999), and the most recent version is referenced in the literature as MT3DMS, where MS denotes the Multi-Species structure for accommodating add-on reaction packages. MT3DMS has a comprehensive set of options and capabilities for simulating advection, dispersion/diffusion, and chemical reactions of contaminants in groundwater flow systems under a range of hydrogeologic conditions. Recent updates to MT3DMS have included the dual-domain formulation and the ability to incorporate site specific processes. The major inputs to MT3DMS for the modeling assessment are as follows:

- Mobile and Immobile Porosity: affecting the groundwater velocity and dissolved storage;
- Mass Transfer Coefficient: affecting the exchange of mass between mobile and immobile portions of the aquifer;
- Partition Coefficient: affecting the adsorption of Cr(VI) and by-products to soil particles;

- Carbon Degradation Rate: affecting the rate of Cr(VI) reduction/precipitation.
- Byproduct Generation Rate: affecting the rate of generation of manganese and arsenic during the introduction of carbon to treatment systems.

The parameters utilized in the solute transport model are described in further detail in Appendix B. Utilizing the solute transport modeling parameters, the remedial design was thoroughly evaluated to optimize the remediation timeframe for the chromium plume, while minimizing the impact of potential by-products. The seven different components of the remedy that were incorporated into the solute transport model are as follows:

- NTH IRZ Wells (Injection and Extraction)
- River Bank Extraction Wells
- Freshwater Injection Wells
- Carbon-amended Injection Wells
- East Ravine Extraction Wells
- Extraction wells northeast of the Compressor Station
- TCS Injection Wells

The factors that were considered in all of the solute transport model runs included well rates, well locations, well spacing, well cycling period durations, carbon substrate amendment injection concentrations, and reinjection destinations. To better visualize the different remedy components modeled, cross-sections were developed to show the well locations and depths with respect to the simulated model structure. Figure 3-3 depicts the following selected cross-section locations:

- Cross-section A-A’ features the River Bank Extraction Wells (Figure 3-4)
- Cross-section B-B’ features the northern Freshwater Injection Well, the NTH IRZ Wells (injection and extraction wells), and the East Ravine Extraction Wells (Figure 3-5)
- Cross-section C-C’ features the extraction wells located northeast of the Compressor Station (Figure 3-6)
- Cross-section D-D’ features the two Carbon-amended Injection Wells that receive water from the River Bank Extraction Wells, and two Freshwater Injection Wells (Figure 3-7)
- Cross-section E-E’ features the two TCS Injection Wells (Figure 3-8)
- Cross-section F-F’ features the two Freshwater Injection Wells (Figure 3-9)

The summary of the remedy operation and the solute transport model results for Cr(VI) and by-products are provided in Appendix B. Tables 3-1 through 3-4 list design information for the remedy wells including design flow rates for the wells. This information is based on the groundwater flow and fate and transport modeling.

3.2 In-Situ Remediation

The in-situ remediation at the Topock site consists of the following:

- Development of an IRZ using a line of wells installed along NTH that will target Cr(VI)- impacted groundwater in the floodplain (the NTH IRZ; Section 3.2.1).
- Implementation of an Inner Recirculation Loop, comprised of Carbon-amended Injection Wells located upgradient of the plume and River Bank Extraction Wells located near the Colorado River. The purpose of the Inner Recirculation Loop is to induce groundwater flow through the NTH IRZ and facilitate cleanup of the floodplain (Section 3.2.2).

- Implementation of a smaller-scale TCS Recirculation Loop, comprised of the extraction wells installed in the area northeast of the Compressor Station and in the East Ravine area and the two TCS injection wells at the Compressor Station (Section 3.2.3). The purpose is to provide hydraulic capture of contaminated groundwater at these locations and to directly treat Cr(VI) under the TCS.

An electrical power, control, and communications system will effectively operate and control the different elements of the in-situ remediation system, and will be used to integrate the in-situ remediation system with other elements of the groundwater remedy. The electrical power, control, and communications system is discussed in further detail along with other general design elements in Section 3.5.1. The specifications provided in the following sections are preliminary and a starting point for design and implementation of the in-situ remediation system. The specifications will be further developed over the course of the design and implementation process. Figure 3-10 provides a conceptual in-situ remediation system flow diagram.

3.2.1 National Trails Highway In-Situ Reactive Zone (NTH IRZ)

The NTH IRZ will consist of the following components:

- Eight groundwater extraction wells (i.e., NTH IRZ extraction wells) situated within four locations or clusters within the NTH IRZ
- Carbon substrate amendment facilities, located at the MW-20 Bench, that will be used to dose the extracted groundwater with carbon substrate
- Up to 24 injection wells (i.e., NTH IRZ injection wells) situated within 16 locations or clusters also located within the NTH IRZ, that will be used to re-inject carbon-amended water into the aquifer
- Above- and below-grade piping networks for the conveyance of extracted groundwater, carbon-amended water, freshwater, and/or water produced from routine remedy O&M activities (i.e., backwashing)
- A well maintenance system to facilitate routine backwashing of the injection wells

3.2.1.1 Description – NTH IRZ

NTH IRZ Extraction and Injection Wells

The NTH IRZ Extraction Wells will be located far enough away from NTH IRZ Injection Wells to minimize the extraction of reduced water containing organic carbon or dissolved metals. Each NTH IRZ Extraction Well will have a flow rate ranging from 50 to 150 gallons per minute (gpm) at approximately 300 feet of water column (ft w.c.) total dynamic head (TDH). The anticipated total extraction flow rate for the NTH IRZ Extraction Wells will be 300 gpm, with an anticipated range of 200 to 400 gpm (see Table 3-1).

The NTH IRZ extractions wells will be constructed using up to 12-inch nominal diameter well casing with one or two screened intervals to target specific intervals of the geologic formation. Electric motor-operated, submersible pumps (Grundfos or similar) will be deployed in each extraction well, and the pump intakes will be positioned above the screens to prevent dewatering of the screen and subsequent fouling. The motors will be 460 volts alternating current (VAC), 3 phase, 60 hertz (Hz). The wellhead connection and control/monitoring devices (e.g., flow meters, water level sensors, leak detection sensors, and submersible pump controls) will be contained within a below-grade concrete vault.

NTH IRZ injection wells will be spaced at approximate 75- to 150-foot intervals as described in Section 4.4.1 of Appendix B. The anticipated total injection flow rate will be 300 gpm, with an anticipated range of 200 to 400 gpm, and the anticipated nominal injection flow rates per well range from 1 to 39 gpm, with a maximum injection flow rate of 80 gpm (IRZ-11).

Injection wells will be constructed with up to 12-inch nominal diameter well casing with one or two discrete screened intervals to target specific intervals of the geologic formation. A more detailed discussion of NTH IRZ Injection Well design considerations is summarized in Section 3.2.5.1. In-well components will include pneumatic

packers (devices to limit flow to certain portions of the aquifer), injection drop pipes, spring-loaded check valves or variable orifice valves, pressure transducers (i.e., water level sensors), backflushing pumps and appurtenance piping, fittings, and controls/instrumentation. The wellhead connections and additional control/monitoring devices (e.g., flow meters, water level sensors, leak detection sensors, and backflush pumping controls) will be contained within a below-grade concrete vault. Additional injection well vault components will include: (1) electrically actuated diaphragm, globe, or other suitable control valves to facilitate the periodic adjustment of injection flow rates—the degree of automated control will consist of manual valve position adjustment from the Supervisory Control and Data Acquisition (SCADA) system human/machine interface (HMI) (see Section 3.5.2); and potentially (2) pressure gauges, sample ports, and/or packer pressure control devices.

Each NTH IRZ injection well will be connected to a carbon-amended groundwater conveyance header, a spare header, backflush piping, and/or a backflush return header. NTH IRZ wells configured as extraction wells will be connected to a groundwater conveyance header. These headers will run the entire length of the IRZ and will be routed to carbon substrate amendment and well maintenance facilities located at the MW-20 Bench.

Organic Carbon Substrate Amendment System (MW-20 Bench)

Carbon substrate amendment facilities will be located at the MW-20 Bench area because of its relatively close proximity to the NTH IRZ wells. Components of the carbon substrate amendment system will include the primary carbon dosing, metering, and control equipment (including valves, flow meters, pumps, and ancillary equipment); the primary carbon substrate storage and carbon substrate storage instrumentation; a tanker truck offload bay; and, potentially, portable tanks, as described in further detail below.

Primary Carbon Substrate Storage. The primary carbon substrate storage system will include double-walled piping and tank systems, with secondary containment around the nozzles and connections as required by regulation or best practices.

Primary carbon substrate storage tanks will be fully compatible with the contained substrate. The carbon substrate storage tanks will be above-grade, horizontal saddle tanks with double-wall construction and an integral interstitial zone to provide secondary containment and appropriate ports for the installation of leak detection monitoring devices (e.g., fluid level sensors). The storage tanks will include:

- An integral overfill prevention device, attached to the tank fill line, designed to prevent filling of the tank beyond 90 percent of the rated capacity
- A primary pressure/vacuum (P/V) vent sized in accordance with applicable codes and regulations
- Emergency vents to prevent damage from failure of the primary P/V vent
- A vapor recovery system designed to capture any emissions generated during the storage tank filling process

Details of electrical classifications (in accordance National Fire Protection Association (NFPA) and California Fire Code electrical hazard classifications) will be shown on engineering drawings in future submittals (see also Appendix C).

Carbon Substrate Storage Instrumentation. Carbon storage instrumentation will include: (1) tank interstitial space fluid level sensors [float switch or similar]; (2) a primary tank level transmitter—radar, ultrasonic, physical reading, or pressure type—with a manual gauging port for operator verification; (3) a primary tank fluid temperature sensor (resistance temperature detector [RTD] or similar); (3) a visible beacon and audible alarm, within the MW-20 Bench only, to notify operators of a high level during tank filling operations; (4) a primary tank head space P/V transmitter; and (5) a pipeline secondary containment leak detection system—i.e., a fluid level switch, pressure monitoring system or similar.

Carbon substrate flow meters and storage tank level sensors shall be correlated to notify the operator in the event of a flow conflict between two monitoring devices.

Tanker Truck Unloading Pad. The tanker truck unloading pad will be constructed on a concrete slab and designed for 7,700 gallons (110 percent of the volume of one tanker truck). The concrete slabs and surrounding walls will either be cast monolithically or the joint will be constructed with a water stop.

Portable Tanks. In addition to utilizing bulk storage, the carbon substrate amendment system will be able to accommodate the use of portable tanks (5 to 1,000 gallon capacity) for the direct injection of dilute carbon substrate solution at wellheads. Portable tanks will be used for specific, targeted injections.

To the extent practical, all valving, instrumentation, manways, and access ladders for tankage will be located on the northern face of the tank to allow O&M personnel to work on the shaded side of the tank during O&M activities.

Organic Carbon Dosing and Delivery Strategy

Carbon substrate flow rates will be based on target dosage concentrations as follows:

- Nominal 100 mg/L (maximum 500 mg/L) of total organic carbon (TOC) in the amended water pumped to the NTH IRZ injection wells

The anticipated carbon substrate flow rate (to the NTH IRZ) is up to approximately 700 gallons per day (gpd), based on ethanol as the substrate.

Injection rates will be adjusted to optimize carbon injection by allowing rest periods or periods of lower injection rates. In addition, the frequency of injections will be modified to allow for adequate dispersion of the carbon substrate away from the well.

Remediation Well Maintenance System

The remediation well maintenance system will consist of backwash pumps located in each of the remediation injection wells (i.e., NTH IRZ Injection Wells, TCS Recirculation Loop Injection Wells, Inner Recirculation Loop Injection Wells). The backwash pumps will operate at two times the average injection rate of the injection well, and water generated by the backflush system will be conveyed to the remedy-produced water conditioning plant (see Section 3.4).

Periodically, wells may require rehabilitation to physically or chemically remove fouling deposits on the well screen, in the filter pack, and/or in the near-well formation. Well rehabilitation will require the removal of downhole equipment. Physical or mechanical rehabilitation of wells may include brushing, surging using a double surge block, and/or pumping/bailing/air lifting. Chemical rehabilitation of wells will include the addition of well cleaning chemicals at the well head (see below), surging, and/or pumping/bailing/air lifting. In addition, well maintenance reagents could be dosed into the carbon amended groundwater conveyance piping network via the well maintenance reagent delivery systems at the MW-20 Bench (note that similar well maintenance reagent delivery systems have been provided in the Hinkley Compressor Station IRZs; however, these systems have not been used for well maintenance as of the date of this report. These systems have only been used to re-inject filtered purge water/produced water from well rehabilitation activities).

Well Maintenance and Rehabilitation Reagents

Potential well and/or piping maintenance reagents include acids (some with dispersants) to dissolve mineral deposits and break up biofilms (muriatic acid, phosphoric acid, glycolic acid, etc.); oxidizing agents to disinfect and degrade microbial biofilms (hydrogen peroxide, chlorine); biocides to inhibit microbial growth (Tolcide®); and chelating agents to aid acid and disinfectant penetration, remove mineral deposits, and break down and disperse biofilms (e.g., citric acid).

The specific well rehabilitation chemicals to be used at Topock are expected to be similar to the well rehabilitation chemicals used in the existing PG&E Hinkley Compressor Station IRZ system. These well rehabilitation chemicals include NuWell® 120 and NuWell® 310, both produced by Johnson Screens. NuWell® 120 is a liquid, food-grade, phosphoric mineral acid (65 to 80 percent phosphoric acid by weight) that serves to remove common mineral

deposits found in wells (e.g., manganese, sulfates, iron, and carbohydrates). NuWell® 120 is typically used in combination with the bioacid dispersant NuWell® 310, a polymeric acid solution. NuWell® 310 serves to:

- Maintain the acid reaction, holding minerals in suspension at pH levels of 3.0 and higher;
- Control sludges by preventing re-precipitation or adhesion;
- Dislodge biofilm masses associated with iron-oxidizing, sulfate-reducing, and slime-forming bacteria;
- Sequester iron and inhibit corrosion on metal surfaces; and
- Protect all forms of metal in the system, eliminating the need for acid inhibitors.

In addition, NuWell® 310 is readily biodegradable and commonly applied to treat potable water systems. A combination of NuWell® 120 and NuWell® 310 will be considered for well rehabilitation use during maintenance of the in-situ remediation system.

3.2.1.2 Design Basis– NTH IRZ

Treatment Chemistry

Chromium-impacted groundwater will be treated in-situ through geochemical precipitation/fixation. Degradable organic carbon substrate (e.g., ethanol, sodium lactate, or other food-grade carbon compounds) injected into the aquifer will stimulate microbial uptake of oxygen, nitrate, ferric iron, sulfate, and manganese IV to create an IRZ, altering the natural biogeochemistry of the groundwater. In the resulting anaerobic environment, soluble Cr(VI) is rapidly reduced to the insoluble form Cr(III). This remediation technology allows chromium to be treated both directly (i.e., by microbes that reduce Cr[VI] to Cr[III]) while consuming excess organic carbon) and indirectly (i.e., by the formation of reactive reduced iron, and less importantly sulfide, compounds in the aquifer). Cr(VI) is readily reduced to Cr(III) in the presence of ferrous iron and sulfide. A more detailed discussion of treatment chemistry is provided in Attachment A of Appendix C.

PG&E has confirmed the validity of this remedial approach by completing pilot studies of the in-situ biological reduction of Cr(VI) as discussed below.

In-Situ Pilot Tests

ISPTs conducted at the Topock site include the floodplain reductive zone ISPT (Floodplain ISPT) and the upland reductive zone ISPT (Upland ISPT).

The Floodplain ISPT was conducted to evaluate the efficacy of using a food-grade reagent mixture to reduce Cr(VI) in groundwater to form stable, insoluble Cr(III). The pilot test consisted of injecting a reagent mixture (lactate solution, yeast extract, and tracer compounds) into each well of an injection well cluster (PTI-1S/M/D) located in the Colorado River floodplain; a total of six injection events were completed over the course of approximately one year. Results of the Floodplain ISPT demonstrated successful creation of an IRZ and reduction of Cr(VI) from mg/L concentrations (e.g., 3.35 mg/L in April 2006) to concentrations of less than a fraction of a µg/L (e.g., 0.2 µg/L in November 2007). In addition, reducing capacity stored within the IRZ was able to sustain Cr(VI) reduction for a minimum of six months without the continuous injection of lactate.

The Upland ISPT was conducted to evaluate the efficacy of using recirculation to distribute ethanol for the reduction of Cr(VI) in groundwater. The pilot test consisted of recirculating ethanol between two recirculation wells (PTR-1 and PTR-2) located approximately 140 feet apart; approximately 38,000 gallons of reagent were injected over the course of six months. Results of the Upland ISPT demonstrated that: (1) ethanol was an effective organic carbon substrate for the in-situ treatment of hexavalent chromium; and (2) dual-screen recirculation wells could successfully distribute reagents between adjacent recirculation wells spaced approximately 140 feet apart.

Organic Carbon Substrate Selection

Based on the preliminary evaluation, the carbon substrates that will be carried forward into remedy design include ethanol (used in the Upland ISPT), sodium lactate (used in the Floodplain ISPT), emulsified vegetable oil,

and liquid whey. Each of these carbon substrates was evaluated in Appendix G of the CMS/FS (CH2M HILL 2009d). Selection of the appropriate substrate will depend on the balance between the mode of delivery, the substrate properties, and the rate of carbon utilization. It is anticipated that for most of the final remedy operational period, substrates that are soluble with fast biodegradation half-lives (i.e., 5 to 20 days), such as lactate and ethanol, will be used to facilitate rapid distribution and establishment of reducing conditions across the IRZ. Whey could be used if infrequent dosing of carbon substrate (i.e., biodegradation half-life of greater than 25 days) is needed; whey is not an ideal carbon substrate for continuous usage because it is perishable with a limited shelf life, and will develop septic odors relatively quickly. Emulsified vegetable oil may be used during future operational stages of the remedy if a low dosage, slow release reservoir of carbon would be advantageous.

More comprehensive engineering criteria, including chemical reaction equations for each substrate, are provided in Attachment A to Appendix C, Design Criteria.

3.2.1.3 Uncertainties and Assumptions

In practice, the distribution of organic carbon and the effectiveness of the Cr(VI) treatment will vary along the NTH IRZ due to geologic and hydrogeologic heterogeneities. Therefore, an adaptive operational approach will be employed to manage these uncertainties during remedy implementation—the system will be operated, data will be collected from monitoring wells within and downgradient of the NTH IRZ, and operations will be modified to optimize organic carbon distribution and Cr(VI) treatment. Modifications to operations and design may include adjustments to injection and extraction rates, adjustments to injection or extraction locations, and/or modifications to organic carbon loading. The specifications regarding injection and extraction flow rates, the carbon source, carbon concentrations, etc. presented in this document are a starting point for design and implementation, but may vary in practice as the adaptive operational approach is implemented.

3.2.2 Inner Recirculation Loop

The intent of the Inner Recirculation Loop is to: (1) induce a hydraulic gradient that will flush the plume towards the NTH IRZ; and (2) facilitate the cleanup of the Colorado River floodplain. The Inner Recirculation Loop will consist of the following system components:

- Five River Bank Extraction Wells installed along the Colorado River
- Four Carbon-amended Injection Wells installed near the western margin of the groundwater plume north of I-40
- Carbon substrate amendment facilities, located at the MW-20 Bench, that will be used to dose the extracted groundwater with carbon substrate;
- Above- and below-grade piping networks for the conveyance of extracted groundwater, carbon-amended water, freshwater, and/or water produced from routine remedy O&M activities (i.e., backwashing)
- A well maintenance system to facilitate routine backwashing of the injection wells

3.2.2.1 Description – Inner Recirculation Loop

River Bank Extraction Wells

It is anticipated that three to five of the River Bank Extraction Wells will be operated at any given time. The expected total average extraction flow rate of these wells is 150 gpm, although flexibility will be provided to increase this flow rate to 500 gpm (see Table 3-2). The nominal extraction flow rate will range from approximately 25 to 50 gpm per well at approximately 350 ft w.c. TDH. Extraction wells will be constructed with up to 12-inch nominal diameter well casing and may have up to two discrete screened intervals. An electric motor-operated, submersible pump(s) (Grundfos or similar) will be installed in each extraction well; motors will be 460 VAC, 3 phase, 60 Hz. Other down-hole components will include pump discharge piping (e.g., drop tube), and control and monitoring instrumentation. The extraction rates will vary over time during the operating life of the remedy.

Each well will be connected to a groundwater conveyance header that will be routed to the carbon substrate amendment system located at the MW-20 Bench. The wellhead connection and additional control/monitoring devices (e.g., flow meters, water level sensors, leak detection sensors, and submersible pump controls) will be contained within a below-grade concrete vault.

Carbon-Amended Injection Wells

Water injected via the Carbon-amended Injection Wells at the Inner Recirculation Loop will include: (1) groundwater captured by the River Bank Extraction Wells and amended with carbon using the carbon substrate dosing facilities located at the MW-20 Bench; and (2) freshwater from the freshwater supply system (see Section 3.3). A description of the carbon substrate amendment facilities is provided in Section 3.2.1.1. The target dosage concentration for flow from the River Bank Extraction Wells is between zero and 50 mg/L of TOC; TOC may be added to facilitate treatment of Cr(VI).

Injections will be timed to allow for adequate dispersion of the injectate away from the well. The anticipated nominal injection flow rate per well will range from 75 to 200 gpm. Carbon-amended Injection Wells will be constructed using up to 12-inch nominal diameter well casing with one or two discrete screened intervals. In-well components may include pneumatic packers, injection line drop pipes, spring-loaded check valves or variable orifice valves, and pressure transducers (i.e., water level sensors), backflushing pumps and appurtenance piping, fittings, and controls/instrumentation.

The wellhead connections and additional control/monitoring devices (e.g., flow meters, water level sensors, leak detection sensors, and backflush pumping controls) will be contained within a below-grade concrete vault. Additional injection well vault components will be as described as in Section 3.2.1.1.

Each Carbon-amended Injection Well will be connected to a carbon-amended groundwater conveyance header, a spare header, backflush piping, and/or a backflush return header. These headers will be routed to the carbon substrate amendment system located at the MW-20 Bench. The purpose of the spare headers is to provide redundancy and flexibility of operation. In addition, the spare headers will be employed to facilitate well or pipe cleaning of biological and/or mineral fouling within the primary carbon-amended groundwater header (see Section 3.2.4).

Remediation Well Maintenance System

The remediation well maintenance system will consist of backwash pumps located in each of the Carbon-amended Injection Wells. These pumps will be either submersible type with electric motor drives or water recirculation jet pumps. The backwash pumps will operate at two times the nominal injection rate of the injection well, and water generated by the backflush system will be conveyed to the remedy-produced water conditioning plant (see Section 3.4).

Periodically, wells may require rehabilitation to physically or chemically remove fouling deposits on the well screen, in the filter pack, and/or in the near-well formation. Well rehabilitation will require the removal of downhole equipment. Physical or mechanical rehabilitation of wells may include brushing, surging using a double surge block, and/or pumping/bailing/air lifting. Chemical rehabilitation of wells will include the addition of well cleaning chemicals, surging, and/or pumping/bailing/air lifting. Well maintenance reagents are discussed in Section 3.2.1.1.

3.2.2.2 Design Basis– Inner Recirculation Loop

The technical design basis includes groundwater pumping and flushing (i.e., application of a recirculation system), in combination with establishing an IRZ treatment barrier across the plume, to facilitate the remediation of the Cr(VI) plume. The Inner Recirculation Loop is a line-to-line recirculation system: a transect of extraction wells oriented across the plume is designed to provide hydraulic capture, and extracted groundwater is subsequently re-injected at another transect strategically positioned upgradient of the extraction transect. Line-to-line recirculation systems encourage flushing; and, if amended with carbon, can also be used to develop an IRZ within the plume.

When the portion of the aquifer requiring treatment is very large, aquifer heterogeneities can lead to unpredictable distribution which, in turn, results in non-uniform treatment. Recirculation systems provide a measure of hydraulic control that can overwhelm aquifer heterogeneities, reducing the uncertainties in substrate distribution, and reducing the number of wells required for coverage.

3.2.2.3 Uncertainties and Assumptions– Inner Recirculation Loop

The Inner Recirculation Loop will be implemented and operated using an adaptive approach, similar to operation of the NTH IRZ system—data will be collected from monitoring wells within the Inner Recirculation Loop, and operations will be modified to optimize the remedy performance.

Modifications to operations and design may include adjustments to injection rates, extraction rates, and/or organic carbon loading. The specifications on injection/extraction flow rates, the carbon source, carbon concentrations, etc. presented in this document are a starting point for design and implementation, but may vary in practice as the adaptive operational approach is implemented.

3.2.3 TCS Recirculation Loop

The TCS Recirculation Loop will be established using extraction wells installed in the area northeast of the TCS (approximately four wells) and in the East Ravine area (approximate four wells) to capture impacted groundwater from the alluvial deposits located downgradient of the TCS and from shallow bedrock in the East Ravine, respectively.

Extracted groundwater will be (1) conveyed to a second carbon storage and amendment facility to be located at the Transwestern Meter Station Bench; (2) dosed with carbon; and (3) injected at two TCS Injection Wells.

3.2.3.1 Description– TCS Recirculation Loop

Extraction Wells Northeast of the Compressor Station

It is anticipated that the four extraction wells will be installed in the area that lies to the northeast of the TCS where the alluvial aquifer extends southward following a depression in the bedrock. These wells will be operated at any given time for a total extraction flow rate ranging from 10 to 60 gpm, with an anticipated combined nominal rate of approximately 19 gpm (see Table 3-3). The expected nominal extraction flow rates per well will be 3 to 15 gpm at approximately 320 ft w.c. TDH. Electric motor-operated, submersible pumps (Grundfos or similar) will be installed in each extraction well; and additional down-hole components will include pump discharge piping (e.g., drop tube), and control and monitoring instrumentation. Each wellhead will be contained in a below-grade vault that will house wellhead piping, fittings, valves, flow meters and transmitters, and pressure transducers/level transmitters. Each well will be connected to a groundwater conveyance header that will be routed to the carbon substrate amendment system located at the Transwestern Meter Station Bench.

East Ravine Extraction Wells

The groundwater production and radius of influence of the East Ravine Extraction Wells is expected to be small. Consequently, it is anticipated that these wells will be operated on a cyclical basis, with the pumps automatically shutting down—to allow for groundwater in the casing to recharge—before automatically restarting based on water level or electric current.

It is anticipated that the four East Ravine Extraction Wells will be operated at any given time for a combined nominal flow rate of 2 gpm (i.e., approximately 0.5 gpm per well). Motor-operated, submersible pumps (Grundfos or similar) will be installed in each extraction well; additional down-hole components will include pump discharge piping (e.g., drop tube), and control and monitoring instrumentation. Each wellhead will be contained in a below-grade vault that will house wellhead piping, fittings, valves, flow meters and transmitters, and pressure transducers/level transmitters. Each well will be connected to a groundwater conveyance header that will be routed to the header of the extraction well network located northeast of TCS.

TCS Injection Wells

The two TCS Injection Wells will each receive approximately 10.5 gpm of carbon-amended groundwater, and injections will be timed to allow for adequate dispersion of the injectate away from the well. In-well components may include injection line drop pipe, spring-loaded check valves or variable orifice valves (to maintain a full drop pipe and prevent vacuum air entrainment), and pressure transducers (i.e., water level sensors). The wellhead connections and/or control/monitoring devices will be contained within a below-grade concrete vault. Electrically-actuated diaphragm, globe, or other suitable control valves may be included in the injection well vault to facilitate periodic adjustment of injection flow rates—the degree of automated control will consist of manual valve position adjustment from the SCADA system HMI (see Section 3.2.5.3).

Organic Carbon Substrate Amendment System (Transwestern Meter Station)

A second carbon substrate amendment system that will include a 3,000-gallon aboveground storage tank (AST) will be located at the Transwestern Meter Station Bench. The AST will be an existing tank that is re-deployed from the Upland ISPT, and will be used to facilitate carbon dosing of groundwater produced from the extraction wells located northeast of TCS and the East Ravine Extraction Wells. An existing concrete decon pad will be used for containment for loading of carbon substrate deliveries to the storage tank.

The AST is a horizontal saddle tank with double-wall construction and an integral interstitial zone to provide secondary containment and appropriate ports for leak detection monitoring devices. The AST includes:

- An integral overfill prevention device, attached to the tank fill line, designed to prevent filling of the tank beyond 90 percent of the rated capacity
- A primary P/V vent sized in accordance with applicable codes and regulations
- Emergency vents to prevent damage from failure of the primary P/V vent
- A product and vapor recovery system

Other components of the Transwestern Meter Station Bench carbon amendment system will include the primary carbon dosing, metering, and control equipment (including valves, flow meters, pumps, and ancillary equipment); carbon substrate storage instrumentation; a tanker truck offload bay; and, potentially, portable tanks, similar to those described in Section 3.2.1.1 for the MW-20 Bench carbon amendment system.

Groundwater extracted from the extraction wells northeast of TCS and the East Ravine Extraction Wells may also be conveyed to the MW-20 Bench to potentially be injected into the NTH IRZ. Carbon substrate flow rates will be based on a target dosage concentration of 100 mg/L of TOC (nominal).

Remediation Well Maintenance and Rehabilitation System

The remediation well maintenance system will consist of backwash pumps located in each of the TCS Injection Wells. These pumps will be either submersible type with electric motor drives or water recirculation jet pumps. The backwash pumps will operate at two times the nominal injection rate of the injection well, and water generated by the backflush system will be conveyed to the remedy-produced water conditioning plant (see Section 3.4).

Periodically, wells may require rehabilitation to physically or chemically remove fouling deposits on the well screen, in the filter pack, and/or in the near-well formation. Well rehabilitation will require the removal of downhole equipment. Physical or mechanical rehabilitation of wells may include brushing, surging using a double surge block, and/or pumping/bailing/air lifting. Chemical rehabilitation of wells will include the addition of well cleaning chemicals, surging, and/or pumping/bailing/air lifting. Well maintenance reagents are discussed in Section 3.2.1.1.

3.2.3.2 Design Basis– TCS Recirculation Loop

As described in the ROD (DOI 2010), remediation of the East Ravine groundwater could take one or more of three forms: (1) groundwater extraction and re-injection upgradient for in-situ treatment of the alluvial aquifer; (2) in-situ treatment of the East Ravine bedrock groundwater; or (3) freshwater flushing of East Ravine groundwater. Options (2) and (3) require that there be sufficient fracture interconnection and effective permeability within the East Ravine bedrock zone such that carbon substrate amendment injections and/or flushing would be effective and sustainable.

Investigation of the East Ravine area has been conducted in two phases. The sustainable purge rates of wells drilled during the first phase were too low for injection to be a viable remedial alternative. Consequently, groundwater extraction is considered the most viable option for the East Ravine area. The second phase of the East Ravine groundwater investigation is ongoing, and an assessment of groundwater conditions and hydraulic properties will be made at the conclusion of the investigations. Further evaluation of these options will be provided in the intermediate (60%) design.

The technical design basis for the TCS Recirculation Loop is similar to that for the Inner Recirculation Loop in that groundwater pumping and flushing (i.e., application of a recirculation system) will be used in combination with carbon substrate amendment to facilitate the remediation of Cr(VI) impacted groundwater. The TCS Recirculation Loop is a line-to-line recirculation system: transects of extraction wells (i.e., the extraction wells northeast of the TCS and the East Ravine extraction wells) oriented across the plume are designed to provide hydraulic capture, and extracted groundwater is subsequently re-injected at another transect (i.e., the TCS Injection Wells) positioned upgradient of the extraction transects. As discussed previously, line-to-line recirculation systems encourage flushing; and, if amended with carbon, can also be used to develop an IRZ within the plume.

3.2.3.3 Uncertainties and Assumptions– TCS Recirculation Loop

The TCS Recirculation Loop will be implemented and operated using an adaptive approach, similar to operation of the NTH IRZ system—data will be collected from select monitoring wells, and operations will be modified to optimize the remedy performance. Modifications to operations and design may include adjustments to injection rates, extraction rates, and/or organic carbon loading. Construction and cultural resources constraints may affect the design and operation of the East Ravine extraction wells and discharge header. The specifications on injection/extraction flow rates, the carbon source, carbon concentrations, etc. presented in this document are a starting point for design and implementation, but may vary in practice as the adaptive operational approach is implemented.

3.2.4 Clean In Place System

3.2.4.1 Description – Clean In Place System

The NTH IRZ contains significant lengths of extracted groundwater, carbon-amended water, and remedy-produced water conveyance pipelines. Within the pipe alignment will be a network of electrical ducts to route electrical power, control, and instrumentation conductors to the NTH IRZ extraction and injection wells. Routine maintenance of these pipelines is likely to be required to address biological fouling and/or mineral scaling. A Clean In Place (CIP) system will be implemented by providing a spare for each of the in-situ remediation system carbon amended groundwater conveyance pipes with valves and fittings to allow for the recirculation of maintenance solution.

The CIP system will consist of a 20,000-gallon frac tank and pumping system for the recirculation of acid- or caustic-based maintenance solutions (e.g., dilute citric acid, dilute phosphoric acid, dispersants) within the active and spare pipelines (refer to Section 3.2.1.1 for a description of piping and well maintenance reagents). The CIP system will be centrally located at the MW-20 Bench area, and may utilize some components of the carbon substrate amendment system (e.g., pumps, tanks, and metering equipment). Water produced during the CIP

maintenance cycles (i.e., maintenance solution and freshwater flush) will be conveyed to the remedy-produced water conditioning plant for conditioning, or will be shipped off-site for disposal.

CIP system piping will be operated at velocities between 3 and 10 feet per second (fps); and CIP reagents selected will be compatible with the HDPE conveyance piping.

3.2.4.2 Design Basis – Clean In Place System

Installation of cleanouts may not be a feasible option within the NTH IRZ due to logistical and safety considerations caused by traffic, EIR constraints limiting the dimensions of trenches and number and dimensions of vaults, etc. Implementation of the CIP system will allow for routine maintenance of the NTH IRZ force mains while avoiding the implementation and design issues listed above.

3.2.4.3 Uncertainties and Assumptions – Clean In Place System

To date, no significant fouling has been observed in the pilot IRZ system injection wells and piping at Topock. This may be related to the batch injection configuration used in the Floodplain pilot (limited flow of nutrients through the screen), and the high-concentration ethanol solution used in the Upland pilot (doubles as a biocide inside the well and related piping). It is also likely that the limited duration of the pilot studies may not have allowed adequate time for fouling to occur to a degree that it impacted operations. A longer duration full-scale system will likely have to deal with well and piping fouling.

3.2.5 General Design Elements– In Situ Remediation

3.2.5.1 IRZ Well Design

The principal elements of IRZ well (i.e. the NTH IRZ extraction and injection wells, inner loop extraction and injection wells, and TCS loop extraction and injection wells) design include:

- **Number of Wells per Location**. In areas outside of the chromium plume footprint (i.e. River Bank Extraction Wells, certain Carbon-amended Injection Wells), or within areas with lower saturated thickness (i.e. extraction wells northeast of Compressor Station, East Ravine extraction wells, southernmost NTH IRZ injection wells), one well will be employed. In areas with greater saturated thickness within the NTH IRZ, a two well cluster will be employed to facilitate recirculation of groundwater and carbon through the target zone.
- **Screen length**. Screen length is chosen based on the thickness of the saturated sediments and the thickness of target contaminated zones within the saturated sediments. As discussed in Appendix B, initial estimates of saturated thickness (along the injection well line) and individual screen length (maximum of 50 feet for NTH IRZ injection wells and greater lengths for the Carbon-amended Injection Wells) are available based on the results of the modeling effort. In areas of greater saturated thickness along the NTH IRZ, adjacent to the Colorado River and under the TCS, two well screens will be provided in each well separated by a pneumatic packer. Well-specific screen intervals will be determined during well installation.
- **Screen diameter**. In general, the wells will be a minimum of 8 inches in diameter and up to 12 inches in diameter to accommodate all in-well infrastructures (e.g., submersible backwash pumps, pressure transducers, inflatable packers, etc.).
- **Screen and filter pack sizing**. The filter pack and screen will be sized based on the formation gradations, determined by collecting sieve samples from select nearby wells.
- **Casing and screen material and type**. Casing material for the IRZ wells will be carbon steel to provide the required tensile strength and collapse pressure resistance for the expected installation depths. Well screen material will comprise continuous wire wrap 316L stainless steel, which provides improved corrosion resistance, provides a high percentage of open area for injection flows, and allows for aggressive development and well rehabilitation.

- **Well seals**. Well seals (placed between screen intervals and above the upper screen interval) will be comprised of neat cement mixed using a maximum of 6 gallons of water to one 100 pound bag of Portland cement. Filter pack sands will be installed to a minimum of 4 feet above the top of the screen, and capped by 2 feet of choker sand to ensure that the overlying neat cement does not leach into the filter pack or screen. The purpose of the well seals is to prevent short circuiting of groundwater or carbon amended groundwater from the above (or below) the target formation interval.

3.2.5.2 IRZ Pipeline Design and Operation

Above- and below-grade piping networks will be installed for conveyance of extracted groundwater, carbon-amended water, freshwater, and/or water produced from routine O&M activities such as backwashing of the injection wells. Pipes (i.e., spares) will also be provided as part of the CIP system loop to re-circulate maintenance reagents to address biological and/or mineral scale deposits on all extracted groundwater, carbon-amended water, and remedy-produced water conveyance lines within the NTH IRZ.

In general, pipe materials are selected to resist corrosion, climatic effects, soil loads, and/or other physical impacts, while being cost-effective and meeting process conditions and project life requirements. Groundwater in the floodplain, in particular, contains high levels of total dissolved solids, chlorides (greater than 2,000 mg/L), sulfate, and other minerals that cause significant corrosion to iron-based piping material from mild carbon steel to Type 316 stainless steel. In addition, pipe material must be compatible with maintenance chemicals used in the CIP system. Below-grade piping will be constructed with high density polyethylene (HDPE). Piping will be single-walled unless it is used to convey: (1) groundwater or remedy-produced water that is California hazardous waste; or (2) concentrated carbon substrate. In these cases, double-walled piping will be used.

Piping will be designed and installed in accordance with best practices for O&M, including flanged or union joints for serviceability and isolation valves for systems requiring routine maintenance. All valves, instruments, control devices, pumps, and other equipment shall be installed in a manner such that they are easily accessible for O&M. Cleanouts will be provided at 400-foot intervals, minimum, unless in conflict with EIR constraints or mitigation measures.

Carbon-amended water distribution force mains will be operated at a relatively low fluid velocity to promote good distribution through the injection well branch distribution piping. To ensure adequate distribution, the design pressure loss in branch distribution piping to each of the injection wells (including frictional losses, and wellhead pressures from drop pipe frictional losses and pressure drop across the foot valve) will be ten times higher than the pressure drop in the distribution header. CIP loop conveyance piping will be designed to operate at a velocity of 3 to 10 fps.

In addition to piping, the pipeline trenches and corridors will be used for routing of electrical conduits, SCADA circuits, and communication lines.

3.2.5.3 Flexibility and Redundancy

A number of system elements, in addition to the well networks, are critical for successful system operation. These include the pumps involved in capturing and moving groundwater, the piping within which the extracted groundwater is conveyed, the carbon substrate storage equipment, the groundwater/substrate blending and distribution equipment, and the process control and electrical systems. Flexibility will be incorporated into this supporting infrastructure such that system operation can be adapted, if necessary—i.e., to support the use of different substrates or different configurations of groundwater extraction and injection. In addition, redundancy will be used wherever appropriate to ensure that the system will operate as continuously as possible, and can be adjusted to meet changing site conditions. Redundancy will include the following:

- Primary process equipment (e.g., substrate dosing pumps, compliance related sensors, safety switches, etc.) will be designed for parallel operation;

- Select wells will be connected to more than one header (e.g., a spare header for the conveyance of carbon-amended groundwater). Note that spare pipes are also required as part of the CIP system loop to re-circulate maintenance reagents to address biological and/or mineral fouling within the different conveyance lines; and
- Cross connections will be installed within the mechanical piping to allow for the recirculation of groundwater or the injection of carbon in multiple configurations.

3.3 Freshwater Supply

The selected remedy includes injection of freshwater from several potential sources. The primary objectives of the fresh water injection are to assist with flushing the chromium plume through the NTH IRZ and to constrain westward spread of carbon-amended water and in-situ byproducts from the Inner Recirculation Loop. This section describes the different sources considered for freshwater supply and provides justification for the preferred supply of freshwater (i.e., a well or wells in Arizona) that is presented in this preliminary (30%) design. The design basis for the freshwater supply is also discussed.

3.3.1 Freshwater Supply Sources

The CMS/FS considered three potential sources of fresh water: a well or wells in Arizona (in proximity to the project site), a well or wells in California (in proximity to the project site), and water from the Colorado River. The preferred source of fresh water is a well or wells in Arizona (in proximity to the project site). This option provides the best assurance of adequate quantity and quality of freshwater to operate the remedy without adverse effect on the remedy performance or on neighboring wells. There is an existing Arizona well, installed by HNWR (well HNWR-1) that is being considered for use. Use of an existing well avoids the disturbance and the uncertainty about quantity and quality of supply that would be associated with drilling a new well.

The CMS/FS also included the possibility of installing a well on the California side of the river. It would be necessary to locate any California freshwater wells far enough from the plume so that the drawdown created by freshwater pumping did not adversely affect the operation of the remedy by drawing the plume away from the IRZ line. To maintain adequate distance from the plume, the most likely location for a freshwater well on the California side of the river would be somewhere near Moabi Regional Park, or possibly further north. As discussed below, the data from existing wells in this area suggest the aquifer near Moabi Regional Park is much less productive than that on the Arizona side of the river. Due to the less productive aquifer conditions, it is doubtful whether an adequate quantity of groundwater for the remediation system could be obtained from a single well near Moabi Regional Park. In addition, pumping freshwater from this area would have an adverse effect on the performance of the remedy.

The third option included in the CMS/FS was to obtain water from the Colorado River. This could be done either by taking water directly from the river through an intake structure on the river bank, or by extracting water from beneath the river bottom through an infiltration gallery. Water drawn directly from the river would likely require filtration and disinfection prior to injection into the aquifer. This would require filters and chemical feed equipment that would increase the size and amount of remedial infrastructure to be constructed and maintained. In addition, additional construction footprint would be required for the direct river intake infrastructure and associated mitigation measures have been established to protect biological resources. In order to avoid the need for filtration and disinfection of water from a direct river intake, another option is that water could be drawn from a shallow infiltration gallery beneath the river bottom. Under this option, the sand in the river bottom would provide filtration, removing suspended solids and microbes. However, the groundwater in the shallow zone beneath the river contains water that is geochemically reduced and contains elevated concentrations of iron and manganese, which could foul the injection wells. It is likely that a conditioning system would be needed to remove iron and manganese before the water pumped from beneath the river bottom could be used in the injection wells. Therefore, no matter whether water was extracted directly from the river or from beneath the river bed, some type of conditioning system would be needed to make river water usable for injection.

3.3.1.1 Evaluation of Freshwater Supply Sources

The criteria used to evaluate the freshwater supply options include the following:

1. Influence of drawdown from freshwater pumping on remedy performance,
2. Quantity of water available,
3. Water quality and potential need for pre-conditioning of water prior to injection, and
4. Disturbance associated with construction.

Each of these criteria is discussed below.

Influence of Drawdown from Freshwater Pumping on Remedy Performance

The remedy is designed to move the chromium plume across an IRZ line in an easterly direction by injecting water to the west and pumping from wells near the river bank. The current design flowrate for freshwater injection is 600 gpm based on modeling results (see Table 3-4). Pumping 600 gpm of freshwater from a well on, in, or near Moabi Regional Park is projected to adversely affect the operation of the remedy. Pumping from a well near Moabi Regional Park or an area further west would tend to draw groundwater toward the north and west, away from the IRZ. Although the remedy could still be designed to operate successfully with a freshwater well in California (near the project site), it would require more time and effort to implement the remedy. Either the time to cleanup would be increased or there would be need for more injection wells and/or higher flow rates of injected water to offset the adverse hydraulic effect of the pumping. Pumping freshwater from the river or a well in Arizona would not have this adverse effect. If water were drawn from the river, there would be negligible effect on groundwater levels.

The groundwater flow model was used to evaluate the relative effects on the remedy of pumping freshwater from Arizona (HNWR-1 well) versus California (a hypothetical well near Moabi Regional Park). Comparison of the model-projected flux of water across the NTH IRZ line under the two different freshwater pumping scenarios provides one means of quantifying the influence that freshwater pumping has on the performance of the remedy. This flux of water across the IRZ line is only one measure of the potential impact of pumping on the remedy. Pumping freshwater from the area of Moabi Regional Park could also make it more difficult to maintain hydraulic control of the western and northern margin of the plume. Obtaining water from the river has no effect on groundwater flow patterns and therefore has a neutral effect on the hydraulic performance of the remedy. Model simulations show that pumping 600 gpm from well HNWR-1 in Arizona would result in a very slight (less than 1%) increase in the flux across the IRZ by relative to obtaining water from the river. Pumping 600 gpm from a well near Moabi Regional Park would decrease the flux across the IRZ line by about 7%, relative to obtaining water from the river or from HNWR-1.

Because pumping freshwater from a hypothetical well near Moabi Regional Park well PM-03 or an area closer to the Compressor Station would have an adverse effect on remedy performance, the preferred option with respect to this criterion is to pump freshwater from a well in Arizona or from the river.

Quantity of Water Available

The freshwater injection system is a critical component of the remedy. It provides a hydraulic barrier to prevent movement of chromium or in-situ by products beyond the plume footprint to the north and west and it provides the hydraulic gradient needed to push the plume across the IRZ. The current design flow rate for the freshwater injection is 600 gpm. It is necessary to obtain a sufficient supply of water that will be reliable over the long term. There should be excess capacity in the extraction well(s) to offset future declines in well efficiency and allow for adjustment of freshwater injection rates to optimize the performance of the remedy. During remedy implementation, several of the Freshwater Injection Wells will be installed in areas where no previous wells have been drilled and hydrogeologic conditions are unknown. If the aquifer is more transmissive than anticipated in these areas, additional freshwater would be needed to create the gradient necessary for remedy operation. On the other hand, if the aquifer is less than transmissive than anticipated, less water would be needed.

Exhibit 3-1 provides a summary of available information for water wells in and near Moabi Regional Park, wells in Arizona (near the project site), and for an infiltration gallery at Moabi Regional Park. Of the 6 wells or test borings drilled at Moabi Regional Park, only 2 were able to produce more than 100 gpm. Based on the available data from the driller's log, well PM-01 was tested at a flow rate of 300 gpm with a specific capacity of about 16 gpm/ft. PM-01 was used for several years, but reportedly produced relatively poor quality water with a TDS concentration of 3,000 mg/L. Well PM-02 was tested at 430 gpm but there was no record of the drawdown so no estimate of specific capacity could be made. Both of these two wells had mineralized water. The water from PM-02 was so saline that it was considered unusable and the well was apparently never put into production (LeRoy Crandall & Associates, 1986).

Subsequent wells drilled at Moabi Regional Park (PM-03 and PM-04) produced water with lower mineral content, but at rates of only 40 to 60 gpm. Attempts were made (by parties other than PG&E) to develop water supplies at two other locations near Moabi Regional Park. An exploratory boring was installed (by parties other than PG&E) south of the park entrance, near the present day location of the Moabi Regional Park water storage tank (along Park Moabi road about 500 feet north of I-40). This boring was extended to a depth of over 500 feet but produced only a small volume of water and was never completed as a well. Another well was drilled about a half mile west of Moabi Regional Park to supply water for the construction of I-40. This well reportedly produced less than 5 gpm (LeRoy Crandall & Associates 1986). Based on this information, the capacity of the aquifer to support a 600 gpm well in the areas south or west of Moabi Regional Park appears doubtful. Wells previously drilled within Moabi Regional Park have produced more than 430 gpm, however these high-volume wells have exhibited relatively high mineral content. Wells that have produced better quality water in or near the park have exhibited low pumping rates.

The existing data for water wells in Arizona are also summarized on Exhibit 3-1. The Topock-2 well was installed in 1980. There is a note on the driller's log that indicates it was tested at 400 gpm with 25 feet of drawdown. The Topock-3 well was installed in 1974. It was tested at 600 gpm with only 10 feet of drawdown. The well casing in Topock-3 is currently in poor condition. When ADEQ attempted to collect vertical profile samples from the well in 2006, they found the casing obstructed and likely collapsed at a depth of 127 feet (GeoTrans 2006). The current maximum production rate of the well is unknown. PG&E is currently in discussions with the well owner about conducting hydraulic testing at the Topock-2 and -3 wells to provide a better estimate of the current production capacity of these wells.

The HNWR-1 well was installed in 2010 to provide water for a pilot revegetation project undertaken by HNWR. It was tested at 900 gpm with 75 feet of drawdown. The well was used to irrigate native plants in the initial phase of the revegetation project. PG&E is in discussion with DOI and USFWS for a potential shared use of this existing well. The capacity of this well could be adequate to supply the HNWR with irrigation water and supply the freshwater needs of the selected remedy. A pump test at the HNWR-1 well is being planned to confirm the production capacity of the well.

Based on the criteria of water quantity, a well in Arizona is preferred because the aquifer in Arizona is proven to be able to provide an adequate supply of water. The ability of the aquifer in or near Moabi Regional Park to provide 600 gpm from any single well is doubtful. The river would also be able to provide an adequate quantity of water.

EXHIBIT 3-1
Summary of Available Data from Walls near Park Moabi and in Arizona
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

	Well No. / Name	Description	Casing Depth	Casing Diameter	Perforated Interval	Pumping Rate (gpm)	Specific Capacity	Water Quality Indicators	Current Status
Water Wells Near Park Moabi	**PM-01**	Original well drilled in 1961	190'	10"	28' to 180'	350 gpm	16 gpm/ft	TDS = 1,500 to 3,000 mg/L (Cr(VI) and As not available)	Unknown. Well was sounded in 1986.
	PM-02	Unused PM supply well. Exact location unknown	114'	10"	86' to 106'	430 gpm	Unknown	Well reportedly produced highly saline water and was considered unusable	Unknown
	PM-03	Well installed in 1986 near where Natl. Trails Highway crosses RR tracks	210'	8"	80' to 200'	60 gpm	0.8 gpm/ft	TDS = 500 mg/L Cr(VI) 9 µg/L Arsenic = 1.7 µg/L	Active
	PM-04	Well installed in 2006 near bathrooms	145'	8"	93' to 140'	40 gpm	0.8 gpm/ft	TDS = 900 mg/L Cr(VI) = 21 µg/L Arsenic = <1.0 µg/L	Active
	Park Moabi Infiltration Gallery	Consisted of 300' of perforated pipe laid near river draining a 26' deep sump	26' deep sump	4' diameter sump	300' of horizontal pipe	Estimated to be 40 to 70 gpm	Unknown	TDS = 2,000 mg/L (Cr(VI) and As not available) Reverse osmosis was needed to make water usable. R.O. system produced 18 gpm	Unknown
	Park Moabi Test Boring	Test boring installed near existing Park Moabi water tanks	512' borehole depth	No casing installed	NA	NA	Unknown	Not sampled	Abandoned Borehole produced very little water so no well was installed.
	Unnamed Well Used for Highway Construction	Located about 1/2 mile west of Park Moabi	86'	12"	Unknown	< 5 gpm	Unknown	Unknown	Unknown. Well was sounded in 1986.
Water Wells in Arizona	**Topock - 2**	Water Supply Well Installed 1980	140'	12"	100' to 140'	400 gpm	16 gpm/ft	TDS = 900 mg/L Cr(VI) = 7 µg/L Arsenic = 12 µg/L	Active
	Topock - 3	Water Supply Well Installed 1974	130'	12"	85' to 130'	600 gpm	60 gpm/ft	TDS = 800 mg/L Cr(VI) = 11 µg/L Arsenic = 14 µg/L	Active
	HNWR -1	Irrigation Well for Pilot Revegetation Project	157'	10"	92' to 157'	900 gpm	12 gpm/ft	TDS = 500 mg/L Cr(VI) = 18 µg/L Arsenic = 15 µg/L	Active

Water Quality and Potential Need for Pre-Conditioning Prior to Injection

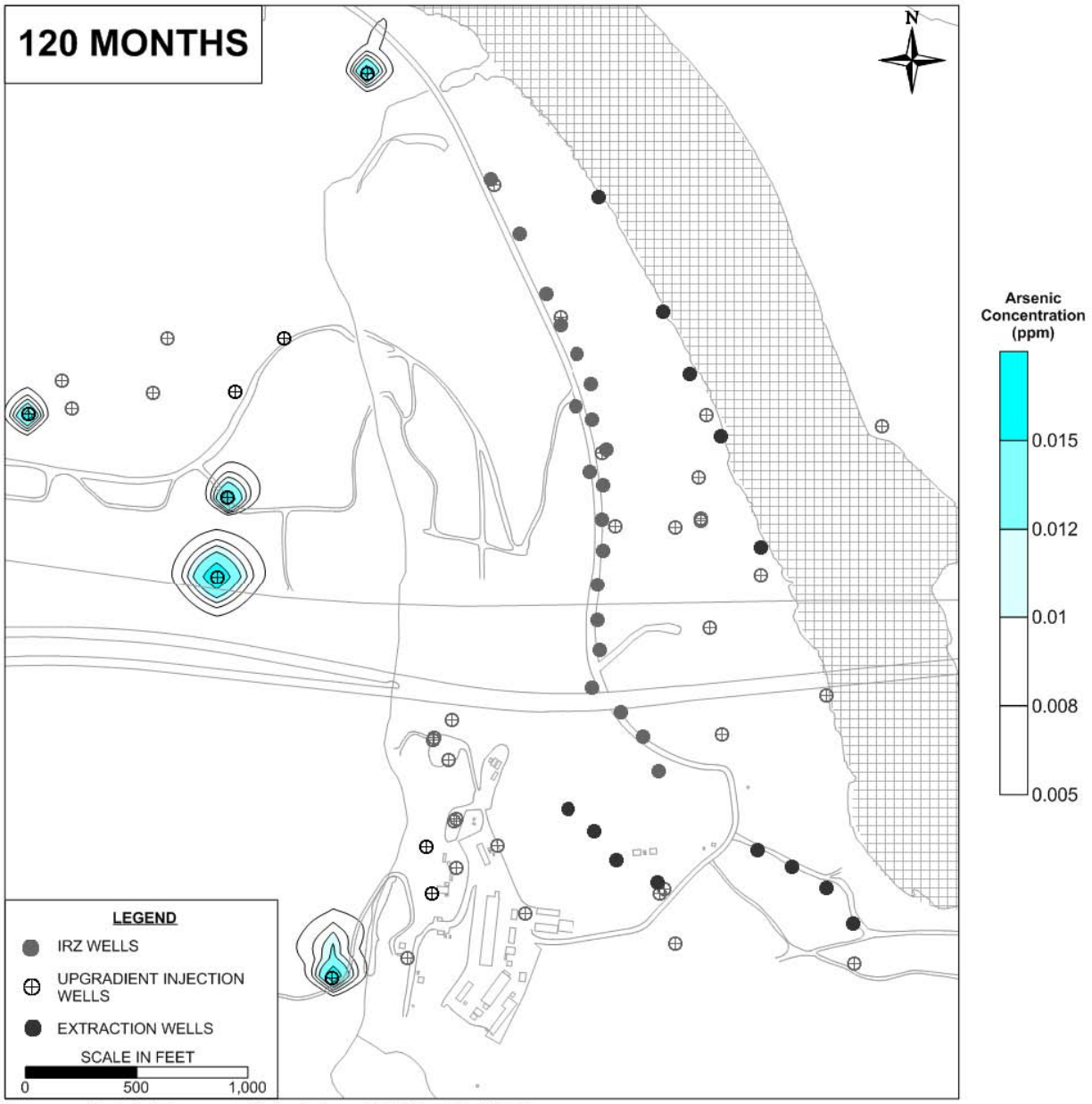
The freshwater will be injected into the aquifer via injection wells located to the north and west of the chromium plume. The water injected must be compatible with the geochemistry of the aquifer in those locations to prevent plugging of the aquifer around the injection wells. In order to avoid frequent rehabilitation and replacement of the injection wells, the injected water must also be low in constituents that directly cause well plugging, such as suspended solids, iron, and manganese. If the injected water is highly mineralized or geochemically incompatible with the aquifer where it is injected, there could be other constituents such as calcium or silica that might cause well plugging.

As noted in Exhibit 3-1, one of the wells drilled at Moabi Regional Park (well PM-02) produced highly mineralized water and was never put into service. The other high-capacity well (PM-01) produced water with a TDS concentration around 3,000 mg/L. Based on the relatively high mineral content of the water, there is some doubt whether a well at Moabi Regional Park would produce water that is geochemically compatible with the injection wells and the aquifer at the Topock site. Well PM-04 has only been sampled once for trace metals and zinc exceeded background levels in that sample. In addition to the concerns about geochemical compatibility and well plugging, the freshwater supply should not contain trace metals or other constituents at concentrations above background. The data set for trace metals in the Moabi Regional Park wells is not extensive. There have been only two trace metals that have sporadically exceeded background in the Moabi Regional Park wells. Well PM-03 had exceedances of copper in two samples and zinc in one. Detection limits were above the background UTLs for several trace metals including beryllium, cobalt, antimony and tin. Trace metals data are not available for the former high-capacity wells PM-01 and PM-02.

A single sample from the HNWR-1 well has been analyzed by PG&E for general chemistry and trace metals. The TDS concentration of the water sample was 490 mg/L, which is less than the average river water sample. There were no exceedances of background trace metal concentrations in this sample, although the detection limits for several metals (i.e., silver, beryllium, cobalt, lead, and antimony) were above the background UTL. The Topock-2 and -3 wells had one exceedance each for lead out of a total of 7 samples from the two wells. Topock-2 also had one exceedance for silver. Detection limits for beryllium, cobalt, and tin were above the background UTLs in the Topock-2 and -3 samples. PG&E is in discussion with HNWR to collect additional samples from the HNWR-1 well.

Cr(VI) is present at similar concentrations in the aquifer at Moabi Regional Park and in Arizona (analytical results from HNWR-1, Topock-2, and Topock-3). Cr(VI) levels in both areas are below the 31.8 µg/L value established as the background concentration for the Topock site. The existing data suggest that the aquifer water quality in either Moabi Regional Park or in Arizona (in the vicinity of HNWR-1, Topock-2, and Topock-3) would be suitable for a freshwater supply from the standpoint of trace metal concentrations.

Arsenic is slightly elevated in the wells in Arizona but it is well below the 24.3 µg/L value established as the background concentration for the Topock site. Solute transport simulations were conducted to predict how arsenic, at concentrations typically found in freshwater obtained from Arizona, would be transported through the aquifer after injection into the Freshwater Injection Wells at Topock. Exhibit 3-2 shows the results of these simulations. Arsenic at concentrations above the MCL of 0.01 mg/L does not extend more than approximately 250 feet from any of the injection wells over the remedy time frame. This attenuation is due to the geochemistry of arsenic, which adsorbs to the iron oxide present in the aquifer matrix, removing the arsenic from solution. The presence of iron oxide in the formation has been established through testing of soil cores from the Upland ISPT and from aerobic cores from the floodplain (ARCADIS 2009b; CH2M HILL 2005b). The simulation presented on Exhibit 3-2 incorporated arsenic concentrations typical of the HNWR-1 well and iron oxide concentrations typical of those measured in the core samples. Based on this analysis, arsenic in the freshwater supply is expected to be rapidly attenuated in the upland aquifer at the Topock site.



Source: Solute Transport Modeling (ARCADIS 2011)

EXHIBIT 3-2
Projected Distribution of Arsenic after Ten Years of Freshwater Injection Using Water from Well HNWR-1
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Surface water extracted from the Colorado River could contain any number trace pollutants due to irrigation return flows, urban runoff, or wastewater discharge to the river. It also contains suspended solids, microbes, and organic carbon which could plug injection wells. Pumping river water from an infiltration gallery could eliminate the suspended solids but not the trace pollutants. In addition, water pumped from an infiltration gallery would likely contain elevated concentrations of iron and manganese due to the geochemically reducing conditions present in the fluvial sediments surrounding and underlying the river. It is very unlikely that water from the river or from a river infiltration galley could be used for the freshwater injection without some kind of preconditioning. Therefore water from the river or from a river infiltration gallery is not preferred based on the criteria of water quality.

Disturbance Associated with Construction

Each of the three options involves similar types of construction. Common elements to all options include pipelines, power supplies, control systems, access roads, security provisions, and small pump house/equipment buildings or secure subsurface vaults to house pump controls.

Unless an existing well could be used, it would be necessary to drill one or more boreholes, conduct testing, and develop one or more large production wells. This activity would likely take 2 to 4 weeks and might involve 24 hour per day work schedules. If water were obtained from the river, some type of intake structure would need to be built. If river water were obtained through an infiltration gallery, the equipment used during installation of the gallery would be similar to well drilling equipment, but the project would likely be of considerably longer duration with more and larger equipment. The infiltration gallery would require sinking a caisson of 8 feet or larger diameter at a location near the river bank. Horizontal collector wells would then be installed through the sides of this caisson extending out under the river. A surface water intake would involve construction along the river bank with concrete abutments and a pipe extending out far enough to ensure submergence even during lowest low water. Fish screens will be required to prevent entrainment of small fish into the pumps. The river intake structure would likely represent the greatest level of disturbance both during and after construction of any of the three options. Much of the river intake construction disturbance could be mitigated if permission could be obtained to mount the river intake from the I-40 or the railroad bridge.

Based on a preliminary evaluation of the type and amount of construction for the three identified options, using the existing HNWR-1 well in Arizona is the preferred option. By using an existing well, which has already been proven to provide an adequate quantity and quality of water, additional well drilling would be avoided. If wells at Moabi Regional Park were selected as the water source, it is likely that several wells would need to be drilled in order to find a sufficient quantity and quality of water. In addition, the length of pipeline would be longer from Moabi Regional Park than from Arizona (HNWR-1).

Construction of a freshwater conditioning plant would increase the infrastructure for the remedy. Therefore, freshwater options that do not require a conditioning plant are favored. As discussed previously, freshwater obtained from the river or from a river infiltration gallery would almost certainly require conditioning prior to injection. It is also likely that some conditioning would be needed to make the mineralized water from Moabi Regional Park compatible with the Topock aquifer or usable in the injection wells. The available data from the HNWR-1 well indicate that no conditioning would be needed with this option. The use of existing well HNWR-1 would avoid the need for additional well drilling and potential conditioning plant construction and is therefore the favored option under this criterion.

Preferred Freshwater Supply Option to Carry into Design

Exhibit 3-3 summarizes the evaluation of freshwater supply sources. Based on this evaluation, using wells in Arizona is the preferred option, specifically the existing HNWR-1 well. By using an existing well, which has already been proven to provide an adequate quantity and quality of water, the need for additional well drilling and conditioning plant construction would be avoided. If the HNWR-1 well cannot be used, a supply well will be installed nearby in Arizona to serve the remedy.

EXHIBIT 3-3
Comparison of Freshwater Options Against Evaluation Criteria
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

	Freshwater Source		
Criteria	**Well(s) in Arizona (near the project site)**	**Well(s) in California (near the project site)**	**River**
Influence of drawdown from freshwater pumping on remedy performance	Pumping in Arizona would not create any adverse effect on the performance of the remedy	Pumping in California would create northerly or northwesterly gradient that would inhibit the movement of the plume through the IRZ and slow down the cleanup and/or require additional infrastructure	Extracting water from the river or from a river infiltration gallery would have no effect on the groundwater gradients and therefore no adverse effect on remedy performance
Quantity of water available	Data from 3 existing wells in indicates that aquifer in Arizona can provide an adequate quantity of water without adverse effects on neighboring wells.	Data from 2 active wells and 5 former wells or borings near Moabi Regional Park indicate that it is doubtful that a single well there could provide an adequate quantity of water.	The river could provide more than sufficient quantity of water for the remediation system without adverse effects on any wells.
Quality of water available / need for conditioning of water prior to injection	The HNWR-1 well produces water that is geochemically compatible with the Topock aquifer and below background for Cr(VI) and As. No conditioning would be needed prior to injection.	Only two of 7 wells or borings at Moabi Regional Park have produced more than 100 gpm and both produced mineralized water that might not be suitable for injection at Topock. It is possible that some type of conditioning would be needed prior to injection.	River water is low in dissolved solids, but contains suspended solids, microbes, and trace contaminants, such as perchlorate, pesticides, herbicides, and pharmaceutical compounds. River water could not be injected without conditioning.
Disturbance associated with construction	Disturbance associated with well drilling could be avoided if existing well HNWR-1 were used. Length of buried pipeline is less than for wells near Moabi Regional Park.	The area around Moabi Regional Park is already developed so disturbance caused by well drilling would be lessened, however more than one well would likely be needed to ensure enough water. The length of pipeline needed would be greater than for either of the other two water sources. Additional disturbance associate with potential conditioning plant construction.	Construction of a river intake structure or subsurface infiltration gallery would be likely result in more disturbance than drilling of a well. Depending on where the intake was located, the length of buried pipeline could less than for either of the other two options. Additional disturbance associate with potential conditioning plant construction.

3.3.1.2 Uncertainties and Assumptions of the Freshwater Supply Source

It is assumed that a new well drilled in the vicinity of existing wells would exhibit production rates and water quality similar to the nearby existing wells; however, it is recognized that there is considerable uncertainty about the performance and quality of any new well until it has been drilled and developed. Well performance will be monitored throughout the life of the remedy and wells will be repaired or replaced as needed to assure a continued supply of freshwater.

Water quality in the Freshwater Extraction Well will be monitored over time. For the basis of design, it is assumed that the water quality will not change enough to require conditioning prior to reinjection. If large changes occur in water quality in the freshwater wells, it may be necessary to change the location or the design of the freshwater wells, or provide conditioning of the water prior to injection.

3.3.2 Design Basis for Freshwater Supply System

The freshwater supply system has been designed with an eye towards providing a reliable service to the remedy, providing the flexibility to adapt to future operating scenarios (e.g., the need to serve freshwater to more wells) with minimal additional disturbance, and not constraining remedy operations. The design also incorporates principles and features that are consistent with the mitigation directives in the EIR and the PA to use existing facilities and previously disturbed areas where possible (e.g., placement of pipelines along existing roadways and ROWs, and in previously disturbed areas; and the incorporation of the existing Compressor Station freshwater storage tanks into the design).

The freshwater supply system consists of the following:

- Extraction well or well(s) in Arizona – assume the HNWR-1 well is the freshwater supply well
- Freshwater piping network
- Freshwater storage
- Freshwater Injection Wells

There is no conditioning plant for freshwater supply. Based on the modeling results, the design flowrates for the supply well and injection wells, and the overall freshwater demand for the remedy are shown in Exhibit 3-4. Additional design parameters and operational provisions are also presented in Exhibit 3-4.

EXHIBIT 3-4
Freshwater Supply Design Basis
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Item	Design Parameters (gpm)		
	Minimum	**Nominal**	**Max (Design)**
Freshwater supply extraction flow rate[a]			
Supply well or well(s) in Arizona – assume HNWR-1	210	360	710
Freshwater supply injection flow rate			
FW-INJ-1[b]	50	100	200
FW-INJ-2[b]	50	100	200
FW-INJ-3 (future well to be installed if needed)	TBD	TBD	TBD
FW-INJ-4[b]	25	50	100
UPGRAD-INJ-1[c]	35	75	200
UPGRAD-INJ-2[c]	35	75	200
UPGRAD-INJ-3[c]	35	100	200
UPGRAD-INJ-4[c]	35	200	200

EXHIBIT 3-4
Freshwater Supply Design Basis
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Freshwater Supply Operational Parameters	
Item	**Design Parameter**
Projected life of the system	30 years
Uptime	80%
Compressor Station Demand (maximum average based on monthly data)	110 gpm
Pipeline capacity, gpm	1,310 [d]
Freshwater storage capacity	420,000 gallons (shared use of existing Compressor Station storage tanks)
Supply pump operating mode	The production well pump will turn on when the storage tanks drop to a pre-set level. This level will be above the level required for the Compressor Station. The well will continue pumping until the tanks reached a pre-set level that will correspond to a full tank, just slightly below the emergency tank overflow level.
Supply pump	As the water demands are expected to fluctuate, a variable frequency drive (VFD) will be used to control pump speed and hence output, based primarily on level in the Compressor Station storage tanks. A flow meter and water level transducer will be monitored remotely (requiring transmitters) to evaluate performance. Monitoring of the well will be accomplished using telemetry.
Power for the supply pump	If the supply well is the HNWR-1 well, use existing power supply, otherwise arrangement will be made with local utility to provide power service to the new well.
Pre-conditioning of freshwater supply	None

Notes:

gpm = gallons per minute

[a] These flows were derived from values provided in Table 3-4 (Freshwater Injection Wells) plus freshwater usage by TCS (110 gpm).

[b] See Table 3-4 for preliminary design parameter summary of Freshwater Injection Wells.

[c] See Table 3-2 for preliminary design parameter summary of Carbon-amended Injection Wells. Wells UPGRAD-INJ-1 and UPGRAD-INJ-2 may be used for injecting carbon-amended water or freshwater. In the former case, there will be no freshwater injection.

[d] This total includes the maximum flow to Carbon-amended Injection Wells (600 gpm) and Freshwater Injection Wells (600 gpm) plus the maximum for TCS usage (110 gpm).

The demand for freshwater may change over the projected 30-year life of the remedy. For example, it is possible that freshwater may be needed for injection at one or more Carbon-amended Injection Wells. To accommodate potential future operational changes associated with the remedy while maximizing the use of existing facilities, the design incorporates the current freshwater supply system for the Compressor Station. The Compressor Station's current water need (approximately 110 gpm) is served by Topock-2 and -3 supply wells in Arizona; the freshwater is conveyed via a pipe crossing the Colorado River on the arch bridge. Coordinating with the Compressor Station's water supply allows for the potential increase in freshwater demand by the remedy to be met with minimal additional infrastructure (see Section 3.3.2.2 for details).

3.3.2.1 Freshwater Supply Piping Network

Figures 3-1 and 3-2 present the alignment of the fresh water piping network. The total length of freshwater pipe is approximately 21,700 feet, with about 25 percent aboveground and 75 percent underground. A hydraulic model of the freshwater piping network, built using the EPANET water supply program (http://www.epa.gov/nrmrl/wswrd/dw/epanet.html), was used to optimize the piping design.

Where available, the pipeline alignment follows existing roadways and existing PG&E pipeline ROWs. Where not available, the pipeline alignment is placed in previously disturbed areas using the Draft Disturbed Areas Map as a guide, and is also placed to avoid known cultural, archaeological, and historical resources. PG&E fully recognizes that the Disturbed Areas Map is currently a work in progress and as such, expects that the pipeline alignment shown in the preliminary design may need to be adjusted to reflect the final map. PG&E will continue to work with interested Tribes to finalize the Disturbed Areas Map.

Assuming the HNWR-1 well is the freshwater supply well, a 12-inch fresh water pipeline will follow Topock-Oatman Highway (Mohave County Road 10) toward the south and southwest, crossing under the BNSF railroad track in the road, crossing underneath the railroad track and under I-40. The 12-inch water pipeline will cross privately-owned parcels south of I-40 and continue onto the existing arched pipeline bridge (co-owned by EPNG and PG&E) to cross the Colorado River. EPNG has completed its evaluation of the integrity of the arched bridge to carry the 12-inch water pipe and has determined that the bridge is capable of accommodating the additional pipe (see Appendix G). PG&E has also initiated its own structural evaluation, and the target for completion is at the end of 2011 or sooner. As mentioned in the CMI/RD Work Plan (CH2M HILL 2011f), backup options to the arched bridge are to install the fresh water pipe under the Colorado River, along the alignment of the existing natural gas pipeline (owned by Transwestern Pipeline) between the railroad bridge and I 40, or to use other existing bridges (BNSF railroad bridge, I-40 bridge, or a pipeline bridge). Until PG&E completes its own evaluation, these backup options, which are unlikely to be needed, cannot be dropped from consideration. PG&E will inform the Agencies in writing of the results of its evaluation when available and will make a recommendation about these backup options at that time. For the preliminary (30%) design, the arched bridge option will be used.

After crossing the Colorado River into California, the water pipeline will follow PG&E's natural gas pipeline ROW to the existing freshwater tank area of the Compressor Station. Midway along this route, the freshwater pipeline will branch to the north to connect to the piping corridor located within NTH and the Compressor Station access road to allow the fresh water system to form a loop. The northern branch will run north on NTH and continue up to the intersection with the IM-3 access road, after crossing under I-40 and the BNSF railroad tracks. The line will continue north to serve the northernmost injection well (FW-INJ-1). The main trunk of this northern branch will continue west on the IM-3 access road to serve the westernmost well located near the IM-3 injection wells (FW-INJ-2). This pipe will also serve freshwater to the four Carbon-amended Injection Wells (UPGRAD-INJ-1 through -4) as needed. This western branch will also continue south through Bat Cave Wash connecting the southernmost injection well (FW-INJ-4). The final leg of this loop is a pipeline segment that goes up the existing Bat Cave Wash access road into the Lower Yard of Compressor Station. The pipeline will follow the western Compressor Station fence line and then proceed east to the water tank area.

In general, the benefits of a looped system are two-folds. First, in a looped system, the flow is divided, therefore smaller pipes can be used, which results in reduced pressure losses and lower energy use. Second, a looped

system provides operational redundancy in that one side of the loop can be used if the other side is out of service for maintenance.

With the current preliminary design, the primary benefit of a looped system is having the operational redundancy and flexibility to minimize unplanned downtime over the decades-long life of the remedy. The energy savings associated with a looped system are small given the current design since most of the freshwater injection flow will not require pumping. This could change if the final design is different. As currently designed, the looped segment is less than 2,200 feet long or just over 10% of the total freshwater pipe length (21,200 linear feet).

3.3.2.2 Freshwater Supply Storage

Storage of freshwater is required to meet the flow demands to injection wells during extended supply well(s) shutdown and outage (that are outside of PG&E control), to balance the difference between production well pumping capacity and the injection well demands, and to meet the fire flow storage requirement for the remedy (primarily for facilities located on the Compressor Station).

Consistent with the mitigation directives to use existing facilities where possible, PG&E is evaluating the shared use of the existing Compressor Station freshwater supply tanks for the remedy. The Compressor Station water tanks have a capacity of 210,000 gallons each and are used to serve the station water needs (about 110 gpm) and to meet fire flow storage requirement. The Compression Station currently receives its freshwater from Southwest Water Inc. in Arizona.

An initial evaluation suggested that there is adequate storage capacity that can be shared with the remedy, as long as there is sufficient supply. Although the estimated Compressor Station water usage is much less than the remedy freshwater usage, sharing of existing Compressor Station facilities dictates that the needs of the Compressor Station will supersede freshwater injection requirements. If it is determined in further evaluation that a new water storage tank is required for the remedy, a new tank will likely be located near the existing tanks. The size has not been determined, but will be during the intermediate (60%) design if needed. If a new tank is designed, it will be equipped with a level transducer and transmitter. In addition, new instruments and valves will be installed on the existing tanks and the pipes connecting to the tanks. The instruments will include a level transducer and a transmitter to communicate with the remedy control system, flow meter and transmitter, and remote controlled valves to stop flow to the injection wells if needed for maintenance or to maintain Compressor Station operations.

Since the existing tanks are situated at an elevation above the Compressor Station, this will allow freshwater to be supplied to the injection wells without pumping (i.e., by using gravity to move the water).

3.3.2.3 Freshwater Injection Wells

Injection of freshwater extracted from Arizona into the wells is planned to be continuous to aid in reducing the time to cleanup. The anticipated nominal injection flow rate per well ranges from 50 to 100 gpm, and the anticipated maximum flow rate is 100 to 200 gpm per well. Injection wells will be constructed using up to 14-inch nominal diameter well casing with one or two discrete screened intervals. In-well components will include drop pipes, spring-loaded check valves or variable orifice valves, and pressure transducers for water level monitoring, submersible backwash pumps and piping, fittings, and controls/instrumentation.

The wellhead connections and control/monitoring devices (e.g., flow meters, flow control valves, water level sensors, and backflush pumping controls) will be contained within pre-cast concrete vaults. These vaults will be installed flush with grade or extended slightly above grade to allow well maintenance vehicles to drive over the wells for easier access. Well vaults will be equipped with removable covers that will be traffic-rated and may be protected from incidental impact by bollards that can be removed during maintenance activities. Two vaults will be provided at each well with one to house the well and one to house the valves and instruments.

3.4 Remedy-produced Water Management

The final groundwater remedy is reliant on over 50 wells used for the IRZ, freshwater and carbon-amended injection, and groundwater extraction. For all wells, especially for the injection and IRZ wells, regular maintenance such as backwashing and rehabilitation is vital to keep efficient and effective operations during the 30-year projected life of the remedy. Well maintenance will also prevent or reduce the need for drilling new replacement wells. These maintenance activities will produce an ongoing water stream that must be managed as part of the remedial action. Other types of produced water with smaller volumes will also need to be managed, such as monitoring well sampling purge water, equipment decontamination wastewater, and rainfall that collects in remedy facility secondary containment. Collectively, these types of water are called remedy-produced water. Exhibit 3-5 lists the remedy-produced water by source (activities that generate the wastewater) and type of wells (see also Table F-1 in Appendix F). The current estimated total volume of remedy-produced water is 7.3 million gallons per year.

EXHIBIT 3-5
Summary of Remedy-produced Water Volume by Source and Type
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Source/Type	Wells	Events/ Year	Annual Volume, MG/year [a]	Comments
Backwash				
Injection/IRZ Wells	41	30-52 [b]	4.7	Weekly backwashing
Well Rehabilitation				
Injection/IRZ Wells	41	1	2.1	Annual rehabilitation
Extraction Wells	14	0.2	0.1	Rehabilitation every 5 years
Other				
Rainwater	-	-	0.3	
Monitoring well sampling purge water and equipment decontamination water	-	-	0.1	
Total			**7.3**	

Notes:
[a] MG = million gallons
[b] IRZ wells will be operated on a 6 month on/18 month off cycle, so backwashes are assumed to be only 30 times per year.
See Appendix F for more detail.

Providing a reliable means of managing this wastewater is a critical component of the overall remedy. It is desirable that the remedy include more than one wastewater management option in order to not constrain remedy operation. Different waste streams may also require different management options.

Remedy-produced water management will entail transporting, conditioning, and disposal or reuse. This section provides a summary and the design basis for the remedy-produced water management system. Appendix F contains a detailed description of the sources of wastewater and the options considered for conveyance, conditioning, and disposal.

3.4.1 Transportation

Over sixty percent of the wastewater is created during well backwashing. This in large part is due to the planned weekly backwash of the injection and IRZ wells. Backwashing rates will be set at twice the injection rate (see Tables 3-1 to 3-4) for a period of 30 minutes of pumping on a 10 minutes on and 5 minutes off cycle. This approach, while beneficial for maintaining well efficiency, results in large volumes of water being generated in a short time. Therefore, the current design includes dedicated automatic backwashing systems connected to pipelines to convey the wastewater to a central water conditioning system located at the Compressor Station. This reduces the amount of time maintenance vehicles and crews are needed to maintain the wells and results in reduced vehicle traffic and emissions.

The wastewater pipelines will be installed in the same utility corridors for remedy piping to service the wells as shown on Figure 3-1. All utility corridors are located in existing roadways/ROWs or previously disturbed areas. Pipelines will be installed above or belowground consistent with the utility corridor.

Because the characteristics of the rehabilitation wastewater may not be known until it is pumped back out of the well, some of this water may be hauled by truck to the central water conditioning system initially and as required. Once it is determined that the rehabilitation water is suitable for transport by pipeline, it may be pumped using portable pumps connected to the pipeline via tee connections. The location of these connections will be shown in future design submittals. The benefit of this approach is to reduce vehicle traffic and speed up rehabilitation activities.

Rehabilitation wastewater from the HNWR-1 well (or other freshwater supply well) in Arizona will be trucked to the central water conditioning system at the Compressor Station and/or to an off-site disposal facility. The design does not include wastewater pipeline connecting the HNWR-1 well in Arizona to the network in California.

3.4.2 Reuse/Disposal Options and Conditioning

The water supply analysis in the EIR was based on the assumption that the final remedy would result in near- zero consumptive use of water. In order to minimize consumptive use, it is necessary to return as much of the remedy-produced water to the aquifer as possible. Therefore, reuse of water is one of the primary considerations for the design of the remedy-produced water management system. The most efficient way to return the remedy-produced water to the aquifer is through the network of NTH IRZ and Carbon-amended Injection Wells associated with the remedial action. An alternative method is through supporting facilities such as a dedicated infiltration gallery in Bat Cave Wash. Remedy-produced water might also be used as cooling water at the compressor station. Even though the wastewater would be evaporated in the cooling towers, it would offset the groundwater pumping that would otherwise be needed for cooling water and this option would therefore not be considered consumptive use.

The following four reuse/disposal options are carried forward in the design:

1. Trucking off-site
2. Discharge to TCS evaporation ponds
3. Reuse by blending with freshwater and use in TCS cooling towers
4. Reuse by blending with carbon-amended water and injection into Carbon-amended Injection Wells or NTH IRZ Injection Wells

The degree of conditioning needed is a function of how the remedy-produced water will be reused or disposed of, and the discharge requirements that are imposed. Exhibit 3-6 provides a summary of the various conditioning requirements and constraints associated with the different disposal options. If the water is to be injected back into the plume through the IRZ and Carbon-amended Injection Wells, it is assumed the water would need to be conditioned to a degree where it would not contribute to the fouling of the injection wells or disruption of the natural geochemistry in the aquifer near the injection wells (see Section 3.4.2.2 for a discussion of conditioning).

EXHIBIT 3-6
Reuse/Disposal Options and Associated Degree of Conditioning Required
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Reuse/Disposal Option	Conditioning Requirements	Other Constraints
1. Trucking off-site	No onsite conditioning is assumed for this option; any conditioning that is required for management of the produced water is assumed to be performed by the permitted receiving facility. All produced water sources are assumed to be acceptable to one or more offsite facilities.	This would require more than 1,200 trucks annually to remove all the produced water, so it is not desirable from an emissions and traffic safety point of view as a primary option. It would also result in consumptive use of all remedy-produced water.
2. Discharge to TCS evaporation ponds	Produced water must not be hazardous, If the pH is less than or equal to 2.0 (characteristic waste level), the water could not be disposed of in the TCS ponds.	This option is limited by the available capacity of the ponds, which is estimated to be between 500,000 and 1,000,000 gallons per year. Water discharged to the ponds would evaporate and therefore be considered consumptive use
3. Reuse by blending with freshwater and used in TCS cooling towers	The cooling towers need relatively clean water to keep operating efficiently. Therefore neutral pH, low concentrations of iron, manganese, and silica, or water quality similar to the current supply (low TDS, and low solids concentrations) is preferred to prevent fouling.	The cooling towers use 11 to 100 gallons per minute (based on a monthly average water usage from 2009 to 2010) depending upon the year and season. Produced water routed to the cooling towers would reduce the amount of groundwater pumped for cooling and should not be considered consumptive use.
4. Reuse by blending with carbon-amended water and injection into Carbon-amended Injection Wells or IRZ wells	These wells will have elevated levels of IRZ byproducts, carbon, and possibly chromium because they will be located within the chromium plume. Injection wells need similar water to the formation water to not cause adverse geochemical reactions that might precipitate or dissolve minerals. This means near neutral water (pH 6.5 to 8.5); elevated levels of IRZ byproducts and low chromium levels are acceptable since they will be taken care of in the reducing zone. Solids need to be filtered to prevent well clogging.	The produced water would need to be blended into the injected water stream and distributed among the wells so that hydraulic control is maintained. Produced water injected back in to the wells would not represent consumptive use.

Note:
Two reuse/disposal options for remedy-produced water previously considered, but are not proposed at this submittal include the Infiltration Gallery in Bat Cave Wash (pending completion of the Soil RFI/RI and CMS/FS) and the disposal at Moabi Regional Park sewage ponds.

3.4.2.1 Management Plan

The reuse/disposal plans for the various types of remedy-produced water differ. Multiple options are maintained to provide operational flexibility and reliability. Exhibit 3-7 describes the management plan. The plan is subject to change if underlying assumptions prove incorrect (such as assuming that injecting back into amended-water wells would not require removal of dissolved constituents). This plan is intended to be flexible and to evolve with operational experience during the groundwater remedy implementation. Additional description of the rationale is included in Appendix F.

EXHIBIT 3-7
Reuse/Disposal Management Plan for Water Produced During Final Groundwater Remedy
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Source	Volume (MG/year)	Management Plan – Listed in Order of Preference
Backwash of Freshwater Injection Wells	1.9	1. Compressor station cooling towers 2. Carbon-amended or IRZ injection wells Note: It is possible that during the first few months of operations, the water around the freshwater injection wells may have levels of chromium that will necessitate managing backwash water differently, such as Option 1 or Option 4 from Exhibit 3-6.
Backwash of NTH IRZ wells and Carbon-amended Injection wells	2.85[a]	Carbon-amended or IRZ wells
Well rehabilitation (all wells) - first flush	0.65[a]	1. TCS ponds 2. Trucked offsite
Well rehabilitation (all wells) – after first flush	1.5[a]	Same as backwash from corresponding well (i.e., freshwater or IRZ/carbon-amended)
Other water – cleaner streams	0.3	Relatively clean water, such as rainwater in containment and some decontamination water will be managed by the same means as the backwash water from Freshwater Injection Wells.
Other water – some purge and decontamination water	0.1	1. TCS ponds 2. Trucked offsite
Other water – wastewater from construction of wells in the future	Short-term	High-solids water: TCS ponds or truck offsite Low-solids water: carbon-amended or IRZ wells

Note:
MG = million gallons
[a] Ongoing testing of IRZ well maintenance schemes may lead to use of fewer backwash events but more frequent well rehabilitations. Assumed that roughly 30% of rehabilitation water will be high-solids or low-pH "first flush" water. Remainder assumed to be similar in nature to backwash water.

Possible Future Changes

As the Topock groundwater remedy operation progresses over its projected multi-decade life, there may be a need to optimize or otherwise change the system. Possible examples of changing conditions include new sources or characteristics of remedy-produced water, the need to further condition the water produced, new disposal or reuse options, or new waste discharge restrictions. These changing conditions may necessitate a change to the produced water management system, such as different, larger conditioning processes, which will in turn trigger the need for agencies' approval, Tribal consultation, and stakeholders' involvement.

3.4.2.2 Conditioning

Water Conditioning will be conducted primarily in a central system located at the Compressor Station. In some cases during well rehabilitation, mobile equipment may be used to condition the produced water at the well location. In the event that the produced water is hazardous, permitted transportable treatment units could be used.

To accomplish the degree of conditioning required and to support implementation of the management plan, the preferred system is solids removal with neutralization**.** Exhibit 3-8 shows the process schematic for this system. This is based on the assumptions that:

- Remedy-produced water that has significantly higher concentrations than what exists in the aquifer water will be sent to the TCS evaporation ponds, or transported offsite for disposal. The preferred approach is to send the water produced at the beginning of rehabilitation events to the TCS ponds (or truck offsite) and to manage the water produced later in the rehabilitation process by the same means as backwash water. The cutover from "early" stage to "later" stage is proposed to be defined through easily measured onsite water quality tests such as pH, turbidity, and conductivity.
- Flexibility for neutralizing low-pH water (with pH > 2.0) from well rehabilitations will be provided either through the produced water management system by caustic addition to the equalization tanks or by an alternative approach. Alternatives include sending the water to the TCS evaporation ponds, transporting to offsite disposal, or neutralizing with temporary permitted transportable treatment units at the well head.

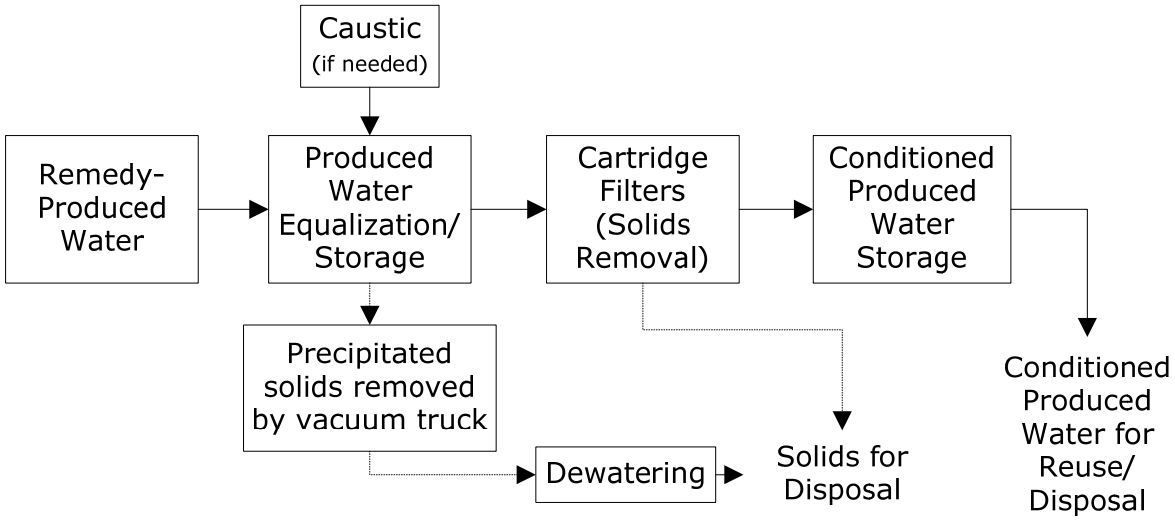


EXHIBIT 3-8
Remedy-produced Water Conditioning Process Schematic
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Under the management plan presented above, removal of dissolved constituents will not be required because the injected water quality will be similar to the aquifer water quality in/near the Carbon-amended Injection Wells, the IRZ wells, and the Freshwater Injection Wells. Temporary fluctuations in water quality that may occur within the remedy footprint during remedy implementation will ultimately result in achieving background water quality for hexavalent chromium when the remedy is complete, and institutional controls will prevent use of affected groundwater while the remedy is being implemented. Furthermore, contaminant migration to the river that could potentially affect water quality goals or beneficial uses does not occur during remedy implementation through

groundwater extraction along the river bank. PG&E believes that this interpretation is consistent with the requirements of the anti-degradation provisions of 40 CFR 131.12 and State Water Resources Control Board Resolution No. 68-16.

The design basis for the remedy-produced water conditioning system is shown on Exhibit 3-9.

EXHIBIT 3-9
Remedy-produced Water Conditioning System Design Criteria
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
Flow – Average	20 gpm	Best current estimate is 7.3 million gallons per year. If 80% uptime, system would process 18 gallons per minute while running.
Flow – Peak	35 gpm	To treat 50,000 gallons per day.
Equalization volume	>50,000 gal 4 tanks	Largest projected daily production of water is 50,000 gallons per day (during rehabilitation of largest injection well). Provide multiple tanks to allow segregation of varying types of produced water. At least one of the tanks will be fitted with mixers to aid in pH adjustment.
Effluent water quality requirements	TSS - < 5 microns pH – 6.5-8.5	Effluent TSS will be < 5 microns to limit injectivity loss in wells used for re-injection. Based on experience at Interim Measure No. 3, Hinkley, and other re-injection sites. Effluent pH will be 6.5 to 8.5 to achieve near neutral pH and not cause adverse geochemical reactions.
Solids dewatering	One dewatering system available at all times	Use phase separators (similar to those at Interim Measure No. 3) for dewatering non-hazardous solids precipitated during pH adjustment steps. Could also be used for the disposal of spent filter cartridges and solid wastes from future sampling.
Influent solids loading	Typical: 60 mg/L total suspended solids	Estimated value consistent with Hinkley results.
Degree of automation	Full	System is to be able to run un-manned (such as nights, weekends, and holidays). Automated to detect non-compliant effluent and shut down system.
Uptime	80%	System can be down for extended periods (~1 week) without jeopardizing well injectivity. Therefore, full system redundancy is not provided. However, where needed to facilitate operation, parallel systems will be installed, such as by installing parallel cartridge filters.
Operating time	24 hours per day	Using automation, the system will be able to run full time while unattended. The system will be designed for continuous and intermittent operation based on levels in the influent tanks.
Effluent discharge	Ability to convey water to all reuse/disposal options	Include connections to allow for trucking of unconditioned water from system effluent tanks.

Additional system components will include the following:

- Portable tanks (frac tanks) will be used to store unconditioned produced water. Frac tanks will be nominal 500-barrel (21,000-gallon) tanks of standard construction with epoxy coating on the steel. Tanks will be placed on level ground with secondary containment. At least one of the tanks will be fitted with mixers to aid in pH adjustment.
- Packaged duplex filter feed pump system complete with controls, electrical panel, valves, and appurtenances will be supplied on a base or skid fabricated of structural steel shapes. The steel will be factory coated. The pumps will operate with a primary and standby. The pumps will be able to supply 35 gpm peak flow at 80 pounds per square inch (185 feet total dynamic head).
- A packaged cartridge filtration system for solids removal will be installed as a two-stage system; the first stage micron rating will be determined by the vendor, and the second stage will be filtered to 5 microns (or less). The packaged system will include at least two pairs of vessels so that one pair is always in standby. The system will include differential pressure instruments with local indication and remote transmission. Electrical control valves will be supplied with the system to automatically divert or allow an operator to divert flow to stand-by filters when differential pressure exceeds operator adjustable set point. The packaged system will be installed on skid fabricated of structural steel shapes. The steel will be factory coated with epoxy. The filter housings will be fabricated of stainless steel or plastic to resist corrosion from 2,000 to 3,000 mg/L chloride in produced water. The system will include an electrical control panel on skid to supply 120-VAC power for instruments and other low voltage equipment.
- The pH neutralization system will include a chemical metering pump to inject 25 percent sodium hydroxide (caustic) into the supply pH probe, analyzer, controller for remote installation from chemical supply and pump. Based on currently available information from IM-3 wells, the pH range control will be 6.5 to 8.5 with operator adjustable set points. This range may be adjusted to match the aquifer conditions in the final remedy injection wells.
- Process piping will be Schedule 80 CPVC to resist corrosion and maintain system pressure under temperature conditions.
- A single steel tank will be installed near the freshwater storage tanks for conditioned produced water. The tank will be sized for 42,000-gallon capacity of standard steel construction with epoxy coating on the steel. The tank will be placed on level ground with secondary containment.
- Two phase separators will be used for solid liquid separation (primary/standby configuration). Separators will be placed in a sloped containment area. Liquids would drain to a sump or tank for return to the unconditioned produced water tanks and future conditioning.
- Two truck-loading stations will be installed for conditioned produced water. The stations will be equipped with a truck loading pump (150 gpm at 90 feet TDH), 4-inch cam-lock chemical resistant hoses, isolation valves, and electrical control panel. Permanent piping will be Schedule 80 PVC. The pumps will have motor with 480 volt, 3-phase electrical supply. Conditioned produced water will be pH 2.1-9 with chloride concentrations up to 2,000 to 3,000 mg/L. One station will be in the maintenance shops area in the Compressor Station and one located at the MW-20 Bench. The pumps and panels will be mounted on small wire mesh reinforced concrete pads. It is assumed an operator will be present during truck loading operations.
- Produced water conveyance (trunk line) piping will be HDPE, or Sch. 40 steel with AWWA C205 cement mortar lining. Pipe sizes will be 4 to 6 inch diameter on the main pipeline (see Appendix C for hydraulic calculations).
- Space will be reserved for the potential need to install granular activated carbon vessels to remove trace hydrocarbons from secondary containment or other sources. Vessels (two) are sized as nominal 1,000-pound capacity units as off-the-shelf standard units. These would be connected downstream of the filters.

- Coagulants or flocculants will be evaluated during the intermediate (60%) design for potential benefits in improving settling of suspended solids in produced water. If the use of these agents is determined to be beneficial, this would require the installation of chemical storage tanks, chemical feed or metering pumps, and controls.

3.5 Other Utilities and Supporting Facilities

Other utilities and supporting facilities needed to ensure proper operations include electrical power, monitoring and control systems (SCADA), as well as access roads, operator's facilities, equipment and materials storage, equipment maintenance and testing areas, office space, bathrooms, waste or refuse containers, and an onsite laboratory. Security provisions will be presented at the intermediate (60%) design after remedial facilities locations are reviewed and confirmed.

Details of the support systems are described in the design criteria (Appendix C, which includes calculations) and are shown in the drawings in Appendix D.

3.5.1 Electrical Power Supply and Distribution

The primary power usage is for pumping and the loads are based on the design flow rates shown in Sections 3.2 to 3.4 (see Appendix D for electrical load details). Electrical power will be supplied by the Compressor Station using the existing power grid. This grid will be comprised of the existing power generators and a new natural gas fired generator installed as part of the final groundwater remedy. The primary function of the power grid is to keep the Compressor Station operating properly.

The new generator will supply 375 kW and 480 VAC 3 phase power to match the existing power bus. The generator system will synchronize with the power bus and will provide load-sharing capability with the existing generators (P-Units). The generator will be installed in a building that is adjacent to the existing P-Units and will be connected to the power bus through a new circuit breaker installed in the existing power switchboard. The plant SCADA system will be configured to monitor the generator run and alarm status. The plant control system will be reprogrammed to shut down the remedy system first if the power being produced is not sufficient to power all necessary systems at the Compressor Station.

Emergency backup generation will be provided to supply power in the event of a service outage. The backup generation will be provided by an existing diesel fired generator. An existing automatic switch will start the generator in the event of an unplanned outage.

The remedy will be powered through a step-up transformer, which will transmit power along the pipeline route to serve the wells and other loads. At each load center, a step down transformer will return the voltage to 480 VAC 3 phase. Seven load centers are currently planned with a transformer and distribution equipment at each one. The transformers will range in size from 75 kilovolt-amperes (kVA) to 300 kVA. At each well or other load, a motor starter will be installed. Voltage will also be transformed to 120 VAC, single phase for instrumentation, lighting, and auxiliary loads. The medium voltage loop will consist of electrical cable installed in conduit. Transformers and electrical equipment will be mounted in underground vaults or aboveground on shallow concrete foundations.

Lightning protection systems and equipment will be provided for all equipment and structures. All electrical systems and equipment will be grounded.

3.5.2 Supervisory Control and Data Acquisition (SCADA) System

A SCADA system will be installed for controlling and monitoring the remedy. The SCADA equipment will be located in the main control room, inside the Operations Building. From the main control room, it will be possible to initiate operation of all pumps, monitor all system status and alarm data, change control set points, and perform all remote control functions. Specific details on implementation of the main control of the system will be developed during later stages the design. The main components of the SCADA include the following:

- A human–machine interface or HMI is the apparatus, which presents process data to a human operator, and through this, the human operator monitors and controls the process.
- A supervisory (computer) system, gathering (acquiring) data on the process, and sending commands (control) to the process.
- Remote terminal units (RTUs) connecting to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system.
- Programmable logic controller (PLCs) can be used as field devices because they are more economical, versatile, flexible, and configurable than special-purpose RTUs or they can be used in a supervisory control function.
- Communication infrastructure connecting the supervisory system to the remote terminal units.
- Various process and analytical instrumentation (e.g., flow, pH, and conductivity measurement)

The SCADA will communicate with numerous digital controllers. These devices will provide local control of one or more pieces of process equipment or process/mechanical systems. The data from the digital controllers will be displayed on the HMIs. The digital controllers will monitor their associated equipment or well status and associated instrumentation including – limit switches, flow rates, pressures, well levels, etc. The information from each well will be transmitted back to the main control station using wires, fiber optic communications, radio transmission or other wireless communication methods. Various other systems including carbon substrate amendment storage and dosing as well as the remedy-produced water conditioning process will be monitored and will have local process control capabilities at the equipment location(s) as well as remotely from the main control room.

3.5.3 Buildings and Structures for Major Equipment

Major equipment associated with the in-situ remediation system includes the carbon substrate amendment systems (carbon tanks, process tanks, storage containers, etc.), the CIP/maintenance system (frac tank, etc.), and other support facilities (i.e., the operations building). Major equipment associated with the remedy-produced water include storage tanks, phase separators, cartridge filters, on-site laboratory, and operator's control room. The following criteria were used to identify candidate locations for the major equipment:

- Previously disturbed areas;
- Avoiding cultural, archaeological, and historical resources;
- Areas of adequate space;
- Proximity to existing asphalt access roads, the Compressor Station, electrical and other utility services, remedy components (for service), and reuse/disposal options for remedy-produced water;
- Limited interference with existing infrastructure (especially major gas pipelines in the area); and
- Limited interference with Compressor Station operations during construction.

Based on these criteria, the NTH IRZ carbon substrate amendment system and CIP system will be located at the MW-20 Bench, and the smaller carbon substrate amendment system serving the TCS Injection Wells will be located at the Transwestern Meter Station Bench. These systems are discussed in detail in Section 3.2.

The remedy-produced water conditioning plant and other supporting facilities, including the operations building, will be located on the Compressor Station property. Since many of the new remedy structures are replacing existing station structures, the net change in building footprint is very small. Consistent with existing structures at the Compressor Station, the new structures will be pre-engineered metal buildings.

The new facilities are the remedy building, operations building, and restroom. The restroom sewer will be connected to the Compressor Station septic system. Space is allotted for 2 personnel on duty including a plant manager, and a technician. The technician will operate and maintain the remedy system. Additional technicians will be needed for future sampling and monitoring, but the extent of the monitoring program is not yet defined. The technicians will spend the majority of their time in the field performing sampling, maintenance, and inspections. The remedy building contains the conditioning equipment as described in Section 3.4. The operations' building contains working space, and a laboratory. The laboratory will be used for basic wet chemistry analysis and colorimetric methods for chromium, IRZ byproducts, and basic water quality parameters. The laboratory will be equipped with sinks and a waste tank. The lab will also include bench space for testing similar to laboratory in the IM-3 treatment plant building. In addition, there will be space for equipment and materials storage, and a tool/working area. The working spaces will be air-conditioned.

Several locations have been identified for influent remedy-produced water storage tanks (see Figure 3-1). This allows for flexibility to move the tanks around in order to accommodate future TCS emission reduction and other operation projects. Piping will be installed to serve the tanks at each of these locations.

3.5.4 Access Roads and Pathways

To the extent necessary, new access roads will be built to service remedial structures (buildings, wells, specific cleanout locations, etc.) which will require frequent maintenance and upkeep. For facilities needing less frequent maintenance, or facilities located in areas with sensitive habitats, PG&E's preference is to use access pathways that can be restored after use, rather than establishing permanent roads to each location. PG&E will work with the affected landowners on access routes and details. Access roads/pathways will be included in the intermediate (60%) design along with the monitoring well network.

If access roads need to be built, the route may be graded and drainage systems may be established. In addition, grading near well vaults or aboveground structures may be necessary to enable maintenance vehicles to reach the well and perform necessary work. Roads may be built with native materials sourced from the site based on balancing cut-and-fill or if needed imported fill may be used. Roads will be built by compacting subgrades and then placing and compacting a surface layer of base rock or soil. Drainage features (ditches, erosion protection, culverts) will likely require imported materials including different types of rock to serve different purposes. Native rocks will also be used as feasible. Design criteria are described in Appendix C; more construction details will be included in the intermediate (60%) design.

SECTION 4

Operations and Maintenance Provisions

Key O&M provisions factored into the preliminary design of the in-situ remediation system, the freshwater supply, the remedy-produced water system, and other support facilities are discussed in Section 3. These provisions include but are not limited to the following:

- The carbon dosing cycle of 6 months on and 18 months off was factored into the design.
- Preliminary well maintenance methods and the list of chemical reagents were discussed.
- The need for frequent backwash for the NTH IRZ and injection wells to maintain overall well efficiency was a major design factor for the remedy-produced water piping to allow for automatic backwash.
- The backwash frequency and duration was a major factor in the sizing of the remedy-produced water conditioning system.
- The need for frequent cleaning of the main pipelines to prevent clogging drove the design of the CIP system.
- The shared use of the existing Compressor Station power system and the freshwater tanks were evaluated from both an infrastructure and an operational standpoint, and reflected in the design.
- For remedial systems located at the Compressor Station, considerations to limit interference with current station operations and the future emissions reduction project have been and are factored into the design.
- The projected 30-year life of the remedy has been and is factored into the design criteria (e.g., selection of materials, degree of automation, selection of certain equipment, etc.).
- Considerations for operational redundancy and future flexibility are evaluated during the design, and balanced against the additional infrastructure needed to support redundancy, (e.g., the looped freshwater piping system).
- An evaluation criteria used in selecting locations of major equipment and structures/buildings was proximity to the Compressor Station and access roads for ease of maintenance, etc.

In conformance with the 1996 CACA and the 2009 CERCLA Model RD/RA CD, a draft O&M plan will be submitted with the intermediate (60%) design submittal. The requirements for the O&M plan specified in the CACA and CERCLA Model CD are listed below:

- Project management and organization
- Communication procedures and protocols
- System description
- Personnel training
- Start-up procedures
- O&M procedures - description of tasks for O&M, including well rehabilitation methods and chemicals use, description of prescribed treatment or operation conditions, and the O&M schedule
- Equipment replacement schedule
- Waste management practices, including types of wastes to be generated and how each type of waste will be managed
- Sampling and monitoring plan during system operation (including data quality objectives, Quality Assurance Project Plan)
- O&M Quality Assurance Project Plan (QAPP)

- Corrective measure completion criteria
- O&M contingency plans to address potential failure modes, e.g.,
  - Related to attainment of RAOs and ARARs compliance
  - Related to system breakdowns and operational problems
  - Related to major operational problems and performance not to design specifications
  - Related to unforeseen events that prevent the operation of the groundwater remedy (e.g., acts of God such as earthquakes, flooding, fires)
- Data management and documentation requirements, including a description of how analytical data and results will be evaluated, documented, and managed
- Details for the collection/maintenance of information.
- Summary of access, approvals, and substantive requirements of ARARs associated with permits (e.g., Report of Waste Discharge)

This sampling and monitoring plan will describe the monitoring network (including existing and new locations), sampling objectives with target ranges for gradients and concentrations, analytical parameters, analytical methods, sampling frequencies, sampling procedures and equipment, sample preservation, sample packing, QA/QC samples, sample paperwork and chain-of-custody procedures, sample handling and shipping, and planned uses of the data. The content of this sampling and monitoring plan will be built upon the preliminary framework presented in the CMI/RD Work Plan (CH2M HILL 2011f), Section 2.3 (Corrective Measure/Remedial Action Monitoring Program) and will incorporate inputs/comments received from DTSC, DOI, and interested Tribes on this subject.

SECTION 5

Institutional Controls

Institutional controls (ICs) are a component of the selected final groundwater remedy. These are legal and administrative mechanisms adopted to limit or prohibit activities on specified property that could interfere with the integrity of the remedy or compromise the continued protection of human health and the environment. The target timeframe for having the ICs in place is prior to remedy construction. It is anticipated that most of these controls would remain in place for the duration of the remedy; that is, until the RAOs are achieved. The ROD indicated that the ICs adopted by the selected groundwater remedy for the Topock site are consistent with the key land use decisions specified in the *BLM Lake Havasu Field Office Resource Management Plan* issued in May 2007 (BLM 2007) and the long range management strategies and emphases specified in the *1994 Lower Colorado River National Wildlife Refuges Comprehensive Management Plan* (USFWS and BOR 1994). These plans identify the policies and management principles for defining surface uses and use of the groundwater on federal lands.

The SOB (DTSC 2011) stated that due to the incomplete evaluation of soil contamination at the Site and the potential unacceptable risk to a future hypothetical groundwater user during the O&M of the remedy, the selected groundwater remedy requires that certain restrictions be imposed on future land use activities. Restrictions are necessary to protect human health and the environment, and to maintain the short and long-term protectiveness of the remedy. The SOB further stated that the restrictions may be imposed through a "Covenant to Restrict Use of Property" (Covenant), which is an enforceable IC mechanism. In its remedy decision letter to PG&E dated January 31, 2011, DTSC directed PG&E to negotiate all necessary land use covenants and restrictions required for the protection of the remedy with DTSC, and to file all such required restrictions with the County Recorder.

An RAO for the final groundwater remedy is to prevent ingestion of groundwater as a potable water source having Cr(VI) in excess of the regional background concentration of 32 µg/L. This RAO will be achieved by prohibiting the installation of potable water wells within the plume area until concentrations within the plume are below the cleanup goal.

The selected final groundwater remedy includes pumping and injecting groundwater to maintain hydraulic conditions so that the chromium plume moves through the treatment zone in the designed direction and at the designed rate. Pumping groundwater is a critical element of the remedy and thus needs to be protected whether it involves pumping from the River Bank Extraction Wells in California or a freshwater supply well in Arizona. Satisfactory performance of the remedy depends upon the control of groundwater flow directions and the gradients necessary to contain and remediate the chromium plume. The remedy also includes several physical elements (wells, pipelines, facilities, etc.) that will need to be protected to ensure that the RAOs can be met.

Based on the principles and directives outlined in the ROD and the SOB, potential future restrictions could be categorized as follows:

- **Category 1 ICs – the objective of these ICs is to prevent the use of groundwater and to protect the hydraulic integrity of the remedy.** This objective will be met by prohibiting the installation of new groundwater wells, in specified areas, for purposes other than site investigation and remediation activities directed by DTSC and DOI.

- **Category 2 ICs - the objective of these ICs is to protect the integrity of the physical elements of the remedy and to ensure access for O&M.** This objective will be met by restricting future development and surface uses of the land, in specified areas, that could compromise the integrity of the remedial facilities or otherwise interfere with the operation of the facilities and the ability for PG&E to monitor, operate, and maintain the remedy.

Further analysis may result in one or more additional categories of objectives of ICs and associated activities to be restricted. The land use considerations included in the management plans identified above will be incorporated into restrictions on federal lands. Key parameters needed to establish ICs include definition of the area(s) and

properties over which the ICs should be applied, location of remedial facilities, activities to be conducted or restricted, and the identification of appropriate mechanisms needed to impose the controls on each property within the area of the ICs.

5.1 Define Areas for Future Restrictions

The area over which to apply **Category 1** restrictions will include at a minimum, the entire footprint of the chromium plume and any additional area outside of the plume footprint where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume. To assist with defining this additional area, the existing groundwater flow model was used to simulate future hypothetical groundwater pumping scenarios from outside the plume area. The pumping scenarios include high-volume groundwater pumping (e.g., irrigation well) to the northwest at either Moabi Regional Park or along the eastern edge of San Bernardino County leased land, and a domestic water supply well (assuming one household with no lawn or swimming pool) within the BOR property area to the west of the plume and north of BNSF Railroad (APN 650-151-03 on Figure 5-1). Results from these initial simulations suggest an area for **Category 1** restrictions as depicted in Figure 5-1. Additional simulations will be conducted to verify this initial finding if the remediation well configuration changes and as new hydraulic data collected prior to the remedy implementation are incorporated into the groundwater flow model.

The area over which to apply **Category 2** restrictions will include at a minimum, the areas with planned groundwater remedial structures (i.e., wells, pipelines, facilities, etc. to be built in 2013-2014). With the exception of the groundwater monitoring network, the locations of planned remedial structures are presented in this preliminary design. Where possible, for planning purposes, future remedial structures (i.e., additional infrastructures to be built after 2014) are also included in the preliminary design in grey out mode.

Tables 5-1A and 5-1B provide an initial listing of potential ICs associated with federal and non-federal lands, respectively (see Figure 5-1 for locations of cited lands/properties). PG&E will work with the Agencies and property owners/parties with other interests to advance the establishment of ICs prior to remedy construction.

5.2 Identify and Evaluate Appropriate IC Mechanisms

As stated above, the SOB identified Covenants as an enforceable IC mechanism, and DTSC directed PG&E to negotiate all necessary land use covenants and restrictions required for the protection of the remedy with DTSC, and to file all such required restrictions with the County Recorder. With respect to privately-owned lands, PG&E will obtain Covenants from existing landowners or employ other mechanisms presently under review, as appropriate.

SECTION 6

Preliminary Evaluation of Approvals, Permits, and Easements/Access Requirements

As required by the 2009 CERCLA RD/RA Model Consent Decree and the 1996 CACA, this section presents a preliminary evaluation of approvals, permits, and easements/access requirements to implement the selected final groundwater remedy as presented in the preliminary (30%) design. This evaluation will be refined and presented again at the intermediate (60%) design stage when locations of remedial structures are expected to be confirmed.

In general, implementation of the selected final groundwater remedy will require approvals of the final design and the Construction/Remedial Action Work Plan from DTSC and DOI pursuant to the authority under RCRA and CERCLA, respectively. Approvals/permits/agreements for access to federal and non-federal lands will also be required to construct, operate, and maintain the planned remedial structures. These are not different from the Category 2 Institutional Controls discussed in Section 5, to ensure access for construction, operation, and maintenance of the remedy until the RAOs are achieved.

6.1 Anticipated Approvals for Access to Federal Lands

Remedial structures are planned on federal lands, including lands owned by BOR (managed by BLM), BLM, and HNWR (managed by USFWS). It is PG&E's understanding that DOI's approval of the forthcoming Remedial Action Work Plan constitutes permission to implement the selected final groundwater remedy and authorization to access federal property. No other application of approval for access to federal lands will be required before field implementation. In addition, the process required for compliance with ARARs is addressed in Section 7 of this report, and there is not a separate process for compliance required for access to federal lands.

6.2 Anticipated Approvals/Permits/Agreements for Access to Non-Federal Lands

Remedial structures are planned on non-federal lands, including lands owned by states (State of California, State of Arizona), local governments (San Bernardino County, Mojave County), transportation agencies (California Department of Transportation [Caltrans], Arizona Department of Transportation [ADOT]), BNSF Railroad, utility companies, the Fort Mojave Indian Tribe, and private property owners.

The selected remedy is being conducted under the authority of CERCLA Section 104 and is therefore exempt from obtaining federal, state, or local permits or complying with other administrative requirements, pursuant to CERCLA Section 121(e). However, PG&E will still be required to comply with the substantive requirements of the identified location- and action-specific ARARs. Below is a preliminary list of anticipated approvals/permits/ agreements for access to non-federal lands:

- Encroachment permits from Caltrans and ADOT for pipeline segments under I-40
- Encroachment permits from BNSF for pipeline segments under BNSF railroad track
- Encroachment permits from the San Bernardino and Mojave counties for infrastructure in the county roadways or their ROWs
- Access agreements with utility companies for remedial structures on their lands/easements/ROWs
- Access agreements with private property owners for remedial structures on their lands

It should be noted that under the Settlement Agreement between PG&E and the Fort Mojave Indian Tribe, PG&E has access to the land owned by the Fort Mojave Indian Tribe (FMIT) to implement the selected final groundwater remedy.

As mentioned above, these approvals/permits/agreements for access to non-federal lands are not different from the Category 2 ICs, previously discussed in Section 5. It is envisioned that, where available, a single vehicle will serve the need for implementation of the remedy.

SECTION 7

Compliance with ARARs and EIR Mitigation Measure Monitoring Program

This section provides a summary of compliance with the EIR mitigation measures and the identified ARARs at the preliminary (30%) design stage.

7.1 Summary of Compliance with EIR Mitigation Measures

There are 154 mitigation measures from the EIR that address nine resource areas including aesthetic, biological, air quality, cultural, geology and soils, hazardous materials, hydrology and water quality, noise, and water supply. A summary of actions taken or to be taken in compliance with the EIR mitigation measures is presented in Table 7-1.

Communications and outreach are key elements in all phases of project implementation. The EIR MMRP mandates various outreach efforts and periodic reporting of specific items (such as human-caused disturbance to project facilities and activities under the grant program). In compliance with the EIR mitigation measures CUL-1a-8a (protocols for continued communication), CUL-1a-2 (communication logs), CUL-1a-3b (report of human-caused disturbances), and CUL-1a-11 (annual report of activities under grant program), the outreach efforts/ communications between PG&E and the Tribes to this point during the design of the final groundwater remedy are presented in Table 7-2.

7.2 Summary of Compliance with Identified ARARs

The ARARs include chemical-specific, location-specific, and action-specific ARARs of federal, California, and Arizona laws and regulations. Because the RAOs were developed based on identified chemical-specific ARARs, attaining the RAOs will result in compliance with the chemical-specific ARARs. Until the RAOs are attained, ICs will be maintained to prohibit development of drinking water supply wells within the plume and any additional area outside of the plume footprint where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume. One specific RAO is to reduce the mass of Cr(T) and Cr(VI) in groundwater at the site to achieve compliance with ARARs in groundwater; this RAO will be achieved through the cleanup goal of regional background of 32 μg/L of Cr(VI).

Because the final groundwater remedy is a CERCLA response action, activities conducted onsite are covered under the permit exemption codified in Section 121(e)(1) of CERCLA. While the permit exemption applies to the administrative or procedural elements (e.g., preparing and submitting permit applications), the substantive requirements of the ARARs remain.

There are 57 ARARs that address several resource areas including biological, air quality, cultural, hazardous materials, and waterways (6 chemical-specific, 38 action-specific and 13 location-specific). A summary of the actions taken or that will be taken to comply with the identified ARARs is presented in Table 7-3.

SECTION 8

Project Delivery Strategy/Updated Schedule

The 2009 CERCLA Model RD/RA Consent Decree requires a discussion of the project delivery strategy at the preliminary (30%) design stage. Because explicit details regarding this requirement were not provided in the CERCLA model CD, the content of this section was developed using the *Guidance on EPA Oversights of Remedial Designs and Remedial Actions Performed By Potentially Responsible Parties, Interim Final, EPA540-G-90/001* (USEPA 1990). Section 4.1.2 (Design Support) of the USEPA Guidance defines "project delivery strategy" as a management approach to implementing the groundwater remedy and states that it normally discusses the following items:

- Health and safety considerations *(see Section 8.1)*
- Procurement method and contracting strategy *(see Section 8.2)*
- Phasing alternatives *(see Section 8.3)*
- Review requirements *(see Section 8.4)*
- Design schedule *(see Section 8.5)*
- Contractor, labor, and equipment availability concerns *(see Sections 8.2 and 8.5)*
- Requirements for addressing sampling and data gathering methods (Field Sampling Plan), quality assurance considerations (Construction Quality Assurance Plan), and air emissions and spill control requirements (Contingency Plan) *(see Section 8.4).*

Each of these items is discussed below. At this preliminary (30%) design stage, some of the items will have more details than others. Where further details are forthcoming, a specific report or document with the anticipated details is identified.

8.1 Health and Safety Considerations

The PG&E Topock project team is committed to executing this project with zero safety incidents. Project protocols have been and will continue to be implemented and enforced to ensure safety for the project team members as well as site visitors, including Tribal Monitors, regulatory agencies, and interested stakeholders.

The preliminary (30%) design includes health and safety design criteria in Appendix C. As the remedial design and the implementation of the remedial action progress, Health and Safety Plans (or addendums or revisions, as appropriate) will be prepared for future field activities including, but not limited to, construction and O&M of the final groundwater remedy. Each contractor performing field work will be responsible for preparing and complying with the standards and procedures in its project-specific health and safety plan. As required by the EIR mitigation measure HAZ-2c, project-specific health and safety plan(s) will be submitted to DTSC prior to beginning any ground disturbing activities.

8.2 Procurement Methods/Contracting Strategy

For this project, PG&E plans to use pre-qualified contractors, where appropriate and available, especially those who have prior experience working at Topock to save time on procurement, to reduce time spent on the learning curve, and to reduce the potential for delays/conflicts during implementation. All contracting will follow PG&E's requirements and protocols including PG&E's Supplier Diversity Program. At this preliminary (30%) design stage, there are no labor or contractor concerns.

8.3 Phasing Alternatives/Transition from Interim Measure to Final Remedy

Transition from the Interim Measure to the final groundwater remedy is a key factor in phasing the remedy implementation. The Revised Groundwater CMI/RD Work Plan (CH2M HILL 2011f) discusses considerations and the potential decision process for transitioning from IM-3 to the final groundwater remedy. The CMI/RD Work Plan also discusses specific ways the IM gradient control/pumping rate metrics or the operation of the IM wells or treatment plant may be incompatible with the construction and start-up of the final groundwater remedy, which will need to be addressed during planning for the transition between the IM and groundwater remedy. This section provides a description of a proposed plan for the transition. The description includes the following elements:

- The criteria used to evaluate the transition alternatives
- The key criteria that were the basis for the proposed transition scenario
- A summary of the proposed transition scenario
- The critical design and sequencing elements of the proposed transition scenario

The objectives of this effort were to conduct a preliminary evaluation of conceptual alternatives for transition from the IM to the final groundwater remedy, and to present a preferred plan for additional evaluation and discussion.

8.3.1 Criteria Used to Evaluate the Transition Alternatives

The following criteria were used in the preliminary evaluation of the conceptual alternatives for transitioning from the IM to the final groundwater remedy:

1. Duration of IM Operation
   a. Minimize duration of IM operation
   b. Minimize duration of the transition period between the IM and the final groundwater remedy
2. Water Quality
   a. Minimize the concentrations of manganese, iron, arsenic, and TOC reaching the IM while it is in operation
   b. Minimize the concentrations of in-situ remediation by-products reaching River Bank Extraction Wells and Carbon-amended Injection Wells
   c. Minimize chromium going to upland groundwater
   d. Consider the ability to restart the IM treatment plant during initial groundwater remedy start-up
3. IRZ and Inner Loop Recirculation System Performance
   a. Minimize interference to IRZ development caused by IM pumping
   b. Establish IRZ cut-off as quickly as possible
   c. Control and reduce the mass of chromium in the floodplain as quickly as possible
   d. Minimize migration of the chromium plume into the floodplain during groundwater remedy start-up
   e. Contain the footprint of the chromium plume to the west
4. Other
   a. Ease of ability to meet the IM discharge quality metric
   b. Ease of ability to meet the IM gradient metric
   c. Control of implementation risks during initial implementation of the NTH IRZ

The key criteria (those considered the most important in the preliminary evaluation) included:

1a) Minimize duration of IM operation
3c) Control and reduce the mass of chromium in the floodplain as quickly as possible
3d) Minimize migration of chromium plume in the floodplain during remedy start-up
4c) Maximize control of implementation risks during initial implementation of the NTH IRZ

8.3.2 Evaluation of Proposed Transition Plan

The results of this preliminary evaluation have lead PG&E to propose a transition scenario in which the IM would be taken off-line once the final groundwater remedy is constructed and is ready to be brought online. The proposed plan described below provided the best balance of the criteria described in Section 8.3.1. The proposed plan would meet the key criteria most consistently by:

- Minimizing the duration of the transition period between the IM and final remedy by:
  - Ceasing operation of the IM as quickly as possible, consistent with stakeholder requests.
  - Minimizing the time required to bring the final groundwater remedy online.
- Controlling and reducing impacts in the floodplain as quickly as possible by:
  - Reducing the time required to bring the final groundwater remedy online by establishing the in-situ barrier as quickly as possible.
  - Bringing the entire NTH IRZ online at one time to ensure that the in-situ barrier is as completely and uniformly established as possible.
- Minimizing migration of the chromium plume during final groundwater remedy start-up by:
  - Reducing the duration of time required to bring the final groundwater remedy online to establish the in-situ barrier as quickly as possible.
  - Bringing the entire NTH IRZ online at one time to ensure that the in-situ barrier is as completely and uniformly established as possible.
  - Bringing the Carbon-amended Injection Wells and Freshwater Injection Wells online as quickly as possible to increase the hydraulic gradient towards the NTH IRZ and enhancing treatment of chromium-contaminated groundwater as quickly as possible.
- Controlling implementation risks by:
  - Minimizing/eliminating any additional infrastructure that could be required to accommodate a partial or step-wise transition.
  - Eliminating any detrimental effects of the IM extraction wells on the development of the NTH IRZ by turning off the IM extraction wells and allowing the distribution of carbon-amended groundwater to be as complete and uniform as possible.
  - Eliminating any potential IM O&M complications (including additional waste generation) by turning the IM extraction wells off while the NTH IRZ is being established.

8.3.3 Implementation

The proposed plan relies on rapid termination of IM operation and a step-wise start-up of the final groundwater remedy (see Exhibit 8-1). The transition plan would generally proceed as follows:

- As soon as the NTH IRZ wells, River Bank Extraction Wells, Freshwater Injection Wells, East Ravine Extraction Wells, and extraction wells northeast of the TCS are built and are ready to be brought online, along with all their associated pipelines, controls, and electrical and mechanical systems, the IM system (extraction, treatment, and injection) will be turned off.
- Once the IM is turned off the NTH IRZ carbon substrate injections will begin and the NTH IRZ cut-off line will be established. This step could be completed 6 to 12 months after start-up.
- Once the NTH IRZ is established, the freshwater injection system will be brought online to begin enhancing the riverward gradient to enhance migration of the hexavalent chromium impacted groundwater toward the IRZ wall. This step could take 3 to 6 months.

- Subsequently, the Inner Recirculation Loop will next be initiated (i.e., start-up of River Bank Extraction Wells and Carbon-amended Injection Wells). This step could take 3 to 6 months.
- Simultaneously to the start-up of the River Bank Extraction Wells, the East Ravine Extraction Wells and extraction wells northeast of TCS will be engaged and begin delivering water to the NTH IRZ wells. This step could take 3 to 6 months.

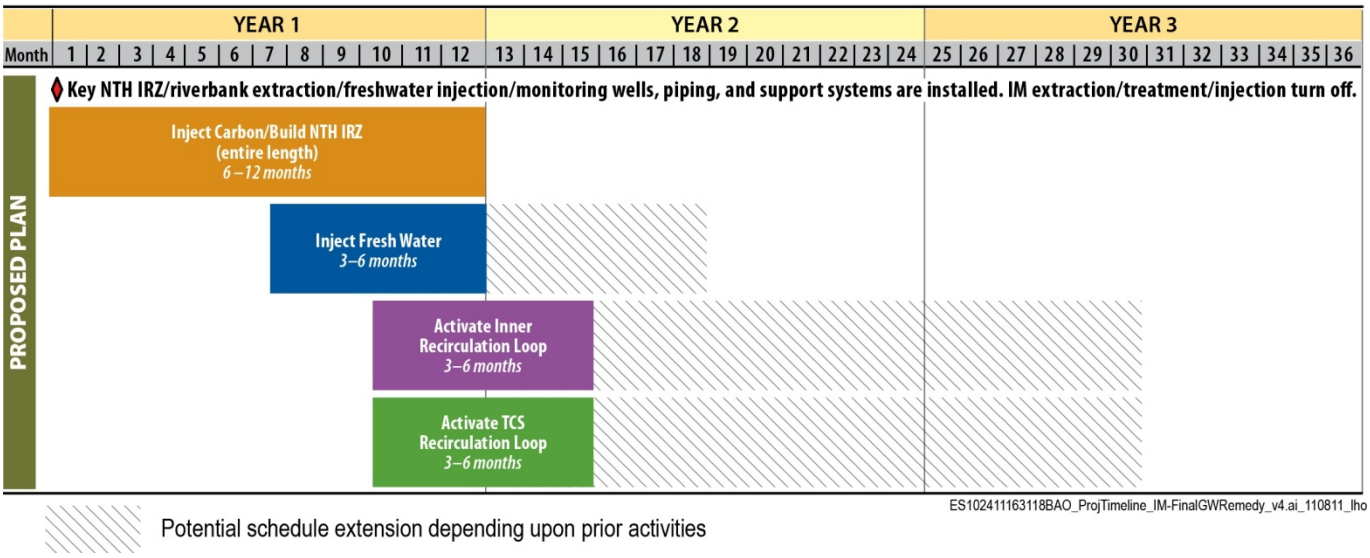


EXHIBIT 8-1
Project Timeline for Implementation of Proposed Transition Plan
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

In summary, the proposed plan provides for the most rapid termination of the IM operation and the least interference from the IM system during the final groundwater remedy initiation. It provides for the most rapid cut-off of the primary plume mass from the floodplain and therefore the most rapid reduction of mass in the floodplain; it minimizes chromium plume migration by rapidly establishing the IRZ cut-off line; and minimizes implementation risks such as the risk of interference from IM pumping during initial implementation of the NTH IRZ.

In a worst-case scenario, operation of the IM pumping could interfere with the remedy start-up and lead to a process failure over portions of the NTH IRZ line (incomplete distribution of carbon substrate and gaps in the NTH IRZ barrier). The downside of complete shutdown of the IM system upon final groundwater remedy start-up is that the hydraulic control exerted by the IM pumping would end. From a hydrogeologic perspective, this is not a significant concern due to the slow migration rate and the presence of the reducing rind.

8.4 Submittals and Review Requirements

Exhibit 8-2 at the end of this section presents the review requirements for the preliminary (30%), intermediate (60%), and pre-final (90%)/final (100%) submittals. Tables 8-1 and 8-2 map the requirements of the 1996 CACA and 2009 CERCLA Model RD/RA Consent Decree to the design documents, and other future documents. Table 8-3 provides the content and packaging of key documents. These tables were also presented in the Revised CMI/RD Work Plan (Tables 4-1A, 4-2A, and 4-5 in CH2M HILL 2011f).

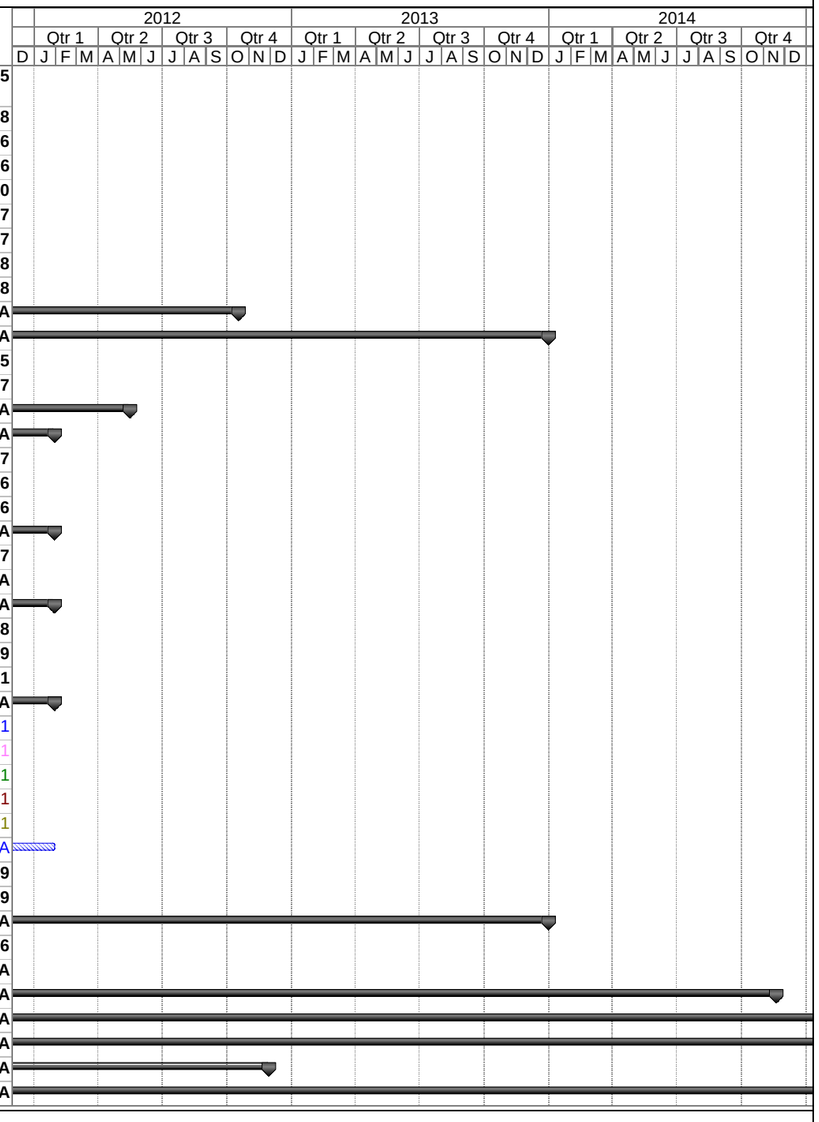
8.5 Updated Project Schedule

The updated project schedule is presented in Exhibit 8-2. A summary of the schedule updates at this preliminary (30%) design stage is listed below:

- CMI/RD Work Plan (Lines 1373-1376) – The schedule was updated to show the completion of the review of the redline Work Plan, the issuance of the Revised Work Plan, and the approval of the Revised CMI/RD Work Plan by DOI.
- Remedial Design (Lines 1377 through 1415) – No change. An update will be provided, as appropriate, at the intermediate (60%) design stage.
- ROWs/Easements/Landowner Agreements/Approvals (Lines 1416-1417) – No change. More details/ update will be provided at the intermediate (60%) design stage after remedial facilities locations are confirmed.
- Community Outreach (Lines 1419 through 1428) – No change. An update will be provided, as appropriate, at the intermediate (60%) design stage.
- Construction (Lines 1429-1439) – Added monthly progress reports during construction. More details will be provided in terms of sequencing and duration at the intermediate (60%) stage after remedial facilities locations are confirmed. A detailed construction schedule (including work breakdown structure [WBS]) will be developed as part of the forthcoming Construction/Remedial Action Work Plan; this schedule will be incorporated into the Rainbow Schedule to the extent needed for additional critical path analysis during construction.
- Startup (Transition from IM to final groundwater remedy) (Lines 1440-1447) – Added the timeline for implementation of the proposed IM to final groundwater remedy transition presented in Section 8.3.3. Added quarterly progress reports during startup period.

EXHIBIT 8-2
Updated Project Schedule
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRELIMINARY (30%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

ID	Task Name	Duration	Forecasted Start	Forecasted Finish	Actual Start	Actual Finish
1	**IM Installation (Note that IM3 is currently in operation and will remain in operation until directed otherwise by agencies)**	**512 days**	**Thu 1/22/04**	**Tue 12/20/05**	**Thu 1/22/04**	**Tue 12/20/05**
32	**IM3 Cultural Resources Management Plan (IM3 CRMP)**	**986 days**	**Thu 7/1/04**	**Mon 3/10/08**	**Thu 7/1/04**	**Mon 3/10/08**
37	**Extraction Well PE-1/Facilities**	**230 days**	**Mon 3/21/05**	**Fri 1/27/06**	**Mon 3/21/05**	**Fri 1/27/06**
47	**Supplemental Extraction Well and Facilities**	**127 days**	**Fri 7/29/05**	**Thu 1/19/06**	**Fri 7/29/05**	**Thu 1/19/06**
55	**Decommissioning of IM2 Batch Treatment**	**1182 days**	**Fri 8/5/05**	**Fri 1/29/10**	**Fri 8/5/05**	**Fri 1/29/10**
66	**Interim Measures and Treated Water Management**	**751 days**	**Mon 5/3/04**	**Fri 2/16/07**	**Mon 5/3/04**	**Fri 2/16/07**
210	**Public Participation Plan**	**578 days**	**Mon 12/20/04**	**Fri 2/9/07**	**Mon 12/20/04**	**Fri 2/9/07**
219	**Baseline Resources Assessments**	**897 days**	**Mon 11/1/04**	**Mon 3/10/08**	**Mon 11/1/04**	**Mon 3/10/08**
233	**Sitewide CEQA Documentation**	**586 days**	**Wed 5/17/06**	**Fri 8/1/08**	**Wed 5/17/06**	**Fri 8/1/08**
237	**Programmatic Biological Assessment (PBA)**	**1531 days**	**Tue 12/19/06**	**Wed 10/17/12**	**Tue 12/19/06**	**NA**
253	**REMEDIAL FACILITY INVESTIGATION/REMEDIAL INVESTIGATION (RFI/RI)**	**4685 days**	**Sat 2/24/96**	**Tue 12/31/13**	**Sat 2/24/96**	**NA**
254	**Historical RFI/RI Reports (Feb. 2005 and Prior Versions)**	**2455 days**	**Sat 2/24/96**	**Fri 7/8/05**	**Sat 2/24/96**	**Fri 7/8/05**
272	**Prepare Site History Report (Vol 1)**	**466 days**	**Tue 11/15/05**	**Wed 8/15/07**	**Tue 11/15/05**	**Wed 8/15/07**
287	**Prepare RFI/RI Vol 1 Addendum**	**1271 days**	**Wed 7/11/07**	**Wed 5/16/12**	**Wed 7/11/07**	**NA**
311	**Prepare Final Groundwater RFI/RI (Vol 2)**	**1739 days**	**Mon 6/27/05**	**Mon 1/30/12**	**Mon 6/27/05**	**NA**
312	**Response to comments on Feb. 2005 RFI/RI Report**	**258 days**	**Tue 10/3/06**	**Wed 9/19/07**	**Tue 10/3/06**	**Wed 9/19/07**
319	**Floodplain Data Gap Investigation**	**93 days**	**Fri 1/6/06**	**Fri 5/12/06**	**Fri 1/6/06**	**Fri 5/12/06**
322	**Pore Water and Seepage Study**	**151 days**	**Mon 6/27/05**	**Tue 1/17/06**	**Mon 6/27/05**	**Tue 1/17/06**
335	**Additional Plume Characterization Investigation**	**1402 days**	**Fri 9/29/06**	**Mon 1/30/12**	**Fri 9/29/06**	**NA**
336	**CA Slant Drilling**	**305 days**	**Fri 9/29/06**	**Wed 11/21/07**	**Fri 9/29/06**	**Wed 11/21/07**
384	**AZ Groundwater Investigation**	**657 days**	**Fri 12/1/06**	**Fri 5/29/09**	**Fri 12/1/06**	**NA**
454	**Additional Investigation**	**1387 days**	**Fri 10/20/06**	**Mon 1/30/12**	**Fri 10/20/06**	**NA**
455	**PGE-7/PGE-8 Hydraulic Test and PGE-6 Decommissioning**	**393 days**	**Fri 10/20/06**	**Mon 4/14/08**	**Fri 10/20/06**	**Mon 4/14/08**
518	**East Ravine Groundwater Investigation**	**516 days**	**Mon 10/29/07**	**Mon 10/19/09**	**Mon 10/29/07**	**Mon 10/19/09**
556	**East Ravine Groundwater Investigation Phase 2/TCS wells**	**264 days**	**Thu 2/25/10**	**Thu 2/24/11**	**Thu 2/25/10**	**Thu 2/24/11**
574	**Field Implementation/Reporting**	**231 days**	**Tue 3/15/11**	**Mon 1/30/12**	**Tue 3/15/11**	**NA**
575	Stakeholder Attending Kick-Off Meeting at Site	1 day	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11
576	Stakeholder Attending Kick-Off Meeting at Site	1 day	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11
577	Stakeholder Attending Kick-Off Meeting at Site	1 day	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11
578	Stakeholder Attending Kick-Off Meeting at Site	1 day	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11
579	Stakeholder Attending Kick-Off Meeting at Site	1 day	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11	Tue 3/15/11
580	Field Implementation/Reporting (assume fieldwork ends 11/30/11)	46 wks	Wed 3/16/11	Mon 1/30/12	Wed 3/16/11	NA
581	**Prepare and Submit Final GW RFI/RI**	**387 days**	**Mon 8/20/07**	**Mon 2/9/09**	**Mon 8/20/07**	**Mon 2/9/09**
602	**Prepare and Submit GW RFI/RI Addendum**	**229 days**	**Wed 8/13/08**	**Mon 6/29/09**	**Wed 8/13/08**	**Mon 6/29/09**
626	**Prepare Final Soil RFI/RI (Vol 3)**	**1958 days**	**Sat 7/15/06**	**Tue 12/31/13**	**Sat 7/15/06**	**NA**
885	**ADEQ Topock Groundwater Study**	**475 days**	**Thu 11/18/04**	**Wed 8/23/06**	**Thu 11/18/04**	**Wed 8/23/06**
889	**CORRECTIVE MEASURES/REMEDIAL ALTERNATIVE DEVELOPMENT**	**1527 days**	**Mon 3/29/04**	**Thu 12/31/09**	**Mon 3/29/04**	**NA**
1037	**CORRECTIVE MEASURE STUDY/FEASIBILITY STUDY (CMS/FS) AND RISK ASSESSMENT**	**3140 days**	**Mon 12/16/02**	**Wed 11/19/14**	**Mon 12/16/02**	**NA**
1205	**STATEMENT OF BASIS**	**1385.6 days**	**Mon 1/4/10**	**Tue 4/21/15**	**Mon 1/4/10**	**NA**
1220	**RECORD OF DECISION**	**1486 days**	**Fri 12/18/09**	**Mon 8/24/15**	**Fri 12/18/09**	**NA**
1243	**Section 106 Programmatic Agreement (PA)**	**1084 days**	**Fri 10/10/08**	**Thu 11/29/12**	**Fri 10/10/08**	**NA**
1276	**EIR DOCUMENTATION**	**2537 days**	**Thu 9/1/05**	**Sun 5/3/15**	**Thu 9/1/05**	**NA**



Project: PG&E Topock Remediation Project
Date: Wed 11/9/11

Tasks Not Started/In Progess
Tasks Finished
Baseline Schedule
Milestone
Overall Task Duration

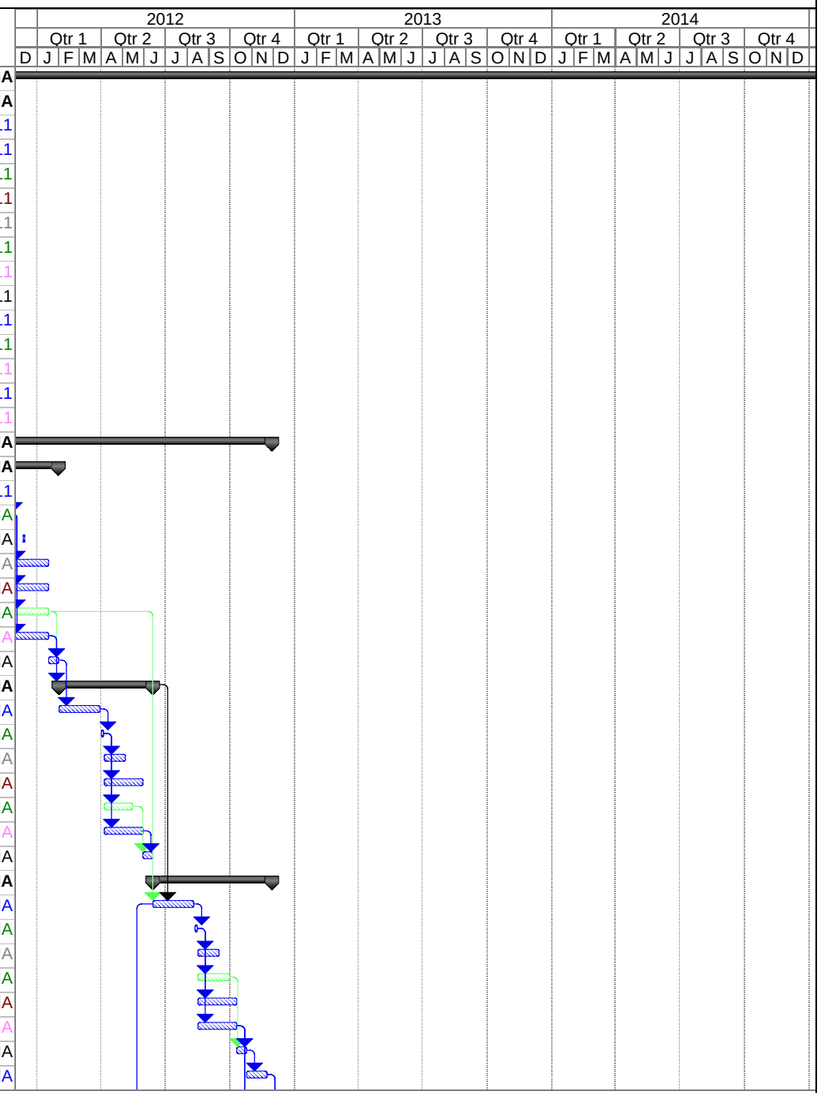
edays = calendar days; days = work days
Baseline Schedule is the 8/15/07 CWG Schedule (rev 1, 12/12/07).
*Timeframes shown are for planning purpose. Actual timeframes may vary.

Color Coding:
PG&E Federal Agencies CWG/TWG Public
DTSC Tribes/SHPO Other CA Agencies AZ Agencies

Major Assumptions
- Permits, CWG/ stakeholder review, and DTSC review & approvals are estimated.
- Actual dates may vary depending on field conditions.

EXHIBIT 8-2
Updated Project Schedule
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRELIMINARY (30%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

ID	Task Name	Duration	Forecasted Start	Forecasted Finish	Actual Start	Actual Finish
1362	**DESIGN, PERMITTING, AND CONSTRUCTION OF GROUNDWATER REMEDY**	**1301.5 days**	**Mon 1/31/11**	**Mon 1/25/16**	**Mon 1/31/11**	**NA**
1363	**Corrective Measure Implementation/Remedial Design (CMI/RD) Workplan**	**199 days**	**Mon 1/31/11**	**Thu 11/3/11**	**Mon 1/31/11**	**NA**
1364	Receipt of notification of DTSC's selection of the corrective measure	1 day	Mon 1/31/11	Mon 1/31/11	Mon 1/31/11	Mon 1/31/11
1365	Prepare/submit Draft Workplan	90.38 edays	Tue 2/1/11	Mon 5/2/11	Tue 2/1/11	Mon 5/2/11
1366	DTSC forward Draft Workplan to CWG/TWG	2 days	Tue 5/3/11	Wed 5/4/11	Tue 5/3/11	Wed 5/4/11
1367	Tribes review of Draft Work Plan	37.38 edays	Wed 5/4/11	Fri 6/10/11	Wed 5/4/11	Fri 6/10/11
1368	CWG/TWG review of Draft Workplan	30.38 edays	Wed 5/4/11	Fri 6/3/11	Wed 5/4/11	Fri 6/3/11
1369	DTSC review/comment on Draft Workplan and provide direction to PG&E	44.38 edays	Wed 5/4/11	Fri 6/17/11	Wed 5/4/11	Fri 6/17/11
1370	DOI review/comment on Draft Workplan and provide direction to PG&E	30.38 edays	Wed 5/4/11	Fri 6/3/11	Wed 5/4/11	Fri 6/3/11
1371	Comment resolution	70.38 edays	Mon 6/20/11	Mon 8/29/11	Mon 6/20/11	Mon 8/29/11
1372	Prepare/submit Redline Workplan with RTCs	3 wks	Tue 8/30/11	Mon 9/19/11	Tue 8/30/11	Mon 9/19/11
1373	DTSC review redline Workplan	5.6 wks	Tue 9/20/11	Thu 10/27/11	Tue 9/20/11	Thu 10/27/11
1374	DOI review redline Workplan	2.8 wks	Tue 9/20/11	Fri 10/7/11	Tue 9/20/11	Fri 10/7/11
1375	Issue Revised Work Plan	1 day	Wed 11/2/11	Wed 11/2/11	Wed 11/2/11	Wed 11/2/11
1376	DOI approved Revised Work Plan	1 day	Thu 11/3/11	Thu 11/3/11	Thu 11/3/11	Thu 11/3/11
1377	**Remedial Design (Preliminary, Intermediate, and Pre-Final/Final)**	**314 days**	**Tue 9/20/11**	**Thu 11/29/12**	**Tue 9/20/11**	**NA**
1378	**Preliminary Design**	**97 days**	**Tue 9/20/11**	**Tue 1/31/12**	**Tue 9/20/11**	**NA**
1379	Prepare/submit Prelim Design Package	2.1 mons	Tue 9/20/11	Fri 11/18/11	Tue 9/20/11	Fri 11/18/11
1380	DTSC forward to CWG/TWG	3 days	Fri 11/18/11	Tue 11/22/11	Fri 11/18/11	NA
1381	Site visits to view Hinkley IRZ/walk pipeline alignment at Topock	2 days	Tue 12/13/11	Wed 12/14/11	NA	NA
1382	CWG/TWG review/comment on Draft Design Package	55 edays	Wed 11/23/11	Tue 1/17/12	NA	NA
1383	Tribes consultation	55 edays	Wed 11/23/11	Tue 1/17/12	NA	NA
1384	DTSC review/comment on Draft Design Package	55 edays	Wed 11/23/11	Tue 1/17/12	NA	NA
1385	DOI review/comment on Draft Design Package	55 edays	Wed 11/23/11	Tue 1/17/12	NA	NA
1386	Comments resolution	2 wks	Wed 1/18/12	Tue 1/31/12	NA	NA
1387	**Intermediate Design**	**95 days**	**Thu 2/2/12**	**Wed 6/13/12**	**NA**	**NA**
1388	Prepare/submit Intermediate Design Package (duration to be confirmed after receipt of comments)	2 mons	Thu 2/2/12	Fri 3/30/12	NA	NA
1389	DTSC forward to CWG/TWG	3 days	Mon 4/2/12	Wed 4/4/12	NA	NA
1390	CWG/TWG review/comment on Intermediate Design Package	30 edays	Thu 4/5/12	Sat 5/5/12	NA	NA
1391	Tribes Consultation	55 edays	Thu 4/5/12	Wed 5/30/12	NA	NA
1392	DTSC review/comment on Intermediate Design Package	40 edays	Thu 4/5/12	Tue 5/15/12	NA	NA
1393	DOI review/comment on Intermediate Design Package	55 edays	Thu 4/5/12	Wed 5/30/12	NA	NA
1394	Comments resolution	2 wks	Thu 5/31/12	Wed 6/13/12	NA	NA
1395	**Pre-Final/Final Design (include plan for decommissioning, removal, and restoration of IM3 facility)**	**121 days**	**Thu 6/14/12**	**Thu 11/29/12**	**NA**	**NA**
1396	Prepare/submit Pre-Final Design Package (duration to be confirmed after receipt of comments)	2 mons	Thu 6/14/12	Fri 8/10/12	NA	NA
1397	DTSC forward to CWG/TWG	3 days	Mon 8/13/12	Wed 8/15/12	NA	NA
1398	CWG/TWG review/comment on Final Design Package	30 edays	Thu 8/16/12	Sat 9/15/12	NA	NA
1399	DTSC review/comment on Final Design Package	45 edays	Thu 8/16/12	Sun 9/30/12	NA	NA
1400	Tribal Consultation	55 edays	Thu 8/16/12	Wed 10/10/12	NA	NA
1401	DOI review/comment on Final Design Package	55 edays	Thu 8/16/12	Wed 10/10/12	NA	NA
1402	Comments resolution	2 wks	Thu 10/11/12	Wed 10/24/12	NA	NA
1403	Prepare/submit Final Design Package (duration to be confirmed after receipt of comments)	1 mon	Thu 10/25/12	Thu 11/22/12	NA	NA



Tasks Not Started/In Progess
Tasks Finished
Baseline Schedule
Milestone
Overall Task Duration

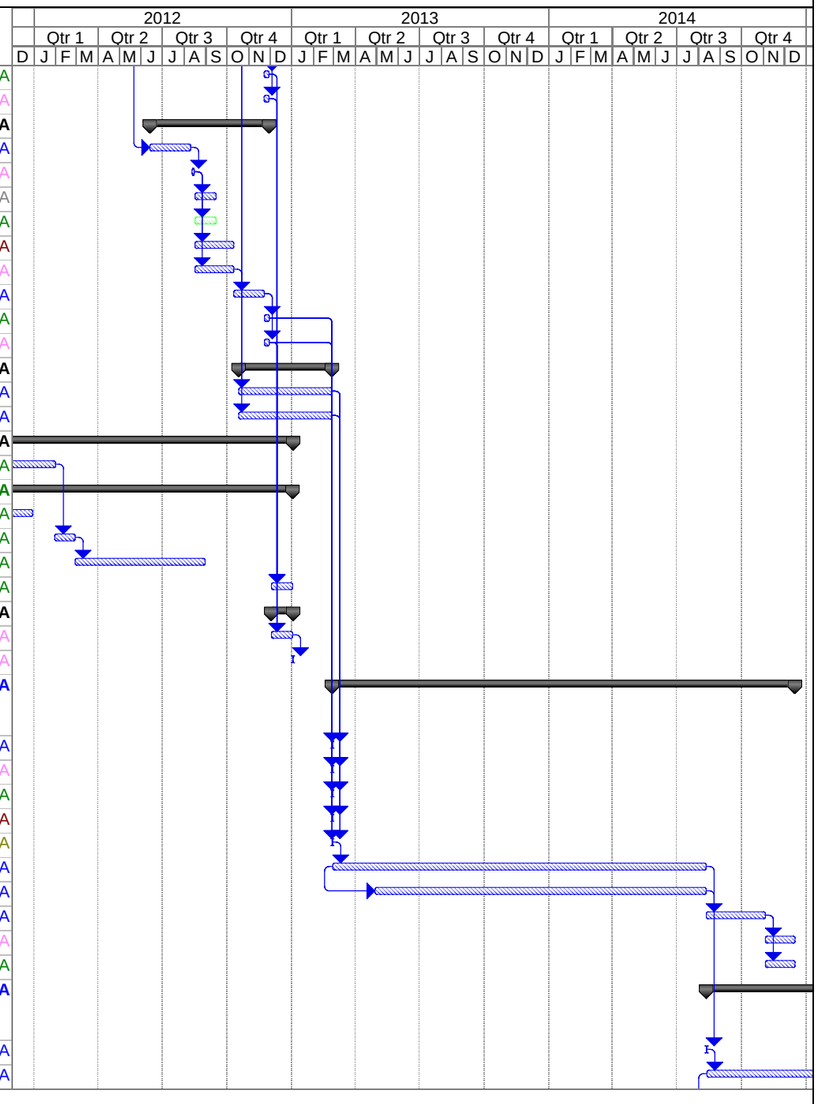
edays = calendar days; days = work days
Baseline Schedule is the 8/15/07 CWG Schedule (rev 1, 12/12/07).
*Timeframes shown are for planning purpose. Actual timeframes may vary.

Color Coding:
PG&E Federal Agencies CWG/TWG Public
DTSC Tribes/SHPO Other CA Agencies AZ Agencies

Major Assumptions
- Permits, CWG/ stakeholder review, and DTSC review & approvals are estimated.
- Actual dates may vary depending on field conditions.

EXHIBIT 8-2
Updated Project Schedule
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRELIMINARY (30%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

ID	Task Name	Duration	Forecasted Start	Forecasted Finish	Actual Start	Actual Finish
1404	DTSC approves design	5 days	Fri 11/23/12	Thu 11/29/12	NA	NA
1405	DOI approves design	5 days	Fri 11/23/12	Thu 11/29/12	NA	NA
1406	**Construction/Remedial Action Work Plan**	**121.5 days**	**Thu 6/14/12**	**Fri 11/30/12**	**NA**	**NA**
1407	Prepare/submit Draft Work Plan	2 mons	Thu 6/14/12	Fri 8/10/12	NA	NA
1408	DOI forward to DTSC/CWG/TWG	3 days	Mon 8/13/12	Wed 8/15/12	NA	NA
1409	CWG/TWG review/comment on Draft Work Plan	30 edays	Thu 8/16/12	Sat 9/15/12	NA	NA
1410	DTSC review/comment on Draft Work Plan	30 edays	Thu 8/16/12	Sat 9/15/12	NA	NA
1411	Tribal Consultation on Draft Work Plan	55 edays	Thu 8/16/12	Wed 10/10/12	NA	NA
1412	DOI review/comment on Draft Work Plan and provides direction to PG&E	55 edays	Thu 8/16/12	Wed 10/10/12	NA	NA
1413	Prepare/submit Final Work Plan	1.5 mons	Thu 10/11/12	Fri 11/23/12	NA	NA
1414	DTSC approves Final Work Plan	5 days	Fri 11/23/12	Fri 11/30/12	NA	NA
1415	DOI approves Final Work Plan	5 days	Fri 11/23/12	Fri 11/30/12	NA	NA
1416	**ROWs/Easements/Landowner Agreements/Approvals/Compliance**	**94.5 days**	**Thu 10/18/12**	**Wed 2/27/13**	**NA**	**NA**
1417	Other Approvals and Compliance	4.5 mons	Thu 10/18/12	Wed 2/27/13	NA	NA
1418	Landowner Agreements/Leasing/ROW Agreements	4.5 mons	Thu 10/18/12	Wed 2/27/13	NA	NA
1419	**Community Outreach**	**325.5 days**	**Fri 10/7/11**	**Thu 1/3/13**	**NA**	**NA**
1420	Prepare/Issue Project Update Factsheet	4 mons	Fri 10/7/11	Tue 1/31/12	NA	NA
1421	**Prepare/Issue Outreach Plan**	**324.5 days**	**Fri 10/7/11**	**Wed 1/2/13**	**NA**	**NA**
1422	Update mailing list	2.95 mons	Fri 10/7/11	Fri 12/30/11	NA	NA
1423	Conduct Community Survey	1 mon	Tue 1/31/12	Tue 2/28/12	NA	NA
1424	Prepare/Issue Outreach Plan	6.3 mons	Wed 2/29/12	Fri 8/31/12	NA	NA
1425	Prepare/Issue factsheet for Corrective Measures Implementation	30 edays	Mon 12/3/12	Wed 1/2/13	NA	NA
1426	**Outreach/Public Participation**	**23 days**	**Mon 12/3/12**	**Thu 1/3/13**	**NA**	**NA**
1427	Prepare/issue factsheet for Remedy Implementation	30 edays	Mon 12/3/12	Wed 1/2/13	NA	NA
1428	Open house	1 day	Wed 1/2/13	Thu 1/3/13	NA	NA
1429	**Construction (the duration shown below is preliminary and will be adjusted as the design progresses; a detailed construction/remedial action implementation schedule will be included in the Construction/Remedial Action Work Plan)**	**469 days**	**Wed 2/27/13**	**Tue 12/16/14**	**NA**	**NA**
1430	Stakeholder Attending Kick-Off Meeting at Site	1 day	Wed 2/27/13	Thu 2/28/13	NA	NA
1431	Stakeholder Attending Kick-Off Meeting at Site	1 day	Wed 2/27/13	Thu 2/28/13	NA	NA
1432	Stakeholder Attending Kick-Off Meeting at Site	1 day	Wed 2/27/13	Thu 2/28/13	NA	NA
1433	Stakeholder Attending Kick-Off Meeting at Site	1 day	Wed 2/27/13	Thu 2/28/13	NA	NA
1434	Stakeholder Attending Kick-Off Meeting at Site	1 day	Wed 2/27/13	Thu 2/28/13	NA	NA
1435	Construction	18 mons	Thu 2/28/13	Tue 8/12/14	NA	NA
1436	Prepare/submit monthly construction progress reports	16 mons	Mon 4/29/13	Tue 8/12/14	NA	NA
1437	Prepare/submit Construction Completion Report	60 days	Tue 8/12/14	Tue 11/4/14	NA	NA
1438	DOI review and approval of Construction Completion Report	30 days	Tue 11/4/14	Tue 12/16/14	NA	NA
1439	DTSC review and approval of Construction Completion Report	30 days	Tue 11/4/14	Tue 12/16/14	NA	NA
1440	**Startup (the sequence/duration shown below is preliminary and will be adjusted as the design progresses; a detailed construction/remedial action implementation schedule will be included in the Construction/Remedial Action Work Plan)**	**379 days**	**Tue 8/12/14**	**Mon 1/25/16**	**NA**	**NA**
1441	Shutdown IM extraction/treatment/injection	1 day	Tue 8/12/14	Wed 8/13/14	NA	NA
1442	Inject carbon/build NTH IRZ (6-12mons)	12 mons	Wed 8/13/14	Fri 7/31/15	NA	NA



Project: PG&E Topock Remediation Project
Date: Wed 11/9/11

Tasks Not Started/In Progess
Tasks Finished
Baseline Schedule
Milestone
Overall Task Duration

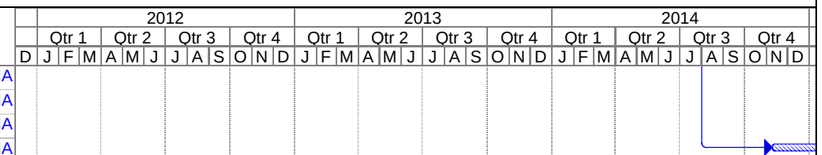
edays = calendar days; days = work days
Baseline Schedule is the 8/15/07 CWG Schedule (rev 1, 12/12/07).
*Timeframes shown are for planning purpose. Actual timeframes may vary.

Color Coding:
PG&E Federal Agencies CWG/TWG Public
DTSC Tribes/SHPO Other CA Agencies AZ Agencies

Major Assumptions
- Permits, CWG/ stakeholder review, and DTSC review & approvals are estimated.
- Actual dates may vary depending on field conditions.

EXHIBIT 8-2
Updated Project Schedule
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRELIMINARY (30%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

ID	Task Name	Duration	Forecasted Start	Forecasted Finish	Actual Start	Actual Finish
1443	Inject freshwater(3-6mons)	6 mons	Thu 2/5/15	Fri 7/31/15	NA	NA
1444	Activate Inner recirculation loop (3-6mons)	6 mons	Tue 5/5/15	Wed 10/28/15	NA	NA
1445	Activate TCS recirculation loop (3-6mons)	6 mons	Tue 5/5/15	Wed 10/28/15	NA	NA
1446	Prepare/submit quarterly progress reports	15 mons	Mon 11/10/14	Mon 1/25/16	NA	NA
1447	Startup complete/start full remedy operations	0 days	Wed 10/28/15	Wed 10/28/15	NA	NA



Project: PG&E Topock Remediation Project
Date: Wed 11/9/11

Tasks Not Started/In Progess
Tasks Finished
Baseline Schedule
Milestone
Overall Task Duration

edays = calendar days; days = work days
Baseline Schedule is the 8/15/07 CWG Schedule (rev 1, 12/12/07).
*Timeframes shown are for planning purpose. Actual timeframes may vary.

Color Coding:
PG&E Federal Agencies CWG/TWG Public
DTSC Tribes/SHPO Other CA Agencies AZ Agencies

Major Assumptions
- Permits, CWG/ stakeholder review, and DTSC review & approvals are estimated.
- Actual dates may vary depending on field conditions.

SECTION 9

Updated Cost Estimate

DTSC's remedy decision letter dated January 31, 2011 (DTSC 2011b) contains a condition of approval that requires PG&E to refine the cost estimate with each iteration of the remedy design (preliminary [30%], intermediate [60%], pre-final [90%], and final) for DTSC approval and to update the financial assurance annually for the life of the project. In compliance with this condition of approval, this section presents the updated cost estimate and Appendix H of this report contains the detailed cost information including the basis for the estimates.

The capital, O&M, and post-remediation deconstruction costs presented in Table D-6 (*Alternative E – Remedial Alternative Cost Summary – In-Situ Treatment with Freshwater Flushing*) of the CMS/FS Report (CH2M HILL 2009d) have been updated to reflect current information presented in the preliminary (30%) design. Exhibit 9-1 summarizes the updated costs.

EXHIBIT 9-1
Summary of Cost Estimates
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

PRESENT VALUE ANALYSIS

Period	Cost Type	Total Cost	Total Cost Per Year	Discount Factor[1]	Present Value
COSTS IN CMS/FS REPORT[2]					
0	Capital Cost, Year 0	$51,600,000	-	1.000	$51,600,000
29	Annual O&M Cost, Year 1-30		$4,000,000	18.785	$75,138,196
10	Long Term Monitoring, Year 31-40		$900,000	3.421	$3,078,878
41	Post-Remediation Deconstruction, Year 41	$7,300,000	-	0.278	$2,030,637
	Total Present Value Of Alternative				**$132,000,000**
UPDATED COSTS[3]					
0	Capital Cost, Year 0	$65,900,000	-	1.000	$65,900,000
29	Annual O&M Cost, Year 1-30		$5,130,000	18.785	$96,364,737
10	Long Term Monitoring, Year 31-40		$900,000	3.421	$3,078,878
41	Post-Remediation Deconstruction, Year 41	$10,800,000	-	0.278	$3,004,229
	Total Present Value Of Alternative				**$168,000,000**

Notes:

[1] Discount factor of 3.17% per year is used

[2] See Table D-6 of the CMS/FS Report (CH2M HILL 2009d)

[3] See Appendix H for detailed cost estimates.

SECTION 10

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Tables

TABLE 2-1
Summary Statistics of Groundwater Sampling Results, July 1997 through June 2011
Groundwater Remedy Basis of Design Report
Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

	Results Summary for RFI/RI Wells [1]						Background Comparison [2]					Chemical-Specific ARAR [3]				
Parameter	Number of Wells Sampled	Number of Primary Samples	Number of Detects	Detection Frequency %	Average Concentration	Maximum Concentration	UTL Value	Number of Wells with Average Exceeding UTL [4]	Number of Wells with Max Exceeding UTL	Frequency of UTL Exceedances		ARAR Value	Number of Wells with Average Exceeding ARAR [4]	Number of Wells with Max Exceeding ARAR	Frequency of ARAR Exceedances	
Chromium, Hexavalent	209	4,144	2,502	60.4	807	17,400	31.8	82	93	1,558 / 4,144	(37.6%)	---	---	---	---	---
Chromium (total)	209	4,221	2,789	66.1	803	16,400	34.1	86	100	1,554 / 4,221	(36.8%)	50	79	93	1,488 / 4,221	(35.3%)
Arsenic	178	851	534	62.7	8.01	157	24.3	4	19	51 / 851	(6.0%)	10	33	46	137 / 851	(16.1%)
Iron	188	1,192	395	33.1	820	110,000	3930	10	16	57 / 1,192	(4.8%)	300	53	49	197 / 1,192	(16.5%)
Manganese	190	1,319	625	47.4	356	9,260	1320	11	26	72 / 1,319	(5.5%)	50	165	134	482 / 1,319	(36.5%)
Molybdenum	123	818	750	91.7	29.4	301	36.3	43	62	220 / 818	(26.9%)	---	---	---	---	---
Selenium	110	602	241	40.0	5.90	155	10.3	11	23	67 / 602	(11.1%)	50	2	3	8 / 602	(1.3%)
Nitrate (as nitrogen)	197	1,187	633	53.3	3.45	35	5.03	37	55	229 / 1,187	(19.3%)	10	21	30	101 / 1,187	(8.5%)

Notes:

[1] - Number of Wells Sampled is the number of wells sampled for each parameter.
- Number of Primary Samples is the total number of primary samples analyzed for each parameter.
- Detection Frequency is the number of times each parameter was detected over the total number of samples analyzed.
- Average concentration is the average of all results using one-half the reporting limit for non detects. Rejected data is not included.
- For duplicate results, the highest concentration between the two results is included. If one result was found above the analytical reporting limit while the other was not, the detected concentration was used, regardless of the analytical reporting limit for the other result. If both results were found to be non-detect, the minimum reporting limit was used.

[2] Site background concentration is the 95% upper tolerance limit (UTL) of the elevated percentile from the Steps 3 and 4 Groundwater Background Study Report (CH2M HILL, 2008), see Table 2-1. Number of Exceedances is the number of times each parameter was detected above the background concentration.

[3] Chemical-specific applicable or relevant and appropriate requirements (ARARs) listed are the most stringent drinking water standard from regulatory standards, see Table 6-2 from the Revised Final RCRA Facility Investigation/Remedial Investigation (RFI/RI), PGE Topock Compressor Station, Needles, California Volume 2 - Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation (CH2M HILL, 2009).

[4] In several cases, the laboratory reporting limit was over two times the UTL and/or ARAR. Assigning half the reporting limit for these samples during calculation of averages will result in a UTL/ARAR exceedence being counted toward the average. As a result, many wells were found to have averages exceeding UTL/ARAR mainly due to this assignment.

Metals are reported in ug/L. Nitrate reported as nitrogen in mg/L.

µg/L dissolved metals concentrations in micrograms per liter
mg/L milligrams per liter
--- not assigned or not applicable

TABLE 2-2
Calculated Site Background UTLs
Groundwater Remedy Basis of Design Report
Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

	Units[1]	Upper Tolerance Limit (UTL)[2]	Elevated Percentile Estimated by UTL (with 95% confidence)
Arsenic	µg/L	24.3	95
Chromium (total)	µg/L	34.1	89
Chromium (Hexavalent)	µg/L	31.8	89
Iron	mg/L	3.93	89
Manganese	µg/L	1,320	89
Molybdenum	µg/L	36.3	95
Nitrate (as Nitrogen)	mg/L	5.03	95
Selenium	µg/L	10.3	95

Notes:

[1] µg/L micrograms per liter
mg/L milligrams per liter

[2] The site background concentration is the 95% upper tolerance limit (UTL) of the elevated percentile from the Steps 3 and 4 Groundwater Background Study Report (CH2M HILL, 2008)

[3] The background values for cadmium and mercury are detection limits of 1.0 and 0.2 mg/L, respectively.

TABLE 2-3
Summary Statistics of Surface Water Sampling Results, July 1997 through June 2011
Groundwater Remedy Basis of Design Report
Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

	Hexavalent Chromium (µg/L)		Dissolved Chromium (µg/L)		Dissolved Arsenic (µg/L)		Dissolved Manganese (µg/L)		Dissolved Iron (µg/L)		Dissolved Selenium (µg/L)		Dissolved Molybdenum (µg/L)		Dissolved Nitrate (mg/L)		Specific Conductance (µS/cm)		pH (pH Units)	
Chemical-Specific ARAR[1]	11 (a)		NA		150 (a)		NA		NA		5 (b)		NA		NA		NA		NA	
Station ID[2]	**Frequency of Detection (Number of Detects/Number of Samples) and Average Concentration[3]**																			
Shoreline Surface Water Monitoring Locations																				
A-Dock	0 \ 6	ND	0 \ 6	ND	0 \ 0	---	0 \ 1	ND	0 \ 0	---	0 \ 0	---	0 \ 1	ND	0 \ 0	---	4 \ 4	944	4 \ 4	8.02
CON	0 \ 75^	ND	6 \ 76	3.23	0 \ 0	---	2 \ 4	65.0	0 \ 1	ND	0 \ 0	---	2 \ 3	4.93	1 \ 1	370	41 \ 41	1120	39 \ 39	8.12
C-TM-1	0 \ 3	ND	0 \ 3	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---
C-TM-2	0 \ 3	ND	0 \ 3	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---
R63	0 \ 13	ND	1 \ 13	0.554	1 \ 1	2.40	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	13 \ 13	979	13 \ 13	8.21
I-3	0 \ 70^	ND	7 \ 71	3.13	0 \ 0	---	3 \ 5	54.1	0 \ 2	ND	0 \ 0	---	3 \ 3	4.73	3 \ 4	488	40 \ 40	957	38 \ 38	8.20
Needles Gauge	0 \ 2	ND	0 \ 2	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---
NR-1	0 \ 48	ND	1 \ 49	0.614	0 \ 0	---	0 \ 1	ND	0 \ 1	ND	0 \ 0	---	0 \ 0	---	0 \ 1	ND	18 \ 18	1020	17 \ 17	8.22
NR-2	0 \ 48	ND	1 \ 49	0.635	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	18 \ 18	1010	17 \ 17	8.23
NR-3	0 \ 46	ND	0 \ 47	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	18 \ 18	1000	17 \ 17	8.22
R-19	0 \ 17	ND	0 \ 17	ND	1 \ 1	2.40	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	17 \ 17	957	17 \ 17	8.27
R-19-B	0 \ 2	ND	0 \ 2	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	1 \ 1	901	1 \ 1	7.82
R-19-C	0 \ 2	ND	0 \ 2	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	2 \ 2	892	2 \ 2	7.84
R-20	0 \ 1	ND	0 \ 1	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	1 \ 1	902	1 \ 1	7.95
R-20-B	0 \ 2	ND	0 \ 2	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	2 \ 2	893	2 \ 2	7.84
R-20-C	0 \ 2	ND	0 \ 2	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	2 \ 2	891	2 \ 2	7.77
R-22	0 \ 69^	ND	7 \ 70	2.68	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	35 \ 35	974	35 \ 35	8.23
R-27	0 \ 70^	ND	6 \ 71	2.67	0 \ 0	---	0 \ 3	ND	0 \ 3	ND	0 \ 0	---	0 \ 0	---	4 \ 18	320	35 \ 35	960	34 \ 34	8.20
R-28	0 \ 83^	ND	7 \ 84	2.74	1 \ 1	2.10	0 \ 4	ND	0 \ 4	ND	0 \ 1	ND	1 \ 2	5.20	6 \ 27	562	51 \ 51	999	50 \ 50	8.25
RRB	0 \ 78^	ND	8 \ 79	2.68	1 \ 1	2.70	1 \ 2	5.00	0 \ 1	ND	0 \ 1	ND	1 \ 2	6.00	0 \ 1	ND	49 \ 49	1190	48 \ 48	8.07
Seasonal Wetlands	0 \ 8	ND	0 \ 8	ND	0 \ 0	---	1 \ 1	8.00	0 \ 0	---	0 \ 0	---	1 \ 1	5.00	0 \ 0	---	8 \ 8	4800	8 \ 8	7.97
River Channel Surface Water Monitoring Locations																				
C-BNS	0 \ 14	ND	0 \ 14	ND	1 \ 1	2.80	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	0 \ 1	ND	14 \ 14	959	14 \ 14	8.22
C-CON	0 \ 99	ND	0 \ 99	ND	2 \ 2	2.45	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	71 \ 71	1000	71 \ 71	8.25
C-I-3	0 \ 99	ND	0 \ 99	ND	2 \ 2	2.65	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	3 \ 5	423	71 \ 71	977	71 \ 71	8.27
C-MAR	0 \ 63	ND	0 \ 63	ND	2 \ 2	2.45	2 \ 2	16.9	1 \ 2	25.5	0 \ 2	ND	0 \ 2	ND	1 \ 4	657	46 \ 46	1150	46 \ 46	7.93
C-NR1	0 \ 99	ND	0 \ 99	ND	2 \ 2	2.15	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	71 \ 71	994	71 \ 71	8.32
C-NR3	0 \ 99	ND	0 \ 99	ND	2 \ 2	2.25	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	71 \ 71	995	71 \ 71	8.31
C-NR4	0 \ 99	ND	0 \ 99	ND	2 \ 2	2.20	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	71 \ 71	991	71 \ 71	8.31
C-R22	1 \ 74	0.115	0 \ 74	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	3 \ 3	538	39 \ 39	1000	39 \ 39	8.25
C-R22a	0 \ 31	ND	0 \ 31	ND	2 \ 2	2.70	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	31 \ 31	962	31 \ 31	8.30
C-R27	0 \ 94	ND	0 \ 94	ND	2 \ 2	2.50	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	3 \ 5	420	67 \ 67	979	67 \ 67	8.27
C-TAZ	0 \ 96	ND	0 \ 99	ND	2 \ 2	2.50	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	0 \ 2	ND	3 \ 5	421	71 \ 71	982	71 \ 71	8.28
Other Surface Water Monitoring Locations																				
SW2	0 \ 12	ND	0 \ 12	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	12 \ 12	987	12 \ 12	7.83
SW1	1 \ 20	0.107	0 \ 20	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	18 \ 18	1020	18 \ 18	7.79

TABLE 2-3
Summary Statistics of Surface Water Sampling Results, July 1997 through June 2011
Groundwater Remedy Basis of Design Report
Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Notes:

ND	not detected
NA	not available
(a)	Freshwater aquatic life protection, continuous concentration 4-day average; expressed as dissolved.
(b)	Freshwater aquatic life protection, continuous concentration 4-day average; expressed as total recoverable.
^	According to the data quality review for the June 2002 monitoring, the results were determined to be false positive due to unidentified interference for these samples, and no action should be taken or project decisions made based on the results. These results were not included in the statistical analyses.
µS/cm	microsiemens per centimeter
µg/L	micrograms per liter
---	not analyzed

At each of the river channel surface water locations, depth specific samples were collected at shallow (1 foot from water surface), middle (middle samples no longer collected after 6/18/2008), and deep depths (1 foot from river bottom). Results for each location summarize the samples collected at depth.

At locations R-19B, R-19C and R-20B, multiple samples were collected at surface, 5-foot, and 10-foot depths and locations. Results for each location summarized the samples collected at depth.

Refer to Appendix A for complete analytical data for surface water sampling.

1 Source: Groundwater Record of Decision, Table 2, Federal Chemical-Specific ARAR #3, Citation: Federal Water Pollution Control Act (Clean Water Act) - 33 USC §§ 1251-1387; 40 CFR 131.38.
2 Surface water locations are listed in order of their position on the river, from north to south.
3 Average concentrations of all results (including estimated concentrations) in micrograms per liter, with half the reporting limit used for non detects. Detected results are the maximum concentrations from primary or duplicate samples.

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-1 (Extraction)							
Layer 1	17	13	38	40	64	1	
Layer 2	17	13	38	40	93		
Layer 3	17	13	38	40	126	1	
Layer 4	17	13	38	40	80		
IRZ-2							
Layer 1	*0*	*0*	*6.3*	*40*	*73*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*93*		
Layer 3	*0*	*0*	*6.3*	*40*	*117*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*72*		
IRZ-3							
Layer 1	*0*	*0*	*6.3*	*40*	*81*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*94*		
Layer 3	*0*	*0*	*6.3*	*40*	*112*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*65*		
IRZ-4							
Layer 1	*0*	*0*	*6.3*	*40*	*88*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*93*		
Layer 3	*0*	*0*	*6.3*	*40*	*102*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*59*		
IRZ-5 (Extraction)							
Layer 1	17	13	38	40	93	1	
Layer 2	17	13	38	40	93		
Layer 3	17	13	38	40	99	1	
Layer 4	17	13	38	40	56		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-6							
Layer 1	*0*	*0*	*6.3*	*40*	*91*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*89*		
Layer 3	*0*	*0*	*6.3*	*40*	*94*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*54*		
IRZ-7							
Layer 1	*0*	*0*	*6.3*	*40*	*92*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*87*		
Layer 3	*0*	*0*	*6.3*	*40*	*93*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*52*		
IRZ-8							
Layer 1	*0*	*0*	*6.3*	*40*	*83*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*80*		
Layer 3	*0*	*0*	*6.3*	*40*	*83*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*51*		
IRZ-9 (Extraction)							
Layer 1	17	13	38	40	80	1	
Layer 2	17	13	38	40	74		
Layer 3	17	13	38	40	79	1	
Layer 4	17	13	38	40	50		
IRZ-10							
Layer 1	*0*	*0*	*6.3*	*40*	*69*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*65*		
Layer 3	*0*	*0*	*6.3*	*40*	*68*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*49*		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-11							
Layer 1	9.8	0	20	40	66	1	
Layer 2	9.8	0	20	40	62		
Layer 3	9.8	0	20	40	66	1	
Layer 4	9.8	0	20	40	51		
IRZ-12							
Layer 1	*0*	*0*	*6.3*	*40*	*61*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*58*		
Layer 3	*0*	*0*	*6.3*	*40*	*59*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*51*		
IRZ-13							
Layer 1	8.5	0	19	40	53	1	
Layer 2	8.5	0	19	40	51		
Layer 3	8.5	0	19	40	57	1	
Layer 4	8.5	0	19	40	52		
IRZ-14							
Layer 1	*0*	*0*	*6.3*	*40*	*56*		*1*
Layer 2	*0*	*0*	*6.3*	*40*	*54*		
Layer 3	*0*	*0*	*6.3*	*40*	*50*		*1*
Layer 4	*0*	*0*	*6.3*	*40*	*44*		
IRZ-15							
Layer 1	7.5	0	15	40	48	1	
Layer 2	7.5	0	15	40	47		
Layer 3	7.5	0	15	40	49	1	
Layer 4	7.5	0	15	40	44		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-16							
Layer 1	7	0	15	40	54	1	
Layer 2	7	0	15	40	53		
Layer 3	7	0	15	35	40	1	
Layer 4	7	0	15	30	33		
IRZ-17							
Layer 1	6.8	0	15	40	51	1	
Layer 2	6.8	0	15	35	49		
Layer 3	6.8	0	15	25	37	1	
Layer 4	6.8	0	15	20	31		
IRZ-18							
Layer 1	*0*	*0*	*6.3*	*40*	*50*		*1*
Layer 2	*0*	*0*	*6.3*	*35*	*48*		
Layer 3	*0*	*0*	*6.3*	*25*	*32*		*1*
Layer 4	*0*	*0*	*6.3*	*20*	*25*		
IRZ-19							
Layer 1	5.8	0	13	40	52	1	
Layer 2	5.8	0	13	40	51		
Layer 3	5.8	0	13	15	25	1	
Layer 4	5.8	0	13	10	15		
IRZ-20							
Layer 1	5.3	0	13	35	46	1	
Layer 2	5.3	0	13	25	39		
Layer 3	5.3	0	13	15	25	1	
Layer 4	5.3	0	13	15	23		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-21							
Layer 1	4.8	0	10	35	49	1	
Layer 2	4.8	0	10	25	29		
Layer 3	4.8	0	10	10	17	1	
Layer 4	4.8	0	10	15	26		
IRZ-22							
Layer 1	*0*	*0*	*6.3*	*35*	*44*		*1*
Layer 2	*0*	*0*	*6.3*	*25*	*27*		
Layer 3	*0*	*0*	*6.3*	*10*	*19*		*1*
Layer 4	*0*	*0*	*6.3*	*15*	*27*		
IRZ-23 (Extraction)							
Layer 1	25	13	38	20	34	1	
Layer 2	25	13	38	15	28		
Layer 3	25	13	38	15	24	1	
Layer 4	25	13	38	15	24		
IRZ-24							
Layer 1	*0*	*0*	*13*	*40*	*31*		*1*
Layer 2					*28*		
Layer 3	*0*	*0*	*13*	*40*	*26*		
Layer 4					*25*		
IRZ-25							
Layer 1	8.5	0	18	40	29	1	
Layer 2					27		
Layer 3	8.5	0	18	40	25		
Layer 4					24		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-26							
Layer 1	*0*	*0*	*13*	*40*	*29*		*1*
Layer 2					*27*		
Layer 3	*0*	*0*	*13*	*40*	*25*		
Layer 4					*25*		
IRZ-27							
Layer 1	8	0	18	40	27	1	
Layer 2					25		
Layer 3	8	0	18	40	23		
Layer 4					24		
IRZ-28							
Layer 1	*0*	*0*	*13*	*40*	*28*		*1*
Layer 2					*26*		
Layer 3	*0*	*0*	*13*	*40*	*24*		
Layer 4					*25*		
IRZ-29							
Layer 1	7	0	15	35	25	1	
Layer 2					22		
Layer 3	7	0	15	30	21		
Layer 4					19		
IRZ-30							
Layer 1	*0*	*0*	*13*	*35*	*27*		*1*
Layer 2					*21*		
Layer 3	*0*	*0*	*13*	*25*	*21*		
Layer 4					*20*		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-31							
Layer 1	5.5	0	13	30	25	1	
Layer 2					15		
Layer 3	5.5	0	3	20	15		
Layer 4					15		
IRZ-32							
Layer 1	*0*	*0*	*13*	*30*	*21*		*1*
Layer 2					*14*		
Layer 3	*0*	*0*	*13*	*20*	*14*		
Layer 4					*13*		
IRZ-33							
Layer 1	5	0	13	25	19	1	
Layer 2					16		
Layer 3	5	0	13	15	16		
Layer 4					11		
IRZ-34							
Layer 1	*0*	*0*	*13*	*25*	*15*		*1*
Layer 2					*13*		
Layer 3	*0*	*0*	*13*	*15*	*13*		
Layer 4					*9.6*		
IRZ-35							
Layer 1	7	0	15	40	11	1	
Layer 2					10		
Layer 3					10		
Layer 4					10		

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				
IRZ-36							
Layer 1	*0*	*0*	*25*	*30*	*8.5*		*1*
Layer 2					*7.6*		
Layer 3					*7.5*		
Layer 4					*7.6*		
IRZ-37							
Layer 1	4	0	10	20	6.3	1	
Layer 2					5.7		
Layer 3					5.7		
Layer 4					5.7		
IRZ-38							
Layer 1	*0*	*0*	*25*	*15*	*4.3*		*1*
Layer 2					*4.3*		
Layer 3					*4.3*		
Layer 4					*4.3*		
IRZ-39							
Layer 1	1	0	5	10	2.4	1	
Layer 2					2.5		
Layer 3					2.5		
Layer 4					2.5		
IRZ-40 (Extraction)							
Layer 1	*0*	*0*	*25*	*10*	4.7		*1*
Layer 2					3.4		
Layer 3					3.4		
Layer 4					3.4		
Extraction Total:	**300**	**200[b]**	**400[b]**	**---**	**---**	**8**	**2**
Injection Total:	**300**	**200[b]**	**400[b]**	**---**	**---**	**24**	**29**

TABLE 3-1

Preliminary Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count	Preliminary Future Provisional Well Count
	Nominal	Minimum	Maximum				

Notes:

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of well screen intervals is preliminary; up to two discrete intervals per well, location to be determined. One well location ID may consist of a well cluster (e.g., a dual screen well for the shallow intervals and an adjacent dual screen well for the deeper intervals) as indicated in the "Preliminary Well Count" column.

[b] Individual well minimum and maximum flow rates are provided herein. However, the total aggregate extraction/injection flow rates are limited to 200 gpm at minimum flows and 400 gpm at maximum flows.

TABLE 3-2

Preliminary Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count
	Nominal	Minimum	Maximum			
River Bank Extraction Wells						
FP-EX-1						
Layer 1					107	
Layer 2					103	
Layer 3	25	25	170	TBD	107	1
Layer 4					59	
FP-EX-2						
Layer 1					81	
Layer 2					75	
Layer 3	0	25	170	TBD	83	1
Layer 4					55	
FP-EX-3						
Layer 1					58	
Layer 2					60	
Layer 3	50	25	170	TBD	54	1
Layer 4					51	
FP-EX-4						
Layer 1					50	
Layer 2					55	
Layer 3	50	25	170	TBD	38	1
Layer 4					50	
FP-EX-5						
Layer 1					27	
Layer 2					26	
Layer 3	25	25	170	TBD	20	1
Layer 4					18	

TABLE 3-2

Preliminary Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count
	Nominal	Minimum	Maximum			
Carbon-Amended Injection Wells						
UPGRAD-INJ-1						
Layer 1	75	35	200	TBD	62	1
Layer 2					71	
Layer 3					74	
Layer 4					62	
UPGRAD-INJ-2						
Layer 1	75	35	200	TBD	63	1
Layer 2					64	
Layer 3					67	
Layer 4					65	
UPGRAD-INJ-3						
Layer 1	100	35	200	TBD	50	1
Layer 2					50	
Layer 3					54	
Layer 4					55	
UPGRAD-INJ-4						
Layer 1	200	35	200	TBD	43	1
Layer 2					45	
Layer 3					47	
Layer 4					48	
Extraction Total:	**150**	**150[b]**	**500[b]**	**---**	**---**	**5**
Injection Total:	**450[c]**	**150[d]**	**600[c,d]**	**---**	**---**	**4**

Notes:

gpm = gallons per minute; TBD = to be determined

[b] Individual extraction well minimum and maximum flow rates are provided herein. However, the minimum and maximum aggregate flow rates from the entire extraction well network are estimated to be 150 gpm and 500 gpm, respectively.

[c] Injection flow rate includes 300 gpm of freshwater for the nominal flow, and up to 600 gpm of freshwater for the maximum flow, as needed.

[d] Individual injection well minimum and maximum flow rates are provided herein. However, the minimum and maximum aggregate flow rates for the entire injection well network are estimated to be 150 gpm and 600 gpm, respectively.

TABLE 3-3

Preliminary Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count
	Nominal	Minimum	Maximum			
Northeast of TCS Extraction Wells						
MID-EX-1						
Layer 1	8	1	15	20	17	1
Layer 2					17	
Layer 3					17	
Layer 4					8.9	
MID-EX-2						
Layer 1	6	1	15	20	12	1
Layer 2					13	
Layer 3					13	
Layer 4					12	
MID-EX-3						
Layer 1	3	1	15	15	11	1
Layer 2					11	
Layer 3					11	
Layer 4					11	
MID-EX-4						
Layer 1	2	1	15	15	5.9	1
Layer 2					6.5	
Layer 3					6.5	
Layer 4					6.5	
East Ravine Extraction Wells[b]						
RAV-EXT-1	0.5	2 Total	4 Total	TBD	TBD	1
RAV-EXT-2	0.5			TBD	TBD	1
RAV-EXT-3	0.5			TBD	TBD	1
RAV-EXT-4	0.5			TBD	TBD	1
TCS Injection Wells						
COMP-INJ-1						
Layer 1	5.3	2.5	19	40	25	1
Layer 2					23	
Layer 3	5.3	2.5	19	40	30	
Layer 4					28	

TABLE 3-3

Preliminary Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Preliminary Injection/Extraction Rate per Model Layer (gpm)			Preliminary Well Screen Length (feet)	Model Layer Thickness (feet)	Preliminary Well Count
	Nominal	Minimum	Maximum			
COMP-INJ-2						
Layer 1	5.3	2.5	19	40	25	1
Layer 2					25	
Layer 3	5.3	2.5	19	30	27	
Layer 4					21	
Extraction Total:	**21**	**10[c]**	**64**	**---**	**---**	**8**
Injection Total:	**21**	**10[c]**	**75[d]**	**---**	**---**	**2**

Notes:

gpm = gallons per minute; TBD = to be determined

[a] Number of well screen intervals is preliminary; up to two discrete intervals per well, location to be determined. One well location ID may consist of adjacent/nested wells.

[b] East Ravine Extraction Wells not expected to produce significant water, and automated pump cycling will be required.

[c] Individual well minimum flow rates are provided herein. However, the total aggregate extraction/injection flow rates are limited to 10 gpm.

[d] Injection flow rate includes up to 75 gpm of freshwater.

TABLE 3-4

Preliminary Remediation Well Design Parameter Summary: Freshwater Injection Wells

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Prelim. Injection/Extraction Rate per Model Layer (gpm)			Prelim. Well Screen Length (feet)	Model Layer Thickness (feet)	Prelim. Well Count	Future Provisional Well Count
	Nominal	Minimum	Maximum				
FW-INJ-1							
Layer 1	100	50	200	TBD	103	1	
Layer 2					104		
Layer 3					105		
Layer 4					77		
FW-INJ-2							
Layer 1	100	50	200	TBD	55	1	
Layer 2					55		
Layer 3					57		
Layer 4					86		
FW-INJ-3[c]	*TBD*	*TBD*	*TBD*	*TBD*	*TBD*		*1*
FW-INJ-4							
Layer 1	50	25	100	TBD	8.5	1	
Layer 2					9.4		
Layer 3					9.4		
Layer 4					9.4		
Total:	**250**	**100[b]**	**600[b,c]**	**---**	**---**	**3[c]**	**1**

Notes:
gpm = gallons per minute; TBD = to be determined
[a] Number of well screen intervals is preliminary; up to two discrete intervals per well, location to be determined. One well location ID may consist of adjacent/nested wells.
[b] Individual injection well minimum and maximum flow rates are provided herein. However, the minimum and maximum aggregate flow rates for the entire injection well network are estimated to be 100 gpm and 600 gpm, respectively.
[C] Preliminary well count could be increased to 4 if future provisional well FW-INJ-3 is determined to be needed. Maximum aggregate injection well network flow rate of 600 gpm accounts for this future provisional well.

TABLE 5-1A
Initial Framework for Institutional Control – Federally Owned Land
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Area	Assessor Parcel No. (APN)	Property Owner	Parties with Other Interests (e.g., existing right of ways, easements, leases, etc.)	Potential Remedial and Investigative Activities	Potential Future Restrictions	
					Category 1 Prohibit installation of new groundwater wells for purposes other than site investigation and remediation activities	**Category 2** Restrict future development and surface uses of the land to allow construction, operation, and maintenance of groundwater remedial structures
Land within the Plume and Additional Area Outside of the Plume footprint where control of groundwater flow directions and gradients are necessary to contain and remediate the chromium plume	650-151-05	Bureau of Reclamation	Managed by BLM	Construct and O&M In-Situ Remediation Zone (IRZ) along NTH, facilities on MW-20 Bench, pipelines, wells, and/or access roads	X	X
	650-161-14	Bureau of Reclamation	Managed by BLM	Construct and O&M pipelines, wells, and/or access roads	X	X
	650-161-09	Havasu National Wildlife Refuge	Managed by USFWS	Construct and O&M pipelines, wells, and/or access roads; soil investigation	X	X
	650-161-11	Havasu National Wildlife Refuge	Managed by USFWS. PG&E has a possessory interest on this parcel for the operation of a compressor station and associated pipelines.	Construct and O&M pipelines, wells, and/or access roads; soil investigation	X	X
	650-161-12	Havasu National Wildlife Refuge	Managed by USFWS. PG&E has a possessory interest on this parcel for the operation of a compressor station and associated pipelines.	Construct and O&M pipelines, wells, and/or access roads; soil investigation	X	X
	National Trails Highway (portion that runs through the site)	Bureau of Reclamation (managed by BLM)	San Bernardino County easement	Construct and O&M In-Situ Remediation Zone (IRZ) along NTH, pipelines and wells	X	X
Land Outside the Plume and the Additional Area where control of groundwater flow directions and gradients are necessary to contain and remediate the chromium plume	650-161-02	Bureau of Reclamation Withdrawn	Managed by BLM, Leased by San Bernardino County	Construct and O&M pipelines, wells, and/or access roads		X
	210-470-08	Havasu National Wildlife Refuge	Managed by USFWS	Construct and O&M freshwater pipeline, freshwater production wells, monitoring wells, conduits (e.g., communication), and/or access roads		X

TABLE 5-1B
Initial Framework for Institutional Control – Non-Federally Owned Land
Groundwater Remedy Basis of Design Report - Preliminary 30% Design
PG&E Topock Compressor Station, Needles, California

					Potential Future Restrictions	
Area	**Assessor Parcel No. (APN)**	**Property Owner**	**Parties with other interests (e.g., existing right of ways, easements, leases, etc.)**	**Potential Remedial and Investigative Activities**	**Category 1 Prohibit installation of new groundwater wells for purposes other than site investigation and remediation activities**	**Category 2 Restrict future development and surface uses of the land to allow construction, operation, and maintenance of groundwater remedial structures**
Land within the Plume and Additional Area Outside of the Plume footprint where control of groundwater flow directions and gradients are necessary to contain and remediate the chromium plume	650-151-06	Fort Mojave Cultural Preservation		Construct and O&M pipelines, wells, and/or access roads	X	X
	650-161-07	Burlington Northern Santa Fe RR Co (CA side)		Construct and O&M pipelines, wells, and/or access roads; soil investigation	X	X
	650-161-08	PG&E		Construct and O&M remedy facilities, pipelines, wells, and/or access roads; soil investigation	X	X
	650-161-09		Caltrans ROW (I-40)	Construct and O&M In-Situ Remediation Zone (IRZ) along NTH, pipelines, wells, and /or access roads; soil investigation	X	X
	650-161-09	San Bernardino County *(south of railroad)*		Construct and O&M In-Situ Remediation Zone (IRZ) along NTH, pipelines, wells, and /or access roads;	X	X
	650-161-09	San Bernardino County *(Half-moon area, south of I-40)*		Construct and O&M In-Situ Remediation Zone (IRZ) along NTH, pipelines, wells, and/or access roads; soil investigation	X	X
	Colorado River	CA State Lands		Construct and O&M monitoring wells		X
	Various	Various	Southern Cal Gas pipeline/ROW	To Be Determined	X	X
	Various	Various	Southwest Gas pipeline/ROW	To Be Determined	X	X
	Various	Various	Mojave Pipeline/ROW	To Be Determined	X	X
	Various	Various	Transwestern Gas pipeline/ ROW	To Be Determined	X	X
	Various	Various	Frontier Telephone ROW	To Be Determined	X	X
	Various	Various	City of Needles Electric overhead power/ROW	To Be Determined	X	X
Land Outside the Plume and the Additional Area where control of groundwater flow directions and gradients are necessary to contain and remediate the chromium plume	650-151-02	San Bernardino County	Concessionaires easements/ leases	To Be Determined		X
	650-141-04	Metropolitan Water District		Construct and O&M monitoring wells and/or access roads		X
	Colorado River	CA State Lands		Construct and O&M monitoring wells		X
	Colorado River	AZ State Lands		Construct and O&M monitoring wells		X
	210-480-05C	Private Property Owner		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	210-470-05	Southwest Water Inc.		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	210-480-01	El Paso Natural Gas		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	210-480-14	Topock Marina		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X

TABLE 5-1B
Initial Framework for Institutional Control – Non-Federally Owned Land
Groundwater Remedy Basis of Design Report - Preliminary 30% Design
PG&E Topock Compressor Station, Needles, California

					Potential Future Restrictions	
Area	**Assessor Parcel No. (APN)**	**Property Owner**	**Parties with other interests (e.g., existing right of ways, easements, leases, etc.)**	**Potential Remedial and Investigative Activities**	**Category 1 Prohibit installation of new groundwater wells for purposes other than site investigation and remediation activities**	**Category 2 Restrict future development and surface uses of the land to allow construction, operation, and maintenance of groundwater remedial structures**
	210-460-13	Topock Marina		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	210-480-15	Topock Marina		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	210-480-09		ADOT (I-40)	Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	Mohave County Road 10 and Frontage Road adjacent to I-40	Mohave County		Construct and O&M freshwater pipeline, conduits (e.g., communication), and wells		X
	BNSF Fee Land	BNSF Northern Santa Fe RR Co (AZ side)		Construct and O&M freshwater pipeline, conduits (e.g., communication), and wells		X
	Various	Various	Mojave Electric Cooperative ROW	To Be Determined		X
	Various	Various	Frontier Telephone ROW	To Be Determined		X
Bridge crossing the Colorado River	Arched bridge	El Paso Natural Gas and PG&E		Install freshwater pipeline and conduits (e.g., communication)		X

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Aesthetics	AES-1	**Impacts on Views from Topock Maze Locus B, a Scenic Vista (Key View 5)** - The proposed project shall be designed and implemented to adhere to the design criteria presented below.			
Aesthetics	AES-1a	a) Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases consistent with CUL1a-5. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation.	Map of mature plant species	Identification and mapping of mature plant species was completed in August 2011. The survey methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Mature Plants Survey Methodology*" (CH2M HILL 2011i) and is included in Appendix A3 of the Basis of Design Report. The mature plant map is under preparation and will be used to guide the remedy design and the planning for construction.	The survey methodology tech memo was completed on October 31, 2011, and provided to interested Tribes on November 8, 2011.
Aesthetics	AES-1b	b) Revegetation of disturbed areas within the riparian vegetation along the Colorado River shall occur concurrently with construction operations. Plans and specifications for revegetation shall be developed by a qualified plant ecologist or biologist before any riparian vegetation is disturbed and shall be implemented consistent with CUL1a-5. The revegetation plan shall include specification of maintenance and monitoring requirements, which shall be implemented for a period of 5 years after project construction or after the vegetation has successfully established, as determined by a qualified plant ecologist or biologist.	Revegetation Plan	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	
Aesthetics	AES-1c	c) Plant material shall be consistent with surrounding native vegetation.	Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	
Aesthetics	AES-1d	d) The color of the wells, pipelines, reagent storage tanks, control structures, and utilities shall consist of muted, earth-tone colors that are consistent with the surrounding natural color palette. Matte finishes shall be used to prevent reflectivity along the view corridor. Integral color concrete should be used in place of standard gray concrete.	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design. In addition, the detailed specification for colors will also be included the intermediate (60%) design.	
Aesthetics	AES-1e	e) The final revegetation plans and specifications shall be reviewed and approved by an architect, landscape architect, or allied design professional licensed in the State of California to ensure that the design objectives and criteria are being met. Planting associated with biological mitigation may contribute to, but may not fully satisfy, visual mitigation.	Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	
Aesthetics	AES-2	**Impacts on Views from Colorado River, a Scenic Resources Corridor (Key View 11)** - The proposed project shall be designed and implemented to adhere to the design criteria presented below:			
Aesthetics	AES-2a	a) A minimum setback requirement of 20 feet from the water (ordinary high water mark or OHWM) shall be enforced, except with regard to any required river intake facilities, to prevent substantial vegetation removal along the river bank.	Design submittals	The OHWM along the bank of the Colorado River, from the mouth of Bat Cave Wash to the BNSF railroad bridge, was mapped in March 2011. The OHWM methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Ordinary High Water Mark Mapping methodology*" (CH2M HILL 2011k) and is included in Appendix A3 of this Basis of Design Report. A 20-feet set back from the OHWM was used to guide the placement of the River Bank Extraction Wells and associated infrastructure in the floodplain. A map showing the OHWM and the 20-feet setback is included in Figure 2-17.	The mapping methodology technical memorandum and a map with the 20-feet setback from the OHWM was submitted on November 18, 2011.

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Aesthetics	AES-2b	b) Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation consistent with CUL1a-5.	Design submittals	Identification and mapping of mature plant species was completed in August 2011. The survey methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Mature Plants Survey Methodology*" (CH2M HILL, 2011i) and is included in Appendix A3 of this Basis of Design Report. The mature plant map is under preparation and will be used to guide the remedy design and the planning for construction.	The survey methodology tech memo was completed on October 31, 2011, and provided to interested Tribes on November 8, 2011.
Aesthetics	AES-2c	c) Revegetation of disturbed areas within the riparian vegetation along the Colorado River shall occur concurrently with construction operations. Plans and specifications for revegetation shall be developed by a qualified plant ecologist or biologist before any riparian vegetation is disturbed. The revegetation plan shall include specification of maintenance and monitoring requirements, which shall be implemented for a period of 5 years after project construction or after the vegetation has successfully established, as determined by a qualified plant ecologist or biologist.	Revegetation Plan	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	
Aesthetics	AES-2d	d) Plant material shall be consistent with surrounding native vegetation.	Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	
Aesthetics	AES-2e	e) The color of the wells, pipelines, and utilities shall consist of muted, earth-tone colors that are consistent with the surrounding natural color palette. Matte finishes shall be used to prevent reflectivity along the view corridor. Integral color concrete should be used in place of standard gray concrete.	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design. In addition, the detailed specification for colors will also be included the intermediate (60%) design.	
Aesthetics	AES-2f	f) The final revegetation plans and specifications shall be reviewed and approved by an architect, landscape architect, or allied design professional licensed in the State of California to ensure that the design objectives and criteria are being met. Planting associated with biological mitigation may contribute to, but may not fully satisfy, visual mitigation.	Revegetation Plan	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	
Aesthetics	AES-3	**Impacts on Visual Quality and Character along the Colorado River (Key View 11)** -- Mitigation Measure AES-1 shall be implemented. Implementation of Mitigation Measures AES-1 would reduce the overall change to the visual character of the view corridor along the Colorado River. Although the proposed project would still be visible, incorporating a facilities design that is aesthetically sensitive and preserving the vegetation would blend the proposed project into their visual setting within the floodplain and would reduce the overall contrast of the proposed project.	Design submittals	This requirement is addressed by the actions taken to address AES-1.	
Air Quality	AIR-1	**Short-Term Construction-Related Emissions of Criteria Air Pollutants and Precursors -** PG&E shall implement the fugitive dust control measures below for any construction and/or demolition activities:			
Air Quality	AIR-1a	a) Use periodic watering for short-term stabilization of disturbed surface area to minimize visible fugitive dust emissions during dust episodes. Use of a water truck to maintain moist disturbed surfaces and actively spread water during visible dusting episodes shall be considered sufficient;	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	
Air Quality	AIR-1b	b) Cover loaded haul vehicles while operating on publicly maintained paved surfaces;	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Air Quality	AIR-1c	c) Stabilize (using soil binders or establish vegetative cover) graded site surfaces upon completion of grading when subsequent development is delayed or expected to be delayed more than 30 days, except when such delay is caused by precipitation that dampens the disturbed surface sufficiently to eliminate visible fugitive dust emissions;	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	
Air Quality	AIR-1d	d) Cleanup project-related track out or spills on publicly maintained paved surfaces within twenty-four hours; and	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	
Air Quality	AIR-1e	e) Curtail nonessential earth-moving activity under high wind conditions (greater than 25 miles per hour) or develop a plan to control dust during high wind conditions. For purposes of this rule, a reduction in earth-moving activity when visible dusting occurs from moist and dry surfaces due to wind erosion shall be considered sufficient to maintain compliance.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be incorporated into the forthcoming Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; and Closure Plan for Decommissioning of Remedy Facilities and Restoration	
Biological Resources	BIO-1	**Potential Fill of Wetlands and Other Waters of the United States and Disturbance or Removal of Riparian Habitat** - Areas of sensitive habitat in the project area have been identified during project surveys. These areas include floodplain and riparian areas, wetlands, and waters of the United States. Habitats designated by DFG as sensitive, including desert washes and desert riparian, are also included. To the extent feasible, elements of the project shall be designed to avoid direct effects on these sensitive areas. During the design process and before ground disturbing activities within such areas (not including East Ravine), a qualified biologist shall coordinate with PG&E to ensure that the footprints of construction zones, drill pads, staging areas, and access routes are designed to avoid disturbance of sensitive habitats to the extent feasible. DTSC shall be responsible for enforcing compliance with design and all preconstruction measures.	Design submittals	During the preparation of the Construction/Remedial Action Work Plan as part of the design process, a qualified biologist will coordinate to ensure that the footprints of construction zones, drill pads, staging areas, and access routes are designed to avoid disturbance of sensitive habitats (floodplain and riparian areas, wetlands, waters of the US, desert washes, and desert riparian) to the extent feasible. The draft and final work plans are planned for submittal in 2012.	
Biological Resources	BIO-1	If during the design process it is shown that complete avoidance of habitats under USACE jurisdiction is not feasible, the Section 404 permitting process shall be completed, or the substantive equivalent per CERCLA Section 121(e)(1). In either event, the acreage of affected jurisdictional habitat shall be replaced and/or rehabilitated to ensure “no-net-loss.” Before any ground-disturbing project activities begin in areas that contain potentially jurisdictional wetlands, the wetland delineation findings shall be documented in a detailed report and submitted to USACE for verification as part of the formal Section 404 wetland delineation process and to DTSC. For all jurisdictional areas that cannot be avoided as described above, authorization for fill of wetlands and alteration of waters of the United States shall be secured from USACE through the Section 404 permitting process before project implementation. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by feasible methods agreeable to USACE and consistent with applicable county and agency policies and codes. Minimization and compensation measures adopted through any applicable permitting processes shall be implemented. Alternately, if USACE declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, the substantive equivalent of the Section 404 permitting process shall be complied with by ensuring that the acreage of jurisdictional wetland affected is be replaced on a “no-net-loss” basis in accordance with the substantive provisions of USACE regulations. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by feasible methods consistent with USACE methods, and consistent with the purpose and intent of applicable county and agency policies and codes. Minimization and compensation measures adopted through any applicable permitting processes shall be implemented. In any event, a report shall be submitted to DTSC to document compliance with these mandates.	Jurisdictional Delineation of Waters and Wetlands Report	During the preliminary (30%) design, it has been determined that complete avoidance of habitats under USACE jurisdiction (e.g., Bat Cave Wash) is not feasible. PG&E will work with the USACE to determine and complete the Section 404 permitting process or the substantive equivalent per CERCLA Section 121(e)(1). It is anticipated that a wetland delineation will be conducted in the Spring of 2012.	

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Biological Resources	BIO-1	If during the design process it is shown that complete avoidance of habitats under DFG jurisdiction (such as changes to the natural flow and/or bed and bank of a waterway) is infeasible, a Section 1602 streambed alteration agreement shall be obtained from DFG and affected habitats shall be replaced and/or rehabilitated. If complete avoidance of identified riparian habitat is not feasible, the acreage of riparian habitat that would be removed shall be replaced or rehabilitated on a no-net-loss basis in accordance with DFG regulations and, if applicable, as specified in the streambed alteration agreement, if needed. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to DFG and consistent with the purpose and intent of applicable county policies and codes, as well as those policies outlined under the respective federal agency guidance documents. Minimization and compensation measures adopted through the permitting process shall also be implemented. Restoration of any disturbed areas shall include measures to achieve "no-net-loss" of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat restoration plan submitted to DFG, BLM, and USFWS that is agreeable to these agencies, or, alternately, through the implementation of a habitat restoration plan consistent with the substantive policies of DFG, BLM, and USFWS. The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan. Alternately, if DFG declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, and during the design process it is shown that complete avoidance of habitats under DFG jurisdiction (such as changes to the natural flow and/or bed and bank of a waterway) is infeasible, the substantive mandates of a streambed alteration agreement shall be implemented, and affected habitats shall be replaced and/or rehabilitated. If complete avoidance of identified riparian habitat is not feasible, the acreage of riparian habitat that would be removed shall be replaced or rehabilitated on a "no-net-loss" basis in accordance with DFG regulations and, if applicable. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to DFG and consistent with the purpose and intent of applicable county policies and codes, as well as those policies outlined under the respective federal agency guidance documents. Minimization and compensation measures adopted through the permitting process shall also be implemented. Restoration of any disturbed areas shall include measures to achieve "no-net-loss" of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat restoration plan developed consistent with the substantive policies of DFG, BLM and USFWS. The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan.	Habitat Restoration Plan	During the preliminary (30%) design, it has been determined that complete avoidance of habitats under DFG jurisdiction (e.g., Bat Cave Wash) is not feasible. PG&E will work with the DFG to determine and complete the Section 1600 permitting process or the substantive equivalent per CERCLA Section 121(e)(1).	

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
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Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Biological Resources	BIO-2a	**Disturbance of Special-Status Birds and Loss of Habitat.** To the extent feasible, the project implementation plans shall be designed to minimize removal of habitat for special-status birds. During the design process and before ground disturbing activities (except within the East Ravine as described in the Revised Addendum and unless otherwise required as noted below), a qualified biologist shall coordinate with PG&E to ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on habitat and nesting habitat for other special-status species, to the extent feasible. DTSC will ensure compliance with all preconstruction and construction phase avoidance measures identified during this process and included in any design plans. Vegetation removal and other activities shall be timed to avoid the nesting season for special-status bird species that may be present. The nesting cycle for most birds in this region spans March 15 through September 30. **Preconstruction Measures**: Preconstruction breeding season surveys shall be conducted during the general nesting period, which encompasses the period from March 15 through September 30, if the final design of the project (including East Ravine investigation Sites I, K and L) could result in disturbance or loss of active nests of special-status bird species. If vegetation removal or other disturbance related to project implementation is required during the nesting season, focused surveys for active nests of special-status birds shall be conducted before such activities begin. A qualified biologist shall conduct preconstruction surveys to identify active nests that could be affected. The appropriate area to be surveyed and the timing of the survey may vary depending on the activity and species that could be affected. For the Yuma clapper rail, the preconstruction surveys shall specifically identify habitat within 300 feet of construction areas, in accordance with substantive policies of USFWS including those set out in USFWS protocols. **Construction Measures**: Before the initiation of project elements that could result in disturbance of active nests or nesting pairs of other special-status birds, a qualified biologist shall be consulted to identify appropriate measures to minimize adverse impacts during the construction phase of the project. If deemed appropriate for the final project design because of the potential for impacts, minimization measures will include focusing construction activities that must be conducted during the nesting season to less- sensitive periods in the nesting cycle, implementing buffers around active nests of special-status birds to the extent practical and feasible to limit visual and noise disturbance, conducting worker awareness training, and conducting biological monitoring (including noise monitoring to determine if construction noise at the edge of suitable nesting habitat is elevated above 60 dBA Leq or ambient levels). An avoidance and minimization plan for special status bird species, as defined in Table 4.3-3 of the EIR and those species protected under the federal Migratory Bird Treaty Act, including the Yuma clapper rail, shall be developed and implemented in consultation with USFWS, and agreed upon by DTSC. Avoidance and impact minimization measures, such as prohibiting construction near or in sensitive bird habitat, limiting construction during breeding seasons, and requiring an on-site biological monitor, shall be included in the design plan and implemented to the extent necessary to avoid significant impacts on sensitive bird species.	Avoidance and Minimization Plan; Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan	A qualified biologist will coordinate to ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on habitat and nesting habitat for other special-status species, to the extent feasible, at the intermediate (60%) stage. An Avoidance and Minimization Plan for special-status birds will be developed in consultation with the USFWS, and is subject to agreement from DTSC.	
Biological Resources	BIO-2b	**Disturbance of Desert Tortoise and Loss of Habitat.** **Preconstruction Measures:** In areas where impacts to potential desert tortoise habitat are unavoidable, measures outlined in the Programmatic Biological Agreement (PBA) and in the USFWS letter concurring with the PBA, shall be implemented, as described below. To the extent feasible, project construction shall be designed to minimize removal of habitat for the desert tortoise. Before any ground-disturbing project activities begin, and except within the East Ravine for which potential effects to the tortoise have been considered per the PBA), a USFWS-authorized desert tortoise biologist shall identify potential desert tortoise habitat in areas that could be affected by the final project design. Through coordination with the authorized biologist, PG&E shall ensure that the footprints of project elements and construction zones, staging areas, and access routes are designed to avoid direct or indirect effects on potential desert tortoise habitat to the extent feasible. These measures include the presence of a USFWS-authorized desert tortoise biologist onsite or designated agent in accordance with the PBA who will examine work areas and vehicles for the presence of desert tortoises, and who will conduct preconstruction desert tortoise surveys in areas where unavoidable impacts to tortoise habitat would occur. If feasible, the preconstruction desert tortoise surveys would coincide with one of the two peak periods of desert tortoise activity (i.e., if feasible, the surveys should be conducted in either the period from April through May, or from September through October). The preconstruction surveys shall be in full accordance with the substantive requirements of USFWS protocols. **Construction Measures**: Before the initiation of project elements that could result in disturbance of desert tortoises or desert tortoise habitat, a USFWS-authorized desert tortoise biologist shall be consulted to identify appropriate measures to minimize adverse impacts. Minimization measures are likely to include micro-siting structures, pipelines, and access roads in previously disturbed areas or in areas with sparse scrub vegetation, conducting worker awareness	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	PG&E, USFWS, and DOI are coordinating on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. Goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan. Measures outlined in the forthcoming PBA and associated USFWS determination letter will be implemented before and during construction activities.	

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Biological Resources	BIO-2c	**Disturbance of Special-Status Species and Loss of Habitat Caused by Decommissioning.** To avoid impacts on special-status species that may occur within the project area as a result of decommissioning activities, an avoidance and minimization plan shall be developed and implemented through consultation with DFG, BLM, and USFWS. These measures shall be based on surveys conducted prior to decommissioning, and during the breeding season (as previously defined in this EIR for each species or suite of species). Restoration of any disturbed areas shall include measures to achieve no net loss of habitat functions and values existing before project implementation. These measures shall be achieved by developing and implementing a habitat restoration plan submitted to DFG, BLM, and USFWS that is agreeable to these agencies. The plan shall include a revegetation seed mix or plantings design, a site grading concept plan, success criteria for restoration, a monitoring plan for achieving no net loss of habitat values and functions, and an adaptive management plan.	Avoidance and Minimization Plan; Habitat Restoration Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	During planning of the IM-3 Decommissioning and Site Restoration Plan, an Avoidance and Minimization Plan and a Habitat Restoration Plan will be developed and implemented through consultation with DFG, BLM, and USFWS.	
Biological Resources	BIO-3a	**Potential Impacts to Aquatic Habitat Related to Turbidity, Erosion, Sedimentation, and Overall Water Quality during Construction of the Intake Structure.** Hydrology & Water Quality Mitigation Measure HYDRO-1 shall be implemented in order to reduce water quality impacts related to erosion and pollutant runoff through implementation of BMPs. In addition, installing the cofferdam and dewatering a portion of the proposed intake structure site during fish screen construction may result in fish stranding. PG&E and its contractor shall coordinate with a qualified fisheries biologist to develop and implement a fish rescue plan. The fish rescue effort would be implemented during the dewatering of the area behind the cofferdam and would involve capturing those fish and returning them to suitable habitat within the river. The fish rescue plan shall identify and describe the following items: collection permits needed, fish capture zones, staffing, staging areas, fish collection and transport methods, species prioritization, resource agency contacts, fish handling protocols, fish relocation zones, site layout and progression of dewatering and fish rescue, and records and data. To ensure compliance, a fisheries biologist shall be present on-site during initial pumping (dewatering) activities and to oversee the fish rescue operation.	Fish Rescue Plan	No further action is required. The preliminary (30%) design does not include a river water intake structure.	
Biological Resources	BIO-3b	**Potential Loss or Degradation of Aquatic Habitat.** To restore, replace, or rehabilitate habitat impacted by the intake structure, PG&E shall implement the measures described below. Unless as provided below, PG&E shall confer with DFG regarding potential disturbance to fish habitat and shall obtain a streambed alteration agreement, pursuant to Section 1602 of the California Fish and Game Code, for construction work associated with intake structure construction; PG&E shall also confer with DFG pursuant to the California Endangered Species Act (CESA) regarding potential impacts related to the loss of habitat or other operational impacts on state-listed fish species, respectively. PG&E shall comply with all requirements of the streambed alteration agreement and any CESA permits to protect fish or fish habitat or to restore, replace, or rehabilitate any important habitat on a "no-net-loss" basis. Alternatively, if DFG declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, the project proponent shall consult with DFG regarding potential disturbance to fish habitat and shall meet the substantive policies of a streambed alteration agreement and of the CESA for construction work associated with intake structure construction and operations. PG&E shall comply with all substantive requirements of the streambed alteration agreement and CESA to protect fish and fish habitat or to restore, replace, or rehabilitate any important habitat on a "no-net-loss" basis and to operate the facility in accordance with CESA to ensure no net loss of habitat function.	Design submittals; O&M Plan	No further action is required. The preliminary (30%) design does not include a river water intake structure.	
Biological Resources	BIO-3b	Additionally, PG&E shall consult with USACE regarding the need to obtain permits under section 404 of the CWA and section 10 of the Rivers and Harbors Act. In conjunction with these permitting activities, the USACE must initiate consultation with USFWS under Section 7 of the federal ESA regarding potential impacts of the proposed project on federally listed fish species due to the loss of habitat on federally listed fish species. PG&E shall implement any additional measures developed through the ESA Section 7 processes, or its equivalent, to ensure "no-net loss" of habitat function. Alternatively, if USACE and/or USFWS decline to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, PG&E shall confer with USFWS regarding potential disturbance to federally listed fish species and federally listed fish species habitat and shall meet the substantive mandates under Section 7 of the federal ESA regarding potential impacts to fish or to habitat of federally listed fish species. PG&E shall implement any additional measures developed through that processes, including compliance with the substantive requirements of all of what would be permit conditions if not exempt pursuant to CERCLA, and to ensure "no-net-loss" of habitat function. Because the type and extent of habitat potentially affected is unknown, PG&E shall have an instream habitat typing survey conducted in the area potentially affected by the intake construction. Further, cooperation with USFWS and other fisheries biologists shall determine suitable and acceptable location(s) for the intake structure(s) to avoid the spawning habitat of special-status fish species. PG&E shall avoid habitat modifications, especially to habitat that is preferred by native fishes for spawning or rearing including side channels, cobble or gravel bars, and shallow backwaters. If these habitat types cannot be avoided, any disturbed habitat will be restored or replaced to achieve "no-net-loss" of habitat types and values as described above.	Design submittals; Instream Habitat Typing Survey Report; O&M Plan	No further action is required. The preliminary (30%) design does not include a river water intake structure.	

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Biological Resources	BIO-3c	**Potential Fish Entrainment and Impingement during Operation of the Intake Structure.** Both screened and unscreened diversions can entrain larval life stages of fish. For example, adverse effects to early life stages of fish could occur if diversions coincide with planktonic larval life stages that occur during summer months, a period of high entrainment vulnerability. Prior to operation of the intake structure, PG&E shall consult with USFWS and DFG to determine the most vulnerable time of the year for entrainment or impingement of razorback sucker and bonytail chub eggs or larvae. PG&E shall install a state-of-the-art positive-barrier fish screen that would minimize fish entrainment and impingement at the intake structure. The fish screen shall be designed in accordance with DFG and the National Marine Fisheries Service criteria, with specific consideration given to minimizing harm to fish eggs and other early life stages. To ensure that the fish screen operates as intended and reduce the risk of impacts, long-term monitoring of the operations and maintenance of the positive-barrier screen shall be conducted. Monitoring at the onset of diversions through the intake shall include approach velocity measurements immediately after the positive-barrier screen operations begin, with fine-tuning of velocity control baffles or other modifications as necessary, to achieve uniform velocities in conformance with the screen criteria established by regulatory agencies.	Design submittals	No further action is required. The preliminary (30%) design does not include a river water intake structure.	
Cultural Resources	CUL-1a	**During Design, Construction, O&M, and Decommissioning Implement Measures to Avoid, Minimize, or Mitigate Impacts on Cultural Resources.** Establishment of a cultural impact mitigation program and a Corrective Measures Implementation Workplan (CMI Workplan), with specific activities stipulated for each phase of the project, will reduce the potential for impacts on historical resources within the project area, and will help preserve the values of and access to the Topock Cultural Area for local tribal users. As detailed below, measures will be implemented to avoid known resources, re-use existing disturbed areas to the extent feasible, allow for tribal input to the final design and maintain access for tribal users during design, construction, operation, and decommissioning activities, as appropriate. During construction, a Worker Education Program and regular archaeological and tribal monitoring will be implemented, and measures intended to reduce the potential for incursion by outside parties will be strengthened. This measure does not apply to the activities included as part of the East Ravine Revised Addendum, Groundwater Investigation (dated December 31, 2010).		The Corrective Measure Implementation Work Plan (CMI Work Plan) was completed in November 2011. Work on the Cultural Impact Mitigation Program (CIMP) commenced in May 2011, the CIMP will be submitted with the final design (due 2012) as directed.	The CMI Work Plan was completed on November 2, 2011.
Cultural Resources	CUL-1a-1	During development of the final design and the construction, operation, and decommissioning phases of the project, PG&E shall carry out and require all subcontractors to carry out all investigative, testing, and remediation activities, including all supporting operations and maintenance activities, in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources, consistent with the CEQA Guidelines, and including the Topock Cultural Area, to the maximum extent feasible as determined by DTSC.	Training material for cultural resources	Implementation of this measure will be carried out in a manner that respects cultural and historic resources, to the maximum extent feasible as determined by DTSC.	
Cultural Resources	CUL-1a-2	As part of the CMI Workplan, PG&E shall develop a written access plan to preserve Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes. This plan will allow access to the extent PG&E has the authority to facilitate such access, and be consistent with existing laws, regulations, and agreements governing property within the project area. The access plan may place restrictions on access into certain areas, such as the Compressor Station and the existing evaporation ponds, subject to DTSC review with regard to health and safety concerns and to ensure noninterference with approved remediation activities. This access plan may be developed in coordination with the federal agencies with land management responsibilities in the project area (e.g., BLM and USFWS) in accordance with the related stipulation (General Principle I.C) contained in the Programmatic Agreement (Appendix PA). PG&E shall demonstrate a good faith effort to coordinate with Interested Tribes [1] by including communication logs as part of the CMI Workplan. [1] *"Interested Tribes" means, for purposes of this EIR and the mitigation measures contained herein, the six tribes that have substantially participated in the various administrative processes surrounding remediation of the site with DTSC, PG&E, and DOI, including throughout development of the final remedy. Interested tribes include the Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe, Fort Yuma-Quechan Indian Tribe, and Hualapai Indian Tribe.*	Access Plan; Communication Log with Tribes (part of the EIR mitigation measure compliance reports)	In its June 17, 2011 comment on the Draft CMI Work Plan, DTSC stated that "Although DTSC specified that the site access and security plan are to be developed as part of the CMI Work Plan, DTSC acknowledges that the full scope of the plan cannot be accomplished without completion of the design. Therefore, DTSC agrees that PG&E can provide conceptual ideas within the CMI Work Plan for the development of a detailed plan as part of the final design." At the time of this writing, PG&E has been in contact with the BLM who has responsibility for preparing the Access Plan required by the PA. BLM has indicated that they are planning to complete their Access Plan by Fall 2011. Given the majority of land within the area is federal land, PG&E is waiting for BLM to complete their Access Plan in order to avoid the potential for inconsistencies. PG&E will then prepare an Access Plans for the lands not under federal management, for submittal with the final design (target late 2012).	

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Cultural Resources	CUL-1a-3	PG&E shall enhance existing measures to prevent and reduce incursions from recreational and/or other outside users from affecting unique archeological and historically significant resources, including resources within the Topock Cultural Area, by:		This mitigation measure will be met through actions taken to comply with CUL-1a-3a through 3d (see below).	
Cultural Resources	CUL-1a-3a	a. Retaining a Qualified Cultural Resource Consultant to implement the Mitigation Monitoring and Reporting Program (MMRP) and conducting yearly inspections (or less frequently upon approval by DTSC) of identified historical resources, including inspections of the Topock Cultural Area, to determine if substantial adverse changes have occurred relative to the condition of the historical resources during the past year or prior to the implementation of the proposed project. PG&E shall offer to retain a tribal monitor at historic rates of compensation or tribal representatives designated by the Tribal Council or chairperson, if so requested, to accompany the Qualified Cultural Resources Consultant during the inspections. The Qualified Cultural Resource Consultant shall be a person who is acceptable to DTSC and who is also a qualified archaeologist with a graduate degree in archaeology, anthropology or closely related field, plus at least 3 years of full-time professional experience in general North American archaeological research and fieldwork, with expertise/experience in the Southwest preferred.	Annual cultural resources monitoring report	PG&E has retained qualified cultural resources consultants for implementation of the MMRP, subject to DTSC's approval.	
Cultural Resources	CUL-1a-3b	b. Developing a site security plan as part of the CMI Workplan. The site security plan shall include, but not be limited to, instructions for PG&E personnel to inspect the project site routinely during construction and report any human-caused disturbance to project facilities and the surrounding environment to DTSC and the appropriate landowner, such as BLM, USFWS, or FMIT, as appropriate, depending on the ownership of the property involved in the incursion. Notification shall be within a specified period, as established in the site security plan for the event, and shall also be summarized as part of the periodic implementation status report, as approved by DTSC for remedy implementation. This measure does not impose any obligation on PG&E to perform law-enforcement duties on federal or private lands, but is intended to provide increased observation of potential intrusions into the project area during construction and operation of the final remedy that may impact significant cultural resources. PG&E staff, or assigned agents, should be instructed to report any outside disturbance to the environment personally observed over the course of the working day. Information shall be reported within a specific period, as established in the site security plan, to DTSC and the appropriate landowners, such as BLM, USFWS, or FMIT, depending on the ownership of the property intruded upon. The site security plan may also include the use of PG&E security cameras at major ingress/egress gates into the project site. Finally, if requested by the FMIT the plan may include the use of private security personnel to patrol the FMIT-owned parcel within the project area to prevent outside incursions.	Site security plan	In its June 17, 2011 comment on the Draft CMI Work Plan, DTSC stated that "Although DTSC specified that the site access and security plan are to be developed as part of the CMI Work Plan, DTSC acknowledges that the full scope of the plan cannot be accomplished without completion of the design. Therefore, DTSC agrees that PG&E can provide conceptual ideas within the CMI Work Plan for the development of a detailed plan as part of the final design." PG&E provided concepts of security provisions in the CMI Work Plan (Section 4.2.3). PG&E will prepare a site security plan for submittals as part of the final design (target late 2012).	
Cultural Resources	CUL-1a-3c	c. Coordinating with BLM and San Bernardino County to facilitate an outreach effort to the staff at Moabi Regional Park, requesting that they communicate to visitors the parts of the project area that are off limits to off-road vehicle usage because of health and safety concerns, public lands management plans, or landowner requests. PG&E shall make a good faith effort to involve the surrounding Tribes in this outreach effort, providing Interested Tribes with the opportunity to comment on outreach materials or provide a tribal cultural resources specialist the opportunity to participate in the outreach activities. As part of this outreach effort, PG&E shall work with Park Moabi and offer to design, develop, and fund the installation of an informational kiosk within Park Moabi that informs visitors of the work being done at the project site. PG&E shall involve the Tribes to the maximum extent feasible, as determined by DTSC, in the design and development of the informational kiosk.	Design submittals	PG&E is currently in the process of implementing this mitigation measure.	
Cultural Resources	CUL-1a-3d	d. Posting signage to indicate those parts of the project area that are off limits to off-road vehicle usage due to possible health and safety concerns and to reduce potential damage to environmental resources. If agreed to by land owners and/or local, state, or federal management entities within the project area, PG&E shall work with the relevant land owner or land management entity to develop, design, and fund the installation of easily visible and clear signage. This may include coordination with BLM to install signage noting the designation of the area as an Area of Critical Environmental Concern owing to its biological and cultural resources, while ensuring that signs are placed in a way that does not draw unwanted attention to specific resources.	Design submittals	PG&E will seek to work with land owners and land management entities (BLM, the Refuge, USFWS) during the design so that the signage can be established prior to commencing construction activities; implementation of this measure may take longer, however, depending upon requirements of land owners and land management entities.	

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Cultural Resources	CUL-1a-4	PG&E shall work with representative members of the Interested Tribes to convene and retain a multidisciplinary panel of independent scientific and engineering experts as part of a Technical Review Committee (TRC). The TRC shall be made up of not more than five multidisciplinary experts who will be on call to review project-related documents, participate in project-related meetings, and advise interested tribal members on technical matters relating to the final design and remedy. The TRC shall include only persons with technical expertise, including but not limited to geology, hydrology, water quality, engineering, paleontology, toxicology, chemistry, biology, or botany. Before July 1, 2011, PG&E shall post an open grant or Request for Qualifications (RFQ) and retain members of the TRC at rates comparable to those paid historically to tribal experts by PG&E for the remediation project. TRC members shall be selected by majority vote of one representative from each participating Interested Tribe. PG&E shall provide Interested Tribes at least 30-days notice of the meeting to select TRC members and to review TRC candidate qualifications. For the purposes of contracting, the grant may be awarded to one tribal government to manage or, alternatively, PG&E may reimburse the Tribe or TRC members directly. The entirety of the monies shall be used to fund the scientific and engineering team exclusively, and shall not be used to fund other tribal government expenses or used to support legal counsel. A stipulation of the open grant shall be that the scientific and engineering team shall provide all deliverables and results to all involved Tribes, despite a possible contract agreement with only one Tribe or with PG&E. Upon conclusion of the construction phase of the project, the necessity and dollar value of the TRC shall be assessed by PG&E and, with the approval of DTSC, shall either be extended, reduced, or terminated under the operations and maintenance phase. An annual activity report shall be sent to DTSC for review and to ensure PG&E is in compliance.	EIR mitigation measures compliance reports (quarterly during design /construction, annual during project operation)	In compliance with this measure, PG&E posted a Request for Qualifications on several job boards, TRC members have been retained, and the TRC has been convened.	July 1, 2011
Cultural Resources	CUL-1a-5	Should any indigenous plants of traditional cultural significance and listed in Appendix PLA of this FEIR be identified within the project area, PG&E shall avoid, protect, and encourage the natural regeneration of the identified plants when developing the remediation design, final restoration plan, and IM-3 decommission plan. In the event that impacts on the identified plants cannot be avoided and such plants will be displaced, PG&E shall retain a qualified botanist who shall prepare a plant transplantation/monitoring plan which can be included as part of the Cultural Impact Mitigation Program (CIMP) referenced in CUL-1a-8 either by (1) transplanting such indigenous plants to an on-site location, or (2) providing a 2:1 ratio replacement to another location decided upon between PG&E and members of the Interested Tribes. Plans to transplant or replace such plants shall be approved by DTSC. In coordination with the qualified botanist, PG&E shall monitor all replanted and replacement plants for at least 3 5 years, and shall ensure at least a 75 percent survivorship during that time. This mitigation measure is not meant to replace or subsume any actions required by state or federal entities with regard to the protection of species listed as rare, threatened, or endangered.	Plant transplantation/ monitoring plan (part of CIMP)	A floristic survey was completed on November 1 through 8, 2011 to establish a comprehensive inventory of plant species that occur in the EIR project area, identify sensitive plants species and to comply with this mitigation measure, which requires PG&E to avoid, protect, and encourage the regeneration of ethnobotanically significant plants listed in Appendix PLA of the EIR. The survey methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Floristic Survey Methodology*" (CH2M HILL, 2011j) and is included in Appendix A3 of this Basis of Design Report. Another round of floristic survey will held in the Spring 2012, however, the exact timing of the survey will be determined by a qualified botanist. A map will be prepared to document the survey results.	The survey methodology technical memorandum was completed on October 31, 2011, and provided to interested Tribes on November 8, 2011.
Cultural Resources	CUL-1a-6	All additional phone calls and alarms associated with remediation activities or facilities shall not be routed through PG&E's existing alarm system utilized at the compressor station. The notification system for remediation-related alerts and/or phone calls shall not introduce additional noise to the project area, to the maximum extent feasible, provided there is ongoing compliance with applicable safety regulations or standards of the Federal Energy Regulatory Commission, Occupational Safety and Health Administration, and other agencies. (See Mitigation Measure NOISE-3 for additional mitigation related to the Topock Cultural Area).	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design. In addition, the detailed specification for phone calls and alarms associated with remediation activities will also be included the intermediate (60%) design.	

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Cultural Resources	CUL-1a-7	Nighttime construction-related activities shall be limited to work that cannot be disrupted or suspended until the following day, such as, but not limited to, well drilling and development or decommissioning activities. Lighting considerations, including the potential use of solar power for some lighting, shall be included as part of the remedial design plan to be developed with involvement of Interested Tribes and the U.S. Department of the Interior. To minimize construction and operations-related lighting impacts, the lighting in the remedial design plan shall include, at a minimum: (1) shrouding/shielding for portable lights needed during construction and operational activities; (2) installation of portable lights at the lowest allowable height and in the smallest number feasible to maintain adequate night lighting for safety; (3) shielding and orientation of lights such that off-site visibility of light sources, glare, and light from construction activities is minimized to the extent feasible. No additional permanent poles shall be installed for lighting. This mitigation measure is not meant to replace or subsume any actions required by the County or state or federal entities with regard to lighting required for minimum security and safety purposes.	Design submittals	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this Basis of Design Report for the preliminary design (see C.5.2). In addition, the detailed specification for lighting will also be included the intermediate (60%) design.	
Cultural Resources	CUL-1a-8	Prior to commencement of construction, PG&E shall submit as part of the final Remedial Design, a CIMP developed in coordination with Interested Tribes for DTSC's review and approval. The CIMP may be developed in coordination with the federal agencies with land management responsibilities in the project area (e.g., BLM and USFWS) in accordance with the Programmatic Agreement (Appendix PA). The CIMP shall include, at a minimum and to DTSC's satisfaction, the following:	CIMP	Work on the CIMP commenced in May 2011. The CIMP will be submitted as part of final design as directed.	
Cultural Resources	CUL-1a-8a	a. Protocols for continued communication. Consistent with past practice and the communication processes previously entered into by PG&E with Interested Tribes, the company shall continue to communicate with Interested Tribes during the design, construction, operation, and decommissioning of the project. Prior to implementation of construction, PG&E shall communicate with Interested Tribes that place cultural significance on the Topock Cultural Area. Outreach efforts between the Tribes and PG&E shall be communicated by PG&E to DTSC quarterly during the design and construction phase for review and input, and annually during project operations.	EIR mitigation measures compliance reports (quarterly during design /construction, annual during project operation)	Outreach efforts have been and are ongoing. Table 7-2 of this report contains a log of Tribal communications for the specified time period. With the completion of the CMI Work Plan in November 2011, PG&E will start to submit quarterly reports to DTSC, starting with the first report (Q4 2011) in January 2012.	
Cultural Resources	CUL-1a-8b	b. Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final remedy, including protocols for the repatriation of significant items of cultural patrimony that may be recovered during the project, and protocols for the curation of cultural materials recovered during the project. Treatment of archaeological sites may include data recovery or capping. If data recovery is proposed, a Research Design following California Office of Historic Preservation guidelines or federal guidelines, as applicable, shall be prepared and reviewed and approved by DTSC.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8c	c. Protocols for the review of cultural resource-related documents throughout the design, construction, and operational phases.	CIMP	Draft protocols for review of cultural resource-related documents were included in the CMI Work Plan (Section 4.8), and will also be included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8d	d. Protocols for the review of project design documents before the beginning of construction, including reviews of project design documents throughout the design process (e.g., Preliminary [approximately 30% completed], Intermediate [approximately 60% completed] and Pre-final design).	CIMP	Draft protocols for review of cultural resource-related documents were included in the CMI Work Plan (Section 4.8), and will also be included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8e	e. Protocols for the appropriate methods to be used to restore the environment to its preconstruction condition upon decommissioning of individual groundwater remedy facilities.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8f	f. A plan for the decommissioning and removal of the IM-3 Facility and proposed restoration of the site (to be an appendix to the CIMP).	Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (appendix to the CIMP)	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8g	g. Protocols for the repatriation of clean soil cuttings generated during construction activities and during drilling associated with repair/replacement activities during operations and maintenance phases. The soil cuttings shall be managed in compliance with applicable laws and regulations on site.	CIMP	Discussions regarding repatriation of soils have been and are ongoing since early 2011. The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	

TABLE 7-1
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Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Cultural Resources	CUL-1a-8h	h. Protocols for the appropriate methods, consistent with Mitigation Measure NOISE-3, to reduce auditory impacts.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8i	i. Protocols for the appropriate methods, consistent with Mitigation Measures AES-1 and AES-2, to reduce visual intrusions.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8j	j. Protocols for tribal notification in advance of project-related activities that the Interested Tribes may feel have the potential to cause adverse impacts to sensitive cultural resources.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8k	k. Protocols to be followed by project personnel to accommodate, if feasible as determined by DTSC, key tribal ceremonies that involve the Topock Cultural Area.	CIMP	Project personnel will accommodate, if feasible as determined by DTSC, key Tribal ceremonies that involve the Topock Cultural Area, provided that such Tribal ceremonies may not interfere with the expeditious implementation of the remedy or create health and safety concerns. This protocol will be included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8l	l. Provisions affording sufficient tribal monitors to observe ground-disturbing activities and/or other scientific surveying (e.g., biological surveys) that may occur in preparation for construction activities. Ground-disturbing activities include trenching, excavation, grading, well excavation/drilling, decommissioning of the IM-3 Facility and subsurface pipeline, or other construction-related activities.	CIMP	Tribal monitors will be invited to observe ground-disturbing activities. This provision will be included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8m	m. Provisions of reasonable compensation for tribal monitors consistent with historic rates.	CIMP	Tribal monitors will receive reasonable compensation consistent with agreed upon historic rates. This provision will be included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8n	n. Locations requiring specific protective devices, such as temporary fencing, flagging, or other type of demarcation during construction.	CIMP	Locations requiring specific protective devices, such as temporary fencing, flagging, or other type of demarcation during construction will be included in the CIMP.	
Cultural Resources	CUL-1a-8o	o. Protocols for the reporting of discoveries of cultural importance consistent with existing statutes and regulations.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	
Cultural Resources	CUL-1a-8p	p. Protocols for the inspection of remediation facilities and/or staging areas throughout the construction phase.	CIMP	The required protocols will be developed and included in the CIMP. The CIMP will be submitted with the final design as directed.	

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Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Cultural Resources	CUL-1a-9	During selection of the design and specific locations for physical remediation facilities, PG&E shall, in communication with the Interested Tribes (and subject to their review), and to the maximum extent feasible, as determined by DTSC, give: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, such as but not limited to wells and pipelines, but not including IM-3 facilities. "Disturbed" areas in this context means those areas outside of documented archaeological site boundaries that have experienced ground disturbance in the last 50 years. PG&E shall produce an aerial map of these disturbed areas to guide project design, and PG&E shall make a good faith effort to provide Tribes with an opportunity to review and comment on the information displayed on the map in determining "disturbed" areas.	Aerial map of disturbed areas	As directed, PG&E prepared an aerial map of disturbed areas to guide project design and made a good faith effort to provide Tribes with an opportunity to review and comment. PG&E provided the disturbed areas map to Interested Tribes for review and comment on May 26, 2011. Written comments on the map were received from the FMIT on July 5, 2011 and the Hualapai Tribe on July 1, 2011. PG&E responded to the Hualapai and the FMIT in July 2011 with an invitation to a site walk for discussion of the comments and groundtruth the map. To date, three Tribes have attended site walks/onsite meetings to discuss the map -- the site walk/meeting with the Colorado River Indian Tribes (CRIT) occurred on June 7, 2011, the site walk/meeting with the FMIT occurred on October 4, 2011, and the site walk/meeting with the Hualapai Tribe occurred on October 26, 2011. Additional discussions regarding the aerial map are planned. A current version of the aerial map is included in Appendix A2 of this Basis of Design Report. In compliance with the directive to give priority to re-use of existing physical improvements and to previously disturbed areas for new physical improvements, the preliminary (30%) design proposes the following: • The freshwater supply for the remedy will be the existing HNWR-1 well. If needed, this water supply can be supplemented by the current Compressor Station water supply (by existing Topock-2 and Topock-3 wells in Arizona). • The freshwater supply storage will be the existing water storage tanks at the Compressor Station. • The remedy-produced water treatment plant will be located entirely within the footprint of Compressor Station and much of it will replace existing structures within the maintenance shop area.	A current version of the aerial map of disturbed areas was submitted on November 18, 2011
Cultural Resources	CUL-1a-10	PG&E shall consider the location of Loci A, B, and C of the Topock Maze during the design and approval of the physical facilities necessary for the final remedy and is prohibited from creating any direct physical impact on the Topock Maze, as it is manifested archaeologically. Through the design, PG&E shall prevent all indirect (e.g. noise, aesthetics) impacts on the Topock Maze, to the maximum extent feasible as determined by DTSC.	Design submittals	The design has been and is carried out in a manner that excluded direct impacts on Loci A, B, and C of the Topock Maze. Prevention of indirect impacts to the Maze will be incorporated into the design to the maximum extent feasible as determined by DTSC.	

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Cultural Resources	CUL-1a-11	PG&E shall provide an open grant for two part-time cultural resource specialist/project manager positions during the design and construction phases of the remediation project. The positions shall be filled by qualified members of an Interested Tribe as nominated by a majority vote of their Tribal Council(s) and appointed by DTSC's project manager if more than two members are nominated. The award of the grants is for continued involvement in review of project documents and participation in project-related meetings, including TRC meetings, at rates of historic compensation. Additionally, in light of FMIT's ownership of land in the project area and historical involvement in the environmental process, additional funding is guaranteed for one full-time FMIT position upon submission of an application by a qualified FMIT member who shall be appointed by the FMIT council, provided such funding is not duplicative of the services and funding provided by PG&E pursuant to the Settlement Agreement between PG&E and the FMIT in Fort Mojave Indian *Tribe v. Dept. of Toxic Substances Control, et al.*, Case No. 05CS00437 for a position with the FMIT's AhaMakav Culture Society. The payment of grant monies shall be timed to the awarded Tribes' fiscal cycles so that the Tribes are not forced to front funds for long periods of time. These positions shall act as cultural resources contacts and project managers for interactions between the Tribes, PG&E, and DTSC to ensure coordination for review and comment of subsequent project and/or environmental documents related to the design and implementation of the groundwater remediation project to avoid, reduce, or otherwise mitigate impacts on historical resources, as defined by CEQA. This funding is separate from provisions for tribal monitor positions and shall not be used for routine tribal business or legal counsel. For review and approval, PG&E shall provide DTSC with the names of the selected grant recipients and an annual report that summarizes activities associated with the grant program. Upon the conclusion of the construction phase of the project, the necessity and dollar value of the grant program shall be assessed by PG&E and, with the approval of DTSC, shall either be extended or terminated under the operations and maintenance phase.	Administrative step - no technical document required	A notice of the open grant for funding of two part-time cultural resource specialist/project manager positions was sent to Interested Tribes by a letter dated April 20, 2011. To date, PG&E has not received any responses to the April 20, 2011 letter from Tribes.	
Cultural Resources	CUL-1a-12	PG&E shall provide sufficient opportunity, as determined by DTSC, for Interested Tribes to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing construction activities occur.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will offer interested Native American Tribes the opportunity to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing activities occur.	
Cultural Resources	CUL-1a-13	PG&E shall, in communication with Interested Tribes, develop as part of the CMI Workplan, a worker cultural sensitivity education program. The program shall be implemented before commencement of construction and throughout construction and operations as personnel are added. This program may include information provided directly by tribal entities either in written form or on video, in a manner consistent with Appendix C in the existing BLM Programmatic Agreement. The worker cultural sensitivity education program shall ensure that every person working on the project as an employee or contractor, before participating in design or outdoor activities at the project site, is informed regarding: • the cultural significance of the Topock Cultural Area, • appropriate behavior to use within the Topock Cultural Area, • activities that are to be avoided in the Topock Cultural Area, and • consequences in the event of noncompliance.	Worker Cultural Sensitivity Education Program	As described in the CMI Work Plan (Section 4.2.1), the education on cultural/historical resources sensitivity for Topock currently occurs via periodic training and project initiation meetings. Sensitivity training classes are conducted at least annually, and are attended by all workers available to participate. Sensitivity training/ education is also provided at project initiation meetings, typically held at the site prior to field work. The training is provided by the Site Operations Manager, the Project Archaeologist, and Interested Tribal members who attend the meetings. In compliance with this measure, a training/education manual will be prepared using existing and new material, as available.	
Cultural Resources	CUL-1b and 1c	**During Design, Construction, O&M, and Decommissioning Consider the Location of Historical Resources and Implement Measures to Avoid Resources to the Extent Feasible.** The following actions will reduce the potential for impacts on identified historically significant resources (other than the Topock Cultural Area, which is separately addressed in CUL-1a) within the project area. As detailed below, these actions include consideration of the location of historical resources, preparation of a cultural resources study, and preparation of a treatment plan. Monitoring of ground-disturbing activities during project construction will further protect historically significant resources. Protective actions are also described pertaining to the discovery of any previously unidentified potentially significant cultural resources.	Design submittals	This mitigation measure will be met through actions taken to implement CUL-1b/c-1 through c-4 (see below). In addition, the aerial map of disturbed areas (CUL-1a-9) provides a first cut at protecting and avoiding archaeological and historical sites.	
Cultural Resources	CUL-1b/c-1	PG&E shall consider the locations of the identified historic resources described above (EIR Table 4.4-3) during the design of the physical improvements necessary for the proposed project and avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible, as determined by DTSC. The final design plans for the project will be submitted to DTSC for review and approval.	Design submittals	The design has been and is carried out to avoid impacts to historical and archaeological resources to the maximum extent practicable as determined by DTSC. The final design will be submitted to DTSC as directed.	

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Cultural Resources	CUL-1b/c-2	During preparation of the final design, and consistent with CUL-1 a-3, PG&E shall retain a Qualified Cultural Resources Consultant to prepare a cultural resources study that assesses the potential for the construction, operations, or decommissioning of specific proposed improvements to result in significant impacts on identified historically significant resources described in Impacts CUL-1b and CUL-1c. This may include a geoarchaeological investigation and/or non-destructive remote-sensing surveys of potentially disturbed areas to determine if a potential exists for buried historical and archaeological resources. "Significant impacts" as used here means the potential for construction to demolish or materially alter in an adverse manner those physical characteristics of a resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the CRHR. The study will be submitted to DTSC for review and evaluation to determine if existing mitigation measures are appropriate.	Cultural resources study/Geoarchaeological investigation report	Consistent with CUL-1a-3, PG&E has retained qualified cultural resources consultants to prepare a cultural resources study. The study will commence at the intermediate (60%) design stage, after the locations of remedial facilities are confirmed.	
Cultural Resources	CUL-1b/c-3	If the cultural resources study determines that the construction of physical improvements would result in significant impacts on identified historically significant resources described in Impacts CUL-1b and CUL-1c, and avoidance of the resource is not feasible, PG&E shall prepare a treatment plan that identifies measures to reduce these impacts (see above description of the CIMP) for DTSC's review and approval. The treatment plan shall identify which criteria for listing on the CRHR contribute to the affected resource's significance and which aspects of significance would be materially altered by construction, operations, or decommissioning and shall provide for reasonable efforts to be made to permit the resource to be preserved in place or left in an undisturbed state. Methods of accomplishing this may include capping or covering the resource with a layer of soil. To the extent that a resource cannot feasibly be preserved in place or left in an undisturbed state, excavation as mitigation shall be restricted to those parts of the resource that would be damaged or destroyed by the project. Excavation as mitigation shall not be required for a historically significant resource if the treatment plan determines that testing or studies already completed have adequately recovered the scientifically consequential information from and about the resource. The plan shall require communication with all Interested Tribes with regard to their perspectives and wishes for the treatment of the resources.	Cultural resources treatment plan	Implementation of this measure is dependent upon the cultural resources study conducted under CUL-1b/c-2.	
Cultural Resources	CUL-1b/c-4	Consistent with CUL-1a-3a above, PG&E shall retain a Qualified Cultural Resources Consultant to observe ground-disturbing activities and shall be required to request the participation of tribal monitors during those activities, including steps necessary during operations and decommissioning activities to ensure that historically significant resources are avoided to the maximum extent feasible, as determined by DTSC, during actual construction (see the description of the CMI Workplan, above). The Qualified Cultural Resources Consultant shall provide training to construction personnel on the locations of identified resources, values associated with the identified resources, responsibility for reporting suspected historic resources, and procedures for suspension of work in the immediate vicinity of the discovery, and shall use exclusionary fencing, flagging, or other appropriate physical barriers to mark the boundaries of identified resources. The Qualified Cultural Resources Consultant shall invite participation from Interested Tribal members to participate in the training. In the event that previously unidentified potentially significant cultural resources are discovered during ground-disturbing activities, the Qualified Cultural Resources Consultant shall have the authority to divert or temporarily halt ground-disturbing activities in the area of discovery to allow evaluation of the potentially significant cultural resources. If such discoveries occur on land managed by a federal agency, Stipulation IX (Discoveries) of the Programmatic Agreement shall apply and are deemed adequate by DTSC. If a discovery occurs on other lands within the project area, the Qualified Cultural Resources Consultant shall contact the PG&E and DTSC project managers at the time of discovery and, in consultation with DTSC and tribal monitors, shall evaluate the resource before construction activities will be allowed to resume in the affected area. For significant cultural resources, and before construction activities are allowed to resume in the affected area, the resource(s) shall be recovered with coordination of the tribal monitors and DTSC. Recovery may include a Research Design and/or Data Recovery Program submitted to DTSC for review and approval. The Qualified Cultural Resources Consultant (and tribal monitors) shall determine the amount of material to be recovered for an adequate sample for analysis or data recovery. Any concerns or recommendations regarding the ground-disturbing activities or the handling of cultural resources shall be directed to the Qualified Cultural Resources Consultant or PG&E's site supervisor.	Training material for historic resources	Consistent with CUL-1a-3, PG&E has retained qualified cultural resources consultants to observe ground-disturbing activities and provide training as required.	
Cultural Resources	CUL-2	**During Project Design Consider the Location of Unique Archaeological Resources and Avoid Resources to the Maximum extent Feasible.** Cultural resources that qualify as unique archaeological sites in the project area would probably also meet one or more of the criteria for historical resources and would be subject to Mitigation Measures CUL-1b/c-2 and CUL-1b/c-3. The mitigation measures under this identified impact are the same as listed for Impact CUL-1b and CUL-1c. These mitigation measures would reduce the potential for impacts on unique archaeological resources.	Cultural resources study/ Geoarchaeological investigation report; Cultural resources treatment plan	The requirements of this mitigation measure will be met by implementation of CUL-1b/c-2 and CUL-1b/c-3.	

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Cultural Resources	CUL-3	**Conduct Survey and Construction Monitoring**. A **paleontological investigation**, **including a detailed survey of the project area** by a qualified paleontologist, shall be conducted to refine the potential impacts on unique paleontological resources within the final design area and determine whether preconstruction recovery of sensitive resources and/or construction monitoring would be warranted. If construction monitoring is determined to be warranted, ground-altering activity would be monitored by a qualified paleontologist to assess, document, and recover unique fossils. Monitoring shall include the inspection of exposed surfaces and microscopic examination of matrix in potential fossil bearing formations. In the event microfossils are discovered, the monitor shall collect matrix for processing. In the event paleontological resources are encountered during earthmoving activities, recovered specimens shall be prepared by the paleontologist to a point of identification and permanent preservation. PG&E shall retain a Qualified Paleontologist to observe ground-disturbing activities where determined necessary based on the results of the paleontological investigation and shall be required to request the participation of tribal monitors during those activities, including steps necessary during operations and decommissioning activities to ensure that historically significant resources are avoided to the maximum extent feasible, as determined by DTSC, during actual construction (see above description of the CMI Workplan). Paleontological resources of scientific value shall be identified and curated into an established, accredited, professional museum repository in the region with permanent retrievable paleontological storage. This measure does not apply to the activities included as part of the East Ravine Revised Addendum, Groundwater Investigation.	Paleontological investigation report	PG&E has retained a paleontologist to conduct the investigation, planning for this investigation is currently underway. A draft report has been prepared and is being reviewed by PG&E.	
Cultural Resources	CUL-4	**With Discovery of Human Remains or Burials Suspend Work, Protect Remains, and Comply with Local, State, and Federal Laws Regarding Discoveries During Ground-Disturbing Activities.** Ground-disturbing activities may disturb as-yet undiscovered human remains or Native American burials and associated grave goods. PG&E shall retain a Qualified Cultural Resource Consultant and request designated tribal monitor(s) to train construction personnel in the identification of human remains so that they may aid in the identification of such resources (see above description of the CIMP). A Qualified Cultural Resource Consultant and tribal monitor(s) shall be in place to adequately oversee all ground-disturbing activities. In the event human remains are uncovered over the course of project construction, operation and maintenance, and/or decommissioning activities, the following procedures shall be followed to ensure compliance with all applicable local, state, and federal laws.	Training material for the identification of human remains	PG&E will retain Qualified Cultural Resources Consultants prior to construction to prepare training material for the identification of human remains, provide training and oversee ground-disturbing activities as required. All of the provisions of this measure will remain in effect during construction, and will be implemented as directed in the event any human remains are uncovered during construction.	
Cultural Resources	CUL-4f	f) The construction contractor shall immediately suspend work within the vicinity of the discovery and determine if the remains discovered are human or nonhuman. This determination shall be made by the Qualified Cultural Resources Consultant, a qualified archaeologist and/or physical anthropologist with expert skill in the identification of human osteological (bone) remains.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	
Cultural Resources	CUL-4g	g)The Qualified Cultural Resources Consultant (and tribal monitor), or construction contractor, shall protect discovered human remains and/or burial goods remaining in the ground from additional disturbance.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	
Cultural Resources	CUL-4h	h)The Qualified Cultural Resources Consultant, archaeologist, or construction site supervisor shall contact the San Bernardino County Coroner, and the PG&E and DTSC project managers immediately. In California, all subsequent action shall conform to the protocols established in the Health and Safety Code and regulations. In Arizona, the Qualified Cultural Resources Consultant or PG&E construction site supervisor will follow Arizona laws and the implementing regulations. Human remains found on federal land would require the notification of the BLM Havasu City field office and compliance with applicable federal laws and regulations, including the Native American Graves Protection and Repatriation Act if the remains are determined to be of Native American origin. The Qualified Cultural Resources Consultant shall coordinate the interaction between Interested Tribes, PG&E, the County, and DTSC to determine proper treatment and disposition of any remains.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	
Cultural Resources	CUL-4i	i) The San Bernardino County Coroner will determine if the remains are of recent origin and if an investigation of the cause of death is required (California Health and Safety Code Section 7050.5). If the coroner determines that the human remains are not Native American and not evidence of a crime, project personnel shall coordinate with the Qualified Cultural Resources Consultant (s) to develop an appropriate treatment plan. This may include contacting the next-of kin to solicit input on subsequent disposition of the remains. If there is no next-of-kin, or recommendations by the next-of-kin are considered unacceptable by the landowner, the landowner will reinter the remains with appropriate dignity in a location outside the project area and where they would be unlikely to be disturbed in the future.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	

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Cultural Resources	CUL-4j	j) In the event that the San Bernardino County Coroner determines that the human remains are Native American and not evidence of a crime, project personnel shall contact the NAHC so that a most likely descendent (MLD) can be identified as required under California Public Resources Code Section 5097.98.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	
Cultural Resources	CUL-4k	k) The MLD (s) shall inspect the area in which the human remains were found and provide treatment recommendations to the landowner and PG&E site manager in accordance with the provisions of PRC Section 5097.98. The treatment may include reburial, scientific removal of the discovered human remains and relinquishment to the MLD(s), nondestructive analysis of human remains and/or other culturally appropriate treatment. If the MLD(s) so requests, the landowner would reinter the remains with the appropriate dignity in a location outside the area of disturbance in a location unlikely to be disturbed in the future.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	
Cultural Resources	CUL-4l	l) To the maximum extent feasible, Mitigation Measure CUL-4 shall be implemented in a manner that is consistent with mitigation required by local, state, and federal requirements.	Corrective Measure Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This requirement will be met by actions to be taken under CUL-4.	
Geology & Soils	GEO-1a	**Construction, Operation and Maintenance, and Decommissioning Impacts Related to Erosion of Soils.**			
Geology & Soils	GEO-1a-a	a) A DTSC-approved grading and erosion control plan, prepared by a California Registered Civil Engineer, shall be completed prior to implementation of any grading in areas of the site where there is a potential for substantial erosion or loss of top soils. The plan shall outline specific procedures for controlling erosion or loss of topsoil during construction, operation and maintenance, and decommissioning.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	A grading and erosion control plan will be prepared and included in the Construction/Remedial Action Work Plan for DTSC review and approval.	
Geology & Soils	GEO-1a-b	b) To ensure soils do not directly or indirectly discharge sediments into surface waters as a result of construction, operation and maintenance, or decommission activities, PG&E shall develop a SWPPP as discussed in mitigation measure HYDRO-1 of the "Hydrology and Water Quality" section of this EIR. The SWPPP shall identify best management practices (BMPs) that would be used to protect stormwater runoff and minimize erosion during construction. PG&E shall prepare plans to control erosion and sediment, prepare preliminary and final grading plans, and shall prepare plans to control urban runoff from the project site during construction, consistent with the substantive requirements of the San Bernardino County Building and Land Use Services Department for erosion control.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	PG&E will prepare a construction SWPPP and BMP Plan prior to construction activities, that will be included in the Construction/Remedial Action Work Plan.	
Geology & Soils	GEO-1a-c	c) During road preparation activities, loose sediment shall be uniformly compacted consistent with the substantive San Bernardino County Building and Land Use Services Department requirements to aid in reducing wind erosion. Ongoing road maintenance including visual inspection to identify areas of erosion and performing localized road repair and regrading, installation and maintenance of erosion control features such as berms, silt fences, or straw wattles, and grading for road smoothness shall be performed as needed to reduce potential for erosion.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed, to aid in reducing wind erosion.	
Geology & Soils	GEO-1a-d	d) Regarding the potential for contaminated soils to be eroded and contribute contamination into receiving waters, Mitigation Measures GEO-2 and HAZ-2 shall be implemented. Mitigation Measure GEO-2 provides the provisions for mitigating erosion through BMPs which shall be implemented. Mitigation Measure HAZ-2 provides the provisions for safe work practices and handling of contaminated soils as investigation derived wastes.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This mitigation measure will be met through actions to be taken to implement Mitigation Measures GEO-2 and HAZ-2 to prevent contaminated soils to be eroded and contribute contamination into receiving waters.	
Geology & Soils	GEO-1b	**Construction, Operation and Maintenance, and Decommissioning Impacts Related to Differential Compaction of Soils.**			
Geology & Soils	GEO-1b-a	a) BMPs shall be implemented during construction, operation and maintenance, and decommissioning activities to minimize impacts on the affected areas. Such BMPs could include, but would not be limited to, the following: uniform compaction of roadways created for accessing the project area as per San Bernardino County Building and Land Use Services Department requirements, returning areas adversely affected by differential compaction to preexisting conditions when these areas are no longer needed, and continuing maintenance of access roads, wellhead areas, and the treatment plant areas.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. The BMPs will be identified in the Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration, as appropriate.	

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Geology & Soils	GEO-1b-b	b) Work area footprints shall be minimized to the greatest extent feasible to limit the areas exposed to differential compaction. Where possible, existing unpaved access roads and staging/working areas shall be reused and maintained for different stages of the construction. New graded areas for staging or for access roads shall be compacted to a uniform specification, typically on the order of 90 to 95% compaction and consistent with substantive San Bernardino County Building and Land Use Services Department requirements to reduce differential compaction and subsequent erosion of site soils.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed, to minimize work area footprints to the greatest extent feasible.	
Geology & Soils	GEO-1b-c	c) After the completion of the operation and maintenance phase, the disturbed areas which result in increased potential for compaction shall be returned to their respective preexisting condition by regarding consistent with the preconstruction slopes as documented through surveys that may include topographic surveys or photo surveys. The areas will be returned to the surrounding natural surface topography and compacted consistent with unaltered areas near the access roads or staging areas in question. The habitat restoration plan outlined in mitigation measure BIO-1 shall include restoration of native vegetation or other erosion control measures where revegetation would be infeasible or inadequate, for purposes of soil stabilization and erosion control of the project area.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. The Habitat Restoration Plan, developed in compliance with BIO-1, will include the requirements under this measure.	
Hazardous Materials	HAZ-1a	**Spills or Releases of Contaminants during Operation and Maintenance Activities.**			
Hazardous Materials	HAZ-1a-a	a) PG&E shall store, handle, and transport hazardous material in compliance with applicable local, state, and federal laws.	O&M Plan	This measure will be implemented as directed.	
Hazardous Materials	HAZ-1a-b	b) All chemical storage and loading areas shall be equipped with proper containment and spill response equipment. BMPs to be implemented may include, but are not limited to, use of secondary containment in mixing and storage areas; availability of spill kits and spill containment booms, and appropriate storage containers for containment of the materials generated during the spill response.	O&M Plan	This measure will be implemented as directed.	
Hazardous Materials	HAZ-1a-c	c) A project-specific HMBP, chemical standard operating procedure (SOP) protocols and contingency plans shall be developed to ensure that proper response procedures would be implemented in the event of spills or releases. Specifically, the HMBP and SOPs shall describe the procedures for properly storing and handling fuel on-site, the required equipment and procedures for spill containment, required personal protective equipment, and the measures to be used to reduce the likelihood of releases or spills during fueling or vehicle maintenance activities. BMPs to be implemented may include, but are not limited to, use of secondary containment in mixing and storage areas; availability of spill kits and spill containment booms, and appropriate storage containers for containment of the materials generated during the spill response. The field manager in charge of operations and maintenance activities shall be responsible for ensuring that these procedures are followed at all times.	Project-specific HBMP; O&M Plan	This measure will be implemented as directed. A project-specific HMBP, chemical standard operating procedure (SOP) protocols and contingency plans will be developed to ensure that proper response procedures would be implemented in the event of spills or releases.	
Hazardous Materials	HAZ-1b	**Spill or Release of Contaminants during Construction and Decommissioning Activities.**			
Hazardous Materials	HAZ-1b-a	a) Fueling areas and maintenance areas would be supplied with proper secondary containment and spill response equipment.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment.	
Hazardous Materials	HAZ-1b-b	b) PG&E shall develop fueling SOP protocols and a contingency plan that would be implemented at all fueling areas on-site. The SOPs shall describe the procedures for properly storing and handling fuel on-site, the required equipment and procedures for spill containment, required PPE, and the measures to be used to reduce the likelihood of releases or spills during fueling or vehicle maintenance activities. Potential measures include but are not limited to, fuel storage in bermed areas, performing vehicle maintenance in paved and bermed areas, and availability of spill kits for containment and cleanup of petroleum releases. The field manager in charge of construction and decommissioning activities shall be responsible for ensuring that these procedures are followed at all times.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Fueling SOP protocols and a contingency plan will be developed as part of the O&M Plan for implementation at fueling areas on-site.	

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Hazardous Materials	HAZ-1b-c	c) PG&E shall comply with local, state, and federal regulations related to the bulk storage and management of fuels.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed, for compliance with local, state, and federal regulations related to the bulk storage and management of fuels.	
Hazardous Materials	HAZ-2	**Reasonably Foreseeable Releases of Chemicals from Excavated or Disturbed Soil** -- Before initiating ground-disturbing operations, a health and safety plan shall be developed and implemented by qualified environmental professionals to ensure health and safety precautions are being met. It is not possible to prepare the health and safety plan at this stage of the planning process because final construction plans and other design documents have not been finalized in sufficient detail. However, at a minimum, the health and safety plan shall include procedures to mitigate potential hazards, and such procedures shall include the use of PPE, measures that provide protection from physical hazards, measures that provide protection from chemical hazards that may be present at the site, decontamination procedures, and worker and health and safety monitoring criteria to be implemented during construction. The worker health and safety plan shall include protective measures and PPE that are specific to the conditions of concern and meet the requirements of the U.S. Occupational Safety and Health Administration's (OSHA's) construction safety requirements and Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). In accordance with OSHA requirements, appropriate training and recordkeeping shall also be a part of the health and safety program. The worker health and safety plan shall be certified by a Certified Industrial Hygienist in accordance with OSHA regulations. The worker health and safety plan shall be explained to the construction workers and all workers shall be required to sign the plan, which will be kept on the construction site at all times. Worker safety training shall occur prior to initiation of ground disturbing activities. Training shall include the review of all health and safety measures and procedures. All workers and engineering inspectors at the site shall provide written acknowledgement that the soils management plan (discussed below), worker health and safety plan, and community health and safety plan were reviewed and training was received prior to commencement of construction activities. The following are specific elements and directives that shall be included in the health and safety plan and implemented by PG&E during construction, operation and maintenance, and decommissioning of this project:	Health and Safety Plan	This mitigation measure will be implemented as directed. A health and safety plan will be developed for O&M activities and will be submitted with the O&M Plan. Similarly, a health and safety plan will be developed for construction activities and will be submitted with the Construction/Remedial Action Work Plan. The plans will be implemented by qualified environmental professionals.	
Hazardous Materials	HAZ-2a	a. Vehicles traveling on unpaved roadways or surfaces would be directed to avoid traveling in areas where contaminated soils are known to be present; vehicle speeds shall be controlled (e.g., limited to 15 mph or slower) to limit generation of dust; measures, such as wetting of surfaces, will be employed to prevent dust generation by vehicular traffic or other dust-generating work activities.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan	This measure will be implemented as directed. Vehicle movement will be controlled to avoid traveling in areas where contaminated soils are known to be present, and limit speeds to limit generation of dust.	
Hazardous Materials	HAZ-2b	b. Pre-mobilization planning shall occur during which the likelihood of encountering contaminated soils shall be reviewed along with the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place prior to implementing the field operations.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Pre-mobilization planning will be used to review the likelihood of encountering contaminated soils, the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place.	
Hazardous Materials	HAZ-2c	c. Should evidence of contaminated soil be identified during ground disturbing activities (e.g., noxious odors, discolored soil), work in this area will immediately cease until soil samples can be collected and analyzed for the presence of contaminants by the site supervisor or the site safety officer. Contaminated soil shall be managed and disposed of in accordance with a project-specific health and safety plan and soil management plan. The health and safety plan and soil management plan shall be approved by DTSC before beginning any ground disturbing activities. While the project is exempt from the requirements of the San Bernardino County Division of Environmental Health, the health and safety plan and soil management plan shall be prepared in general accordance with the substantive requirements of this agency.	Health and Safety Plan; Soil Management Plan	This measure will be implemented as directed. A Health and Safety Plan and a Soil Management Plan will be prepared as part of the Construction/Remedial Action Work Plan and submitted to DTSC.	
Hazardous Materials	HAZ-2d	d. In the event that drilling sites must be located within areas of suspected soil contamination, the appropriate PPE shall be worn by all personnel working in these areas and methods specified in the health and safety plan used to control the generation of dust. When working in these areas, personnel shall be required to follow all guidance presented in the site-specific health and safety plan and soil management plan. The site-specific health and safety plan shall include provisions for site control such as, but not limited to, delineation of the exclusion, contaminant reduction and support zones for each work area, decontamination procedures, and procedures for the handling of contaminated soils and other investigation derived wastes. Soil that is excavated shall be loaded directly into containers such as roll-off bins; dust suppression methods shall be used prior to and during loading of soils into the bins. Suspected contaminated soils shall be segregated from suspected uncontaminated soils.	Health and Safety Plan	This measure will be implemented as directed. A Health and Safety Plan will be prepared as part of the Construction/Remedial Action Work Plan and submitted to DTSC.	

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Hazardous Materials	HAZ-2e	e. Personnel working at the site shall be trained in Hazardous Waste Operations.	Health and Safety Plan	This measure will be implemented as directed. A Health and Safety Plan will be prepared as part of the Construction/Remedial Action Work Plan, and will include requirement for training of personnel working at the site in Hazardous Waste Operations.	
Hazardous Materials	HAZ-2f	f. All soil excavated and placed in roll-off bins or trucks for transportation off-site shall be covered with a tarp or rigid closure before transporting, and personnel working in the area shall be positioned upwind of the loading location.	Soil Management Plan	This measure will be implemented as directed. A Soil Management Plan will be prepared as part of the Construction/Remedial Action Work Plan, and will include requirement for soil excavated and placed in roll-off bins or trucks for transportation off-site to be covered with a tarp or rigid closure before transporting.	
Hydrology and Water Quality	HYDRO-1	**Exceedance of Water Quality Standards.** The project shall implement BMPs to meet the substantive criteria of NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities Order No. 2009-0009-DWQ NPDES No. CAS000002 (General Permit) (SWRCB 2009) as well as all other applicable federal, state, and local permit and regulatory requirements, even if a permit is not required pursuant to CERCLA, for purposes of ensuring the protection of receiving water quality. As such, a BMP plan shall be prepared and implemented for the project prior to construction and decommissioning phase activities. Impacts on water quality from pollutants, including soils from erosion, shall be controlled through use of the following types of BMPs, which shall be incorporated into the appropriate project-specific BMP plan. The General Permit requirements include specific BMPs as well as numeric effluent levels (NELs) and numeric action levels (NALs) to achieve the water quality standards (SWRCB 2009:3). Types of BMPs cited in the General Permit (SWRCB 2009:Attachment A:7) include: a) Scheduling of Activities; b) Prohibitions of Practices; c) Maintenance Procedures; d) Other Management Practices to Prevent or Reduce Discharge of Pollutants to Waters of the United States; e) Treatment Requirements; and f) Operating Procedures and Practice to Control Site Runoff, Spillage or Leaks, Sludge or Waste Disposal, or Drainage from Raw Materials Storage. Visual inspections and monitoring and sampling are required under the General Permit to evaluate the effectiveness of the BMPs and to determine whether modifying BMPs or implementing additional BMPs is required. The BMP designations cited below are based on those used by the California Stormwater Quality Association Construction BMP Handbook (California Stormwater Quality Association 2003) and are consistent with the types of BMPs referenced in the General Permit: g) Scheduling (SS-1): Proper scheduling assists in identifying ways to minimize disturbed areas, which allows for a reduction in the active project area requiring protection and also minimizes the length of time disturbed soils are exposed to erosive processes. h) Preservation of Existing Vegetation (SS-2): Preserving existing vegetation to the maximum extent practicable facilitates protection of surfaces from erosion and can also help to control sediments. Sensitive areas should also be clearly identified and protected. i) Hydraulic Mulch (S S-3), Straw Mulch (S S-6), and Wood Mulching (SS-8): Using various mulches is a method for temporarily stabilizing soil and can be used on surfaces with little or no slope. j) Geotextiles, Plastic Covers, and Erosion Control Blankets/Mats (SS-7): These erosion control methods can be used on flat or, usually, sloped surfaces, channels, and stockpiles. k) Stabilized Construction Entrance/Exit (TC-1): A graveled area or pad located at points where vehicles enter and leave a construction site can be built. This BMP provides a buffer area where vehicles can drop their mud and sediment to avoid transporting it onto public roads, to control erosion from surface runoff, and to help control dust. l) Runoff Control Measures (SS-9, SS-10, and SC-10): These include graded surfaces to redirect sheet flow, diversion dikes or berms that force sheet flow around a protected area, and stormwater conveyances (swales, channels, gutters, drains, sewers) that intercept, collect, and redirect runoff. Diversions can be either temporary or permanent. Temporary diversions include excavation of a channel along with placement of the spoil in a dike on the downgradient side of the channel, and placement of gravel in a ridge below an excavated swale. Permanent diversions are used to divide a site into specific drainage areas, should be sized to capture and carry a specific magnitude of storm event, and should be constructed of more permanent materials. A water bar is a specific kind of runoff diversion that is constructed diagonally at intervals	BMP Plan	This measure will be implemented as directed. PG&E will prepare a construction SWPPP and BMP Plan prior to construction activities which will be included in the Construction/Remedial Action Work Plan.	

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		across a linear sloping surface such as a road or right-of-way that is subject to erosion. Water bars are meant to interrupt accumulation of erosive volumes of water through their periodic placement down the slope, and divert the resulting segments of flow into adjacent undisturbed areas for dissipation. m) Silt Fence (SC-1): A temporary sediment barrier consisting of fabric is designed to retain sediment from small disturbed areas by reducing the velocity of sheet flows. n) Gravel Bag Berm (SC-6) and Sand/Gravel Bag Barrier (SC-8): A temporary sediment barrier consisting of gravel-filled fabric bags is designed to retain sediment from small disturbed areas by reducing the velocity of sheet flows. o) Desilting Basin (SC-2) and Sediment Trap (SC-3): Constructing temporary detention structures facilitates the removal of sediment from waters. The devices provide time for sediment particles to settle out of the water before runoff is discharged. Secondary concerns include potential pollutants from inappropriate material storage and handling procedures and nonstormwater discharges. These will be addressed through the following types of BMPs, which shall be incorporated into the stormwater BMP plan: p) Material Delivery and Storage (WM-1): Provide covered storage for materials, especially toxic or hazardous materials, to prevent exposure to stormwater. Store and transfer toxic or hazardous materials on impervious surfaces that will provide secondary containment for spills. Park vehicles and equipment used for material delivery and storage, as well as contractor vehicles, in designated areas. q) Spill Prevention and Control (WM-4): Ensure that spills and releases of materials are cleaned up immediately and thoroughly. Ensure that appropriate spill response equipment, preferably spill kits preloaded with absorbents in an overpack drum, is provided at convenient locations throughout the site. Spent absorbent material must be managed and disposed of in accordance with applicable regulations. In particular, absorbents used to clean up spills of hazardous materials or waste must be managed as hazardous waste unless characterized as nonhazardous. r) Solid Waste Management (WM-5): Provide a sufficient number of conveniently located trash and scrap receptacles to promote proper disposal of solid wastes. Ensure that the receptacles are provided with lids or covers to prevent windblown litter. s) Hazardous Waste Management (WM-6): Provide a sufficient number of proper receptacles to promote proper disposal of hazardous wastes. t) Concrete Waste Management (WM-8): Dispose of excess concrete in specific concrete washout facilities. u) Sanitary/Septic Waste Management (WM-9): Locate sanitary and septic waste facilities away from drainage courses and traffic areas. Maintain the facilities regularly. v) Vehicle and Equipment Cleaning (NS-8): Clean vehicles and equipment that regularly enter and leave the construction site. w) Vehicle and Equipment Fueling (NS-9): Fuel vehicles and equipment off- site whenever possible. If off-site fueling is not practical, establish a designated on-site fueling area with proper containment and spill cleanup materials. x) Vehicle and Equipment Maintenance (NS-10): Use off-site maintenance facilities whenever possible. Any on-site maintenance areas must be protected from stormwater runoff and on-site flooding.			

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Hydrology and Water Quality	HYDRO-1	In addition to BMPs implemented to avoid or reduce impacts from the construction and decommissioning phases, BMPs shall also be implemented to avoid or reduce impacts from the operations and maintenance phases. To address potential violation of water quality standards caused by insufficient treatment, system failure at concentrations in excess of water quality standards, proper design shall include contingency measures such as safeguards to shut down the extraction wells in case of pipeline failure or malfunction. In addition, operation of the proposed project will be governed by and follow an operations and maintenance plan. PG&E will comply with all applicable water quality standards, the General Permit, and any SWRCB or RWQCB resolutions identified as ARAR, as well as a corrective action monitoring program. Under the corrective action monitoring program, data will be collected to measure performance of the remedy, compliance with standards, and progress of the remedial action as a part of the project description. In addition, the project will be operated to continually assess performance issues and to modify the type, method, and configuration of the treatment delivery systems to enhance performance of the remedy to attain the cleanup goals and to respond to site conditions and performance issues as described in the project description.	O&M Plan	This measure will be implemented as directed. An O&M Plan will be developed and will include BMPs to avoid or reduce impacts from the operations and maintenance phases, and a monitoring program in compliance with applicable water quality standards, the General Permit, and identified ARARs.	
Hydrology and Water Quality	HYDRO-1	A SWPPP will also be prepared for the proposed project, which will contain BMPs related to industrial activities (industrial SWPPP). The BMPs are designed to reduce pollutants in discharges that may affect receiving water quality during operations and maintenance of the proposed project. As noted above, BMP designations are based on those used by the *California Stormwater Quality Association Construction BMP Handbook* (California Stormwater Quality Association 2003) and those referenced in the General Permit The SWPPP will incorporate BMPs such as the following: y) Good Housekeeping: Maintain facility in a clean manner and train facility personnel to contribute to a safe, clean, and orderly environment by properly disposing of trash in designated containers, storing materials in appropriate locations, and keeping equipment clean and in good working condition. z) Preventative Maintenance: Prevent or minimize release of pollutants. Develop Standard Operating Procedures for operation and maintenance of facility components and train employees to follow the procedures. aa) Non-Stormwater Discharges (SC-10): Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Conduct regular inspections of high priority areas. bb) Spill Prevention, Control, and Cleanup (SC-1 1): Store materials properly to prevent spills from entering the storm drain system or surface waters. Ensure that spill cleanup materials are located on-site and are easily accessible. Clean up leaks and spills immediately using proper absorbent materials. Absorbents used to clean up hazardous materials must be disposed of as hazardous waste. Educate employees about spill prevention and cleanup. cc) Vehicle and Equipment Fueling (SC-20): Maintain clean fuel-dispensing areas using dry cleanup methods, such as sweeping or using rags and absorbents for leaks and spills. Cover the fueling area to prevent contact with stormwater. Train personnel in pollution prevention, focusing on containment of spills and leaks. dd) Outdoor Loading/Unloading (SC-30): Load and unload chemicals during dry weather, if possible, and load and unload in designated areas. Check equipment regularly for leaks. ee) Outdoor Liquid Container Storage (SC-3 1): Cover the storage area with a roof and provide secondary containment. Inspect storage areas regularly for leaks or spills. ff) Outdoor Equipment Operations (SC-32): Perform activities during dry weather, cover the work area with a roof, and use secondary containment. Train employees in proper techniques for spill containment and cleanup. gg) Waste Handling and Disposal (SC-34): Cover storage containers with leak-proof lids, check for leaks weekly, and clean storage areas regularly. Ensure that wastes are disposed of properly. hh) Tank Design System: Ensure that tank systems have sufficient strength to avoid collapse, rupture, or failure and that they are protected against physical damage and excessive stress. Provide adequate secondary containment.	Stormwater Pollution Prevention Plan (SWPPP)/BMP Plan and Monitoring and Reporting	This measure will be implemented as directed. An industrial Storm Water Pollution Prevention Plan (SWPPP) will be developed as part of the O&M Plan and implemented to reduce pollutants in discharges that may affect receiving water quality during operations and maintenance of the remedy	

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Hydrology and Water Quality	HYDRO-1	In conformance with the substantive requirements of General Permit (Order No. 2009-0009-DWQ, a monitoring and reporting program will be implemented to assess the effectiveness of BMPs and to modify BMPs and revise the SWPPP, if necessary, to continue to reduce pollutants and impacts on receiving waters. The monitoring program shall include the following minimum elements as per the General Permit: ii) quarterly, nonstormwater visual inspections, jj) storm-related visual inspections within 2 business days of a qualifying rain event (producing precipitation of one-half inch or more of discharge), kk) visual inspection after a storm event, ll) monitoring of nonvisual pollutants based on the calculated risk level for the project, with Risk Level 2 and 3 requiring a minimum of three samples per day during qualifying rain events (SWRCB 2009:Tables 5 and 6, 22–27), and mm) monitoring and reporting for linear projects as per Attachment A of the General Permit Results of this monitoring shall be reported annually to DTSC and to the Storm Water Multi-Application Reporting and Tracking System (SMARTS). The annual report shall include a summary and evaluation of all sampling and analysis results, original laboratory reports, and chain of custody forms; a summary of all corrective actions taken during the compliance year; and identification of any compliance activities or corrective actions that were not implemented. NEL Violation Reports and/or NAL Violation Reports are required for Risk Level 3 and linear underground/overhead project (LUP) Type 3 Discharges. Should the project meet these criteria, the respective reports shall be submitted within 5 days of the end of the storm event, as per General Permit requirements, and provide the required information identified (SWRCB 2009:26–27 and Attachment A). The implementation of stormwater plans shall include an education component to train workers on water quality concerns and proper BMP implementation, maintenance, and repair, in addition to stormwater management program training on the construction BMP plan and industrial SWPPP.	Stormwater Pollution Prevention Plan (SWPPP)/BMP Plan and Monitoring and Reporting	This measure will be implemented as directed. The SWPPP will include a monitoring and reporting program to assess the effectiveness of BMPs and to modify BMPs and revise the SWPPP, if necessary.	
Hydrology and Water Quality	HYDRO-2	**Exceedance of Water Quality Standards and/or Waste Discharge Requirements** - Implement Mitigation Measure HYDRO-1. Implementation of appropriate BMPs defined in Mitigation Measure HYDRO-1 would minimize impacts on water quality by controlling erosion and siltation. Consequently, any impacts associated with erosion and siltation resulting from alterations of drainage and hydrology and water quality during construction, operation and maintenance, and decommissioning.	Stormwater Pollution Prevention Plan (SWPPP)/BMP Plan and Monitoring and Reporting	This measure will be met through actions to be taken under HYDRO-1.	
Hydrology and Water Quality	HYDRO-3	**Exceedance of Water Quality Standards and/or Waste Discharge Requirements.** Implement Mitigation Measure HYDRO-1. Mitigation Measure HYDRO- 1 shall be implemented. Implementation of appropriate BMPs defined in Mitigation Measure HYDRO-1 would minimize impacts on water quality by controlling potential pollutants, including sediment, and runoff discharges from the project area. Consequently, any impacts associated with pollutants resulting from alterations of drainage and water quality during construction, operation and maintenance, and decommissioning.	Stormwater Pollution Prevention Plan (SWPPP)/BMP Plan and Monitoring and Reporting	This measure will be met through actions to be taken under HYDRO-1.	
Noise	Noise-1	**Short-Term Groundborne Noise and Vibration Levels Caused by Construction Activities near Sensitive Receptors.**			
Noise	Noise-1a	a) Construct new wells a minimum of 45 feet from vibration-sensitive receptors. Avoid constructing wells within 30 feet of vibration- sensitive land uses located in California and 275 feet of vibration- sensitive land uses located in Arizona;	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	The EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Since the EIR does not define vibration-sensitive land uses, PG&E assumes that they are residential and mobile home parks. Based on this definition, none of the remediation wells presented in the preliminary (30%) design are located within 45 feet of vibration-sensitive receptors or within 30 feet and 275 feet of vibration-sensitive land uses in California and Arizona, respectively. Locations of new monitoring wells will be presented in the intermediate (60%) design, these wells will be placed to meet the requirements of this mitigation measure.	

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Noise	Noise-1b	b) A disturbance coordinator will be designated by the project applicant, which will post contact information in a conspicuous location near the entrance so that it is clearly visible to nearby receivers most likely to be disturbed. The coordinator will manage complaints resulting from the construction vibration. Reoccurring disturbances will be evaluated by a qualified acoustical consultant retained by the project applicant to ensure compliance with applicable standards. The disturbance coordinator will contact nearby vibration-sensitive receptors, advising them of the construction schedule.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	Noise disturbance coordinators have been designated to manage communication with nearby vibration-sensitive receptors, and noise/vibration issues and complaints.	November 18, 2011
Noise	Noise-2	**Project-Generated Construction-Related Noise Levels.**			
Noise	Noise-2a	a) Construction equipment shall be properly maintained per manufacturer specifications and fitted with the best available noise suppression devices (e.g., mufflers, silencers, wraps). All impact tools shall be shrouded or shielded, and all intake and exhaust ports on power equipment shall be muffled or shielded.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Construction equipment will be maintained and fitted with available noise suppression devices, impact tools will be shrouded or shielded, and all intake and exhaust ports on power equipment will be muffled or shielded.	
Noise	Noise-2b	b) Construction equipment shall not idle for extended periods of time (more than 15 minutes) when not being utilized during construction activities.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. Construction equipment will not be left idle for extended periods of time (more than 15 minutes) when not being used.	
Noise	Noise-2c	c) Construction activities shall include the use of berms, stockpiles, dumpsters, and or bins to shield the nearest noise-sensitive receptor adjacent to construction activities to within acceptable non-transportation noise level standards. When construction activities are conducted within the distances outlined above (i.e., 1,850 feet and 5,830 feet from California receptors and 330 feet and 735 feet from Arizona receptors for daytime and nighttime noise, respectively) relative to noise-sensitive uses in the project area, noise measurements shall be conducted by a qualified acoustical consultant at the nearest noise-sensitive land use relative to the construction activities with a sound level meter that meets the standards of the American National Standards Institute (ANSI Section S14 1979, Type 1 of Type 2) to ensure that construction noise associated with the project component complies with applicable daytime and nighttime noise standards. If noise levels are still determined to exceed noise standards, temporary barriers shall be erected as close to the construction activities as feasible, breaking the line of sight between the source and receptor where noise levels exceed applicable standards. All acoustical barriers shall be constructed with material having a minimum surface weight of 2 pounds per square foot or greater and a demonstrated Sound Transmission Class (STC) rating of 25 or greater as defined by the American Society for Testing and Materials' Test Method E90. Placement, orientation, size, and density of acoustical barriers shall be specified by a qualified acoustical consultant.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	This measure will be implemented as directed. The use of berms, stockpiles, dumpsters, and or bins to shield the nearest noise-sensitive receptor adjacent to construction activities will be implemented. When construction activities are within the distance outline, the additional requirements specified in this measure will be implemented.	
Noise	Noise-2d	d) A disturbance coordinator will be designated by the project applicant, which will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby receivers most likely to be disturbed. In addition, mailing of the same information will be sent to nearby receptors and all Tribes. The coordinator will manage complaints resulting from the construction noise. Reoccurring disturbances will be evaluated by a qualified acoustical consultant retained by the project applicant to ensure compliance with applicable standards. The disturbance coordinator will contact nearby noise- sensitive receptors, advising them of the construction schedule.	Corrective Measure Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Closure Plan for Decommissioning of Remedy Facilities and Restoration	Noise disturbance coordinators have been designated to manage communication with nearby vibration-sensitive receptors, and noise/vibration issues and complaints.	November 18, 2011
Noise	NOISE-3	**Land Use Compatibility of Future Project Noise Levels with Places of Worship and the Topock Cultural Area.** Provided that the proposed project would be required to achieve the normally acceptable exterior noise level standard for places of worship, the following mitigation measure shall be incorporated in the project design:		This mitigation measure will be met through actions taken to implement NOISE-3a and 3b (see below).	
Noise	NOISE-3a	a) Implement all of the mitigation measures outlined for Impact NOISE- 1 and Impact NOISE-2;		This measure will be met through actions to be taken under mitigation measures outlined for Impact NOISE- 1 and Impact NOISE-2.	
Noise	NOISE-3b	b) Upon completion of detailed project design, the determination of remediation activities and the schedule established to achieve these activities shall be communicated to Native American Tribes. PG&E shall maintain a liaison with requesting Tribes to alert them to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis.		This measure will be implemented as directed. A liaison with requesting Native American Tribes will alert them to project activities that would generate new noise in the Topock Cultural Area on at least an annual basis.	

TABLE 7-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Date Completed
Water Supply	WATER-1	**Depletion of Groundwater.** To mitigate potentially significant effects on local groundwater levels associated with the freshwater extraction wells, in the event that freshwater is to be supplied from wells rather than from a surface intake, a hydrologic analysis shall be conducted during the design phase of the project to evaluate the proposed pumping rates for extraction, the potential cone of depression, and the extraction effect on any existing wells in proximity. Proximity shall be defined by the cone of depression boundary of any well to be used in the extraction process. Extraction well location and/or extraction rates shall be adjusted during project design based on this analysis to ensure that extraction does not substantially adversely affect the production rates of existing nearby wells (e.g., adversely affect well production such that existing land uses would not be supported). It shall be demonstrated using computer simulations or other appropriate hydrologic analysis that production rates of existing nearby wells will not be substantially affected before the installation of any new freshwater extraction wells.		Work on the required hydrologic analysis has commenced and will be reported in the intermediate (60%) design.	

TABLE 7-2
Log of Outreach/Communication with Tribes
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

ID	Date/Time	Party Initiated Contact	Party Received Contact	Summary of Outreach/ Communications
1	5/28/11 10:36 AM	PG&E (Glenn Caruso)	Hualapai (Loretta Jackson-Kelly and Dawn Hubbs)	Transmits draft disturbed area maps and proposes conference call June 2.
2	6/17/11 1:32 PM	FMIT (Leo Leonhart)	PG&E (Yvonne Meeks)	Leo asks for names of selected TRC members
3	6/17/11 1:52 PM	PG&E (Yvonne Meeks)	FMIT (Leo Leonhart)	Yvonne provides names of members
4	6/17/11 6:27 AM	PG&E (Glenn Caruso)	Hualapai (Loretta Jackson-Kelly and Dawn Hubbs)	Informs Hualapai of another call to discuss disturbance maps on June 24.
5	6/16/11 6:53 PM	PG&E (Yvonne Meeks)	Chemehuevi (Ron Escobar)	Copy of letter (per Ron's request) describing the tribal cultural resources/project manager position that will be funded by PG&E under the EIR and requests input from Chemehuevi.
6	6/21/2011	PG&E (Yvonne Meeks)	5 candidate (Dr. Rosenblum; Dr. Prucha; Mr. Guay; Dr. Eggers; Dr. Schlinger)	Letters to TRC Candidates informing them of their being shortlisted and asking for additional information (i.e. background checks, etc.)
7	6/30/2011	HDR (Sandra Flint)	2 candidates (Dr. Rosenblum; Dr. Prucha)	Letters to two candidates informing them of their selection as TRC members.
8	7/12/11 9:08 AM	PG&E (Glenn Caruso)	CRIT (Doug Bonamici)	Glenn spoke to Doug and asked if CRIT had comments on disturbance maps. Doug to get back to him.
9	7/25/11 9:31 AM	PG&E (Glenn Caruso & Yvonne Meeks)	Hualapai (Loretta Jackson-Kelly and Dawn Hubbs)	Letter in response to questions from Loretta's 7/1/11 letter to DTSC and DOI asks for Hualapai to share availability to discuss and ground truth for disturbance maps.
10	7/27/11 2:50 PM	PG&E (Glenn Caruso & Yvonne Meeks)	FMIT (Nora McDowell-Antone)	PG&E response on Hargis' letter dated July 5 and asks for FMIT to share availability to ground truth for disturbance maps.
11	7/27/11 6:16 PM	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone)	Attached resume of employee who did field reconnaissance for disturbance maps.
12	8/12/11 3:07 PM	PG&E (Curt Russell)	FMIT (Nora McDowell-Antone)	Informs Tribe that PG&E will be conducting plant and wetlands survey and invites to orientation session on August 18.
13	8/12/11 3:15 PM	PG&E (Curt Russell)	Hualapai (Loretta Jackson-Kelly and Dawn Hubbs)	Informs Tribe that PG&E will be conducting plant and wetlands survey and invites to orientation session on August 18.
14	8/12/11 3:21 PM	PG&E (Curt Russell)	CRIT (Eric Shepard and Doug Bonamici)	Informs Tribe that PG&E will be conducting plant and wetlands survey and invites to orientation session on August 18.
15	8/12/11 3:24 PM	PG&E (Curt Russell)	Chemehuevi (Ron Escobar & Tito)	Informs Tribe that PG&E will be conducting plant and wetlands survey and invites to orientation session on August 18.
16	8/17/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Chemuhuevi (Charles Wood)	Letter to Tribe announcing selection of TRC members.
17	8/17/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Cocopah (Sherry Cordova)	Letter to Tribe announcing selection of TRC members.

TABLE 7-2
Log of Outreach/Communication with Tribes
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PG&E Topock Compressor Station, Needles, California

ID	Date/Time	Party Initiated Contact	Party Received Contact	Summary of Outreach/ Communications
18	8/17/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	CRIT (Eldred Enas)	Letter to Tribe announcing selection of TRC members.
19	8/17/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	FMIT (Timothy Williams)	Letter to Tribe announcing selection of TRC members.
20	8/17/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Fort Yuma-Quechan Tribe (Mike Jackson)	Letter to Tribe announcing selection of TRC members.
21	8/17/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Hualapai (Louise Benson)	Letter to Tribe announcing selection of TRC members.
22	8/18/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	19 candidates (Ms. Wilbur; Dr. Budek-Schmeisser; Dr. Kumar; Babs; Dr. Jarnot; Mr. Bramwell; Dr. Tilton; Mr. McKinley; Mr. Gantney; Mr. Conovaloff; Dr. Wolfe; Dr. Ogaard; Dr. Sullivan; Dr. Smith; Mr. Arnold; Mr. Chambers; Mr. Creed; Sula; Mr. Field)	Letters to candidates not selected for TRC.
23	9/12/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Cocopah (Sherry Cordova)	Invites Tribes to TRC kick-off meeting on October 20.
24	9/12/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	CRIT (Eldred Enas)	Invites Tribes to TRC kick-off meeting on October 20.
25	9/12/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Fort Yuma-Quechan Tribe (Mike Jackson)	Invites Tribes to TRC kick-off meeting on October 20.
26	9/12/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	FMIT (Timothy Williams)	Invites Tribes to TRC kick-off meeting on October 20.
27	9/12/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Chemehuevi (Charles Wood)	Invites Tribes to TRC kick-off meeting on October 20.
28	9/12/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	5 Technical Consultants (Dr. Eggers; Brad Guay; Dr. Prucha; Dr. Rosenblum; Dr. Schlinger)	Invites Technical Consultant to TRC kick-off meeting on October 20.
29	9/14/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Hualapai (Louise Benson)	Invites Tribes to TRC kick-off meeting on October 20.
30	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Chemehuevi (Charles Wood)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.

TABLE 7-2
Log of Outreach/Communication with Tribes
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

ID	Date/Time	Party Initiated Contact	Party Received Contact	Summary of Outreach/ Communications
31	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Cocopah (Sherry Cordova)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.
32	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	CRIT (Eldred Enas)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.
33	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	FMIT (Timothy Williams)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.
34	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Fort Yuma-Quechan Tribe (Mike Jackson)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.
35	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Hualapai (Louise Benson)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.
36	9/30/2011	PG&E (Yvonne Meeks) & HDR (Sandra Flint)	Hualapai (Louise Benson)	Informs Tribes that 1 of the 5 chosen technical consultants is leaving and asks for potential nominations, if any, by October 12 or informing PG&E of more time needed by October 12.
37	10/18/11 5:59 PM	PG&E (Curt Russell)	Hualapai (Loretta Jackson-Kelly and Dawn Hubbs)	Informs Tribes of next plant survey starting November 1, 2011 and additional survey in March 2012. Ask Tribes to RSVP by October 31 if they plan to attend the November survey.
38	10/18/11 6:04 PM	PG&E (Curt Russell)	CRIT (Eric Shepard and Doug Bonamici)	Informs Tribes of next plant survey starting November 1, 2011 and additional survey in March 2012. Ask Tribes to RSVP by October 31 if they plan to attend the November survey.
39	10/18/11 6:06 PM	PG&E (Curt Russell)	Chemehuevi (Ron Escobar & Tito)	Informs Tribes of next plant survey starting November 1, 2011 and additional survey in March 2012. Ask Tribes to RSVP by October 31 if they plan to attend the November survey.
40	10/18/11 6:16 PM	PG&E (Curt Russell)	Fort Yuma-Quechan Tribe (Pres. Escalanti)	Informs Tribes of next plant survey starting November 1, 2011 and additional survey in March 2012. Ask Tribes to RSVP by October 31 if they plan to attend the November survey.
41	10/27/11	PG&E (Yvonne Meeks)	Hualapai (Louise Benson, Loretta Jackson-Kelly, and Dawn Hubbs)	Proposes monthly meetings to provide up to date information on planned and ongoing studies, field activities, measures that are being taken to mitigate in accordance with the project EIR, and/or other project related activities of interest to the group. Draft agendas will be submitted a week in advance of the meetings. Input from the Tribe on the agenda items are appreciated prior to the meeting. In addition, propose an organizational meeting on November 22, 2011 to discuss further.
42	10/27/11	PG&E (Yvonne Meeks)	Chemuevi (Charles Wood, Ron Escobar, and Tom Pradetto)	Proposes monthly meetings to provide up to date information on planned and ongoing studies, field activities, measures that are being taken to mitigate in accordance with the project EIR, and/or other project related activities of interest to the group. Draft agendas will be submitted a week in advance of the meetings. Input from the Tribe on the agenda items are appreciated prior to the meeting. In addition, propose an organizational meeting on November 22, 2011 to discuss further.

TABLE 7-2
Log of Outreach/Communication with Tribes
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

ID	Date/Time	Party Initiated Contact	Party Received Contact	Summary of Outreach/ Communications
43	10/27/11	PG&E (Yvonne Meeks)	Cocopah (Sherry Cordova and Jill McCormack)	Proposes monthly meetings to provide up to date information on planned and ongoing studies, field activities, measures that are being taken to mitigate in accordance with the project EIR, and/or other project related activities of interest to the group. Draft agendas will be submitted a week in advance of the meetings. Input from the Tribe on the agenda items are appreciated prior to the meeting. In addition, propose an organizational meeting on November 22, 2011 to discuss further.
44	10/27/11	PG&E (Yvonne Meeks)	CRIT (Eldred Enas, Lisa Swick, and Doug Bonamici)	Proposes monthly meetings to provide up to date information on planned and ongoing studies, field activities, measures that are being taken to mitigate in accordance with the project EIR, and/or other project related activities of interest to the group. Draft agendas will be submitted a week in advance of the meetings. Input from the Tribe on the agenda items are appreciated prior to the meeting. In addition, propose an organizational meeting on November 22, 2011 to discuss further.
45	10/27/11	PG&E (Yvonne Meeks)	FMIT (Timothy Williams, Linda Otero, and Nora McDowell-Antone)	Proposes monthly meetings to provide up to date information on planned and ongoing studies, field activities, measures that are being taken to mitigate in accordance with the project EIR, and/or other project related activities of interest to the group. Draft agendas will be submitted a week in advance of the meetings. Input from the Tribe on the agenda items are appreciated prior to the meeting. In addition, propose an organizational meeting on November 22, 2011 to discuss further.
46	10/27/11	PG&E (Yvonne Meeks)	Fort Yuma-Quechan Tribe (Mike Jackson, Bridgette Nash, and Arlene Kingery)	Proposes monthly meetings to provide up to date information on planned and ongoing studies, field activities, measures that are being taken to mitigate in accordance with the project EIR, and/or other project related activities of interest to the group. Draft agendas will be submitted a week in advance of the meetings. Input from the Tribe on the agenda items are appreciated prior to the meeting. In addition, propose an organizational meeting on November 22, 2011 to discuss further.
47	11/08/11	PG&E (Melanie Day)	Hualapai (Dawn Hubbs and Carrie Cannon)	Transmits the methodologies for the Mature Plants and Floristic surveys.
48	11/08/11	PG&E (Melanie Day)	FMIT (Nora McDowell-Antone)	Transmits the methodologies for the Mature Plants and Floristic surveys.
49	11/08/11	PG&E (Melanie Day)	CRIT (Lisa Swick and Charlie Land)	Transmits the methodologies for the Mature Plants and Floristic surveys.
50	11/08/11	PG&E (Melanie Day)	Cocopah (Jill McCormack)	Transmits the methodologies for the Mature Plants and Floristic surveys.
51	11/08/11	PG&E (Melanie Day)	Chemehuevi (Ron Escobar)	Transmits the methodologies for the Mature Plants and Floristic surveys.

TABLE 7-3
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/future document(s) will document continued compliance with this ARAR?	Action (30% Design Report Compliance Status)
Chemical Specific								
1	Federal Chemical-Specific	Federal Safe Drinking Water Act - 42 USC § 300f, et seq.; 40 CFR 141 -- Subpart F– Maximum Contaminant Level Goals (MCLGs)	ARAR Relevant and Appropriate	MCLGs are not federally enforceable drinking water standards, but CERCLA § 121(d) identifies MCLGs as relevant and appropriate requirements.	Remedy Implementation	PG&E		Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal maximum contaminant level goals (MCLG) for Cr(T) of 100 µg/L There is no federal MCLG for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.
2	Federal Chemical-Specific	Federal Safe Drinking Water Act - 42 USC § 300g-1; 40 CFR 141 -- Subpart G – National Primary Drinking Water Regulations (MCLs)	ARAR Relevant and Appropriate	These MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants (e.g., Chromium) in sources (or potential sources) of drinking water. MCLs may be applicable where water at a CERCLA site is delivered through a public water supply system.	Remedy Implementation	PG&E		Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer below the federal maximum contaminant level (MCL) for Cr(T) of 100 µg/L. There is no federal MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in situ by -products (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional controls.
3	Federal Chemical-Specific	Federal Water Pollution Control Act (Clean Water Act) - 33 USC §§ 1251-1387; 40 CFR 131.38	ARAR Applicable	These are federally promulgated Water Quality Standards for surface waters. Such water quality standards include specific criteria for water bodies in California, including standards for Hexavalent Chromium.	Remedy Implementation	PG&E		Surface water sampling in the Colorado River near the site show concentrations less than the federal water quality criteria (California Toxics Rule) for Cr(VI) of 11 µg/L. Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will increase the level of certainty that surface water quality will continue to remain below this level. The remedy is designed to prevent migration of contaminants to the Colorado River that would result in an exceedance of California Toxics Rule criteria.

TABLE 7-3
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/future document(s) will document continued compliance with this ARAR?	Action (30% Design Report Compliance Status)
52	California Chemical-Specific	California Safe Drinking Water Act - Title 22, CCR, Div 4, Ch 15, §64431, §64444	ARAR Applicable	Maximum Contaminant Levels (MCLs) which shall not be exceeded in the water supplied to the public. California state MCLs for drinking water standards are more stringent than primary federal standards.	Remedy Implementation	PG&E		Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the state MCL for Cr(T) of 50 µg/L. There is no state MCL for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation, institutional controls will prevent use of affected groundwater as a drinking water source until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.
53	California Chemical-Specific	Secondary MCLs list for drinking water - Title 22, CCR, Div 4, Ch 15, §64449	ARAR Relevant and Appropriate	State secondary MCLs for drinking water standards are more stringent than federal standards. These secondary MCLs are relevant and appropriate standards, which establish the maximum permissible level of contaminants in sources (or potential sources) of drinking water. These secondary MCLs would be applicable if water at the site was used as drinking water and delivered through a community water supply system.	Remedy Implementation	PG&E		There is no secondary MCL for Cr(VI) or Cr(T). Secondary MCLs are community acceptance standards for constituents that may adversely affect the taste, odor or appearance of drinking water. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source.
55	California Chemical-Specific	Groundwater and vadose zone protection standards - Title 22, CCR, Div 4.5, Ch 15, Article 6, §66265.94	ARAR Applicable	RCRA hazardous waste Interim Status TSD facilities shall comply and ensure that hazardous constituents entering the groundwater, surface water, and soil from a regulated unit do not exceed the concentration limit from contaminants of concern in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Remedy Implementation	PG&E		Compliance with this requirement will be achieved by reducing the concentration of Cr(VI) in the affected aquifer to the regional background concentration of 32 µg/L at the conclusion of remedy implementation. Although concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation, institutional controls will prevent use of affected groundwater until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation.
Action Specific								
31	Federal Action-Specific	Federal Safe Drinking Water Act - 42 USC §300f, et seq. Part C – Protection of Underground Sources of Drinking Water; 40 CFR 144-148	ARAR Applicable	These Underground Injection Control Regulations assure that any underground injection performed on-site will not endanger drinking water sources. Substantive requirements include, but are not limited to, regulation of well construction and well operation. These requirements will be applicable if underground injection is proposed as a part of a site remedy.	Underground injection activities	PG&E	Filing of inventory of injection wells	Injection wells are classified as Class V injection wells and will be registered with USEPA prior to installation. The injection wells will be monitored to ensure they will not endanger drinking water sources. An institutional control will be enforced throughout the chromium plume area during implementation of the remedial action to prohibit use of the groundwater as a drinking water source. All injection wells will be properly closed upon completion of the remedy.

TABLE 7-3
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Item No.[1]	Category[1]	Citation[1,2]	Determination[1,2]	Description in DOI's ARARs Table[1,2]	Triggering Event	Compliance Responsibility	Which existing/future document(s) will document continued compliance with this ARAR?	Action (30% Design Report Compliance Status)
32	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) - **33** USC § 1344 ; 40 CFR 230.10	ARAR Applicable	This section of the Clean Water Act prohibits certain activities with respect to on-site wetlands and waterways. No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed activity which would have less adverse impact to the aquatic ecosystem.	Activities that occur in the Colorado River or in jurisdictional waters of the United States that result in discharge of dredged or fill material.	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	The preliminary (30%) design includes facilities in the jurisdictional water of the US (see Figure 2-16). PG&E will work with the USACE to ensure compliance with the substantive requirements of Section 404 per CERCLA Section 121(e)(1). It is anticipated that a wetland delineation will be conducted in the Spring of 2012.
33	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) - 33 USC § 1342; 40 CFR 122; 40 CFR 125	ARAR Applicable	These National Pollutant Discharge Elimination System (NPDES) requirements regulate discharges of pollutants from any point source into waters of the United States.	Point source discharges to waters of the US.	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action required. The remedy as presented in the preliminary (30%) design does not result in point source discharges to waters of the United States that will require an NPDES permit.
34	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) - 40 CFR 122.26	ARAR Applicable	These regulations define the necessary requirements with respect to the discharge of storm water under the NPDES program. These regulations will apply if proposed remedial actions result in storm water runoff which comes in contact with any construction activity from the site remediation.	Ground disturbance as a result of construction is > 1 acre	PG&E	SWPPP, BMP Plans and Monitoring & Reporting, Construction/Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 and Site Restoration, Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare construction SWPPP and BMP Plan prior to construction activities, that will be included in the Construction/Remedial Action Work Plan.
35	Federal Action-Specific	River and Harbor Act of 1899 - 33 USC §§ 401 and 403	ARAR Applicable	This Act prohibits the creation of any obstruction in navigable waters, in addition to banning activities such as depositing refuse, excavating, filling, or in any manner altering the course, condition, or capacity of navigable waters. These requirements will apply if proposed activities at the Topock site have the potential of affecting any navigable waters on the site.	Activities with the potential to affect any navigable waters on the site	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action required. The remedy, as presented in the preliminary (30%) design, will not affect navigable waters.
38	Federal Action-Specific	Clean Air Act - USC §§ 7401, et seq. (National Emission Standards for Hazardous Air Pollutants (NESHAP)); 40 CFR 61; 40 CFR 63	ARAR Applicable	NESHAPs are regulations which establish emissions standards for certain hazardous air pollutants (HAPs) identified in the regulations. NESHAPs will apply if remediation activities on the site produce identified HAP emissions.	Activities produce identified HAP emissions	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action required. The remedy, as presented in the preliminary (30%) design does not include activities subject to NESHAPs.

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39	Federal Action-Specific	Religious Freedom Restoration Act - 42 USC § 2000bb	ARAR Applicable	Pursuant to this Act, the government shall not substantially burden a person's exercise of religion, unless the application of the burden is in furtherance of a compelling government interest, and it is the least restrictive means of furthering that interest. To constitute a "substantial burden" on the exercise of religion, a government action must (1) force individuals to choose between following the tenets of their religion and receiving a governmental benefit or (2) coerce individuals to act contrary to their religious beliefs by the threat of civil or criminal sanctions. If any remedial action selected imposes a substantial burden on a person's exercise of religion, it must be in furtherance of a compelling government interest and be the least restrictive means of achieving that interest.	Activities with the potential to impose a substantial burden on a person's exercise of religion.	DOI/BLM	Design submittals, Construction/ Remedial Action Work Plan, O&M Plan, Progress Reports, Decommissioning Plan	The remedy, as presented in the preliminary (30%) design does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan is being developed for Tribal access to areas within the Topock site for traditional religious, cultural, or spiritual purposes during implementation of the Remedy. BLM is also developing a *Cultural and Historic Properties Management Plan* to avoid, minimize and mitigate potential affects to historic properties, including the Topock TCP during implementation of the Remedy. BLM distributed a draft CHPMP on November 1, 2011. Comments on the draft CHPMP are due December 5, 2011. The BLM is anticipating that the final CHPMP will be issued by January 20, 2012 The preliminary (30%) design was submitted on November 18, 2011. PG&E will prepare future design submittals, a Construction/Remedial Action Work Plan, a Plan for decommissioning, removal, and restoration of IM-3 facility, and a Decommissioning Plan for Remedy Facilities and Restoration. The other documents will be prepared and submitted.
40	Federal Action-Specific	Endangered Species Act of 1973 - 16 USC §§ 1531-1544; 50 CFR 402	ARAR Applicable	The ESA makes it unlawful to remove or "take" threatened and endangered plants and animals and protects their habitats by prohibiting certain activities. Examples of such species in or around the Topock site may include, but are not limited to, southwestern willow flycatcher, Mojave Desert tortoise, Yuma clapper rail, Colorado pike minnow, razorback sucker, and bonytail chub. Any remedial action selected for the Topock site will not result in the take of, or adverse impacts to, threatened and endangered species or their habitats, as determined based on consultation with the Fish and Wildlife Service under section 7 of the ESA.	Expiration of existing PBA (end of 2012) or construction of remedy, whichever is sooner	DOI/USFWS/ PG&E	PBA, Construction/Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Decommissioning Plan for Remedy Facilities and Restoration.	PG&E, USFWS, and DOI are coordinating on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. Goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan.
41	Federal Action-Specific	Migratory Bird Treaty Act - 16 USC 703-712	ARAR Applicable	This Act makes it unlawful to "take, capture, kill," or otherwise impact a migratory bird or any nest or egg of a migratory bird. The Havasu National Wildlife Refuge, which is part of the Topock site, was created as a refuge and breeding ground for migratory birds and other wildlife, therefore, there is potential for contact with migratory birds during proposed remediation activities. Any remedial action selected for the Topock site will be designed and implemented so as to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg.	Remedial action for Topock site	PG&E	Construction/Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Decommissioning Plan for Remedy Facilities and Restoration	Avoidance and minimization measures will be included in the Construction/Remedial Action Work Plan to the extent necessary to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg.

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45	Arizona Action-Specific	Arizona Well Standards - A.A.C. R-12-15-850	ARAR	These requirements on the placement of wells will apply if the selected remedy includes placement of wells in Arizona.	During project design and before construction	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. Wells constructed in Arizona will comply with the Arizona Well Standards
46	Arizona Action-Specific	Design criteria for treatment units - A.A.C. R18-5-(501-502)	ARAR	These minimum design criteria will apply if the selected remedy includes construction of a groundwater treatment plant.	Construction of wells in Arizona	PG&E		No further action is required. The preliminary (30%) design does not involve the construction of a groundwater treatment plant in Arizona.
47	Arizona Action-Specific	Requirements for wells, groundwater withdrawal, treatment, and reinjection - A.R.S. §45-454.01	ARAR	This statute exempts new well construction, withdrawal, treatment, and reinjection into a groundwater aquifer as a part of a CERCLA Remedial Action from the requirements of the Arizona Groundwater Code, except that they must comply with the substantive requirements of A.R.S. 45-594, 45-595, 45-596, and 45-600. If groundwater that is withdrawn is not reinjected into the aquifer, the groundwater shall be put to reasonable and beneficial use.	Construction of wells in Arizona	PG&E		This remediation project is a CERCLA remedial action. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S 45-594) by a State-licensed well driller(A.R.S. 45-595). A notice of intention to drill will be filed (A.R.S. 45-596), and a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600). Most of the groundwater that is withdrawn will be reinjected into the aquifer. Any groundwater that is withdrawn but not reinjected into the aquifer shall be put to reasonable and beneficial use.
48	Arizona Action-Specific	Well construction standards - A.R.S. §45-594 and 595	ARAR	These provisions identify the well construction standards and requirements for new well construction in the State of Arizona. These requirements will apply if the selected remedy involves the construction of wells in Arizona.	Construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. If a new freshwater supply well or additional monitoring wells in Arizona are required they will be constructed in conformance with State construction standards (A.R.S 45-594) by a State-licensed well driller(A.R.S. 45-595).
49	Arizona Action-Specific	Notice of intention to drill - A.R.S. §45-596	ARAR	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.	Construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. If a new freshwater supply well or additional monitoring wells in Arizona are required, a notice of intention to drill will be filed (A.R.S. 45-596).

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50	Arizona Action-Specific	Report by driller - A.R.S. §45-600	ARAR	Substantive requirements will apply if the selected remedy involves the construction of wells in Arizona.	Construction of wells in Arizona	PG&E		The preliminary (30%) design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. In addition, new monitoring wells may also be constructed in Arizona, the locations of the monitoring wells will be presented in the intermediate (60%) design. If a new freshwater supply well or additional monitoring wells in Arizona are required, a well driller's report will be filed within 30 days of completion of drilling (A.R.S. 45-600).
51	Arizona Action-Specific	Arizona Remedial Action Requirements - A.R.S. §49-282.06(A)(2)	ARAR	Any treatment of groundwater must be conducted in a manner to provide for the maximum beneficial use of the waters of the state.	Treatment of groundwater in Arizona	PG&E		No further action is required. The preliminary (30%) design does not involve treatment of groundwater in Arizona.
74	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.11	ARAR Applicable	Owners or operators who generate waste shall determine whether waste is a hazardous waste. Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Activity that generates waste that could potentially be hazardous	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Waste generated during construction and operation of the remedy will be evaluated when the wastes are generated to determine if they are hazardous wastes.
75	California Action-Specific	Hazardous Waste Control Act (HWCA) - Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.12	ARAR Applicable	A generator shall not treat, store, dispose of, transport or offer for transportation, hazardous waste without having received an identification number. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Activity that generates waste that could potentially be hazardous	PG&E	USEPA ID Number	Hazardous waste generated by the final remedy will be managed under the existing USEPA ID number for the Topock groundwater remediation area, CAR000151118.
76	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards for owners and operators of hazardous waste transfer and TSD facilities Title 22, CCR, Div 4.5, Ch 14, Article 2	ARAR Applicable	Establish requirements for a hazardous waste treatment facility to have a plan for waste analysis, develop a security system, conduct regular inspections, provide training to facility personnel, and use a quality assurance program during construction. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.	Activity associated with construction and operation of a treatment facility or long term (longer than 90 days) storage of hazardous waste. If waste is simply removed, stored in appropriate containers after characterization, and removed off-site within 90 days, PG&E will be required to follow the substantive requirements of PG&E of a generator, including use of manifests, record keep, segregation of incompatibles, etc.	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration	In-situ treatment of contaminated groundwater or conditioning of remedy-produced water does not comprise a hazardous waste treatment facility as defined in the hazardous waste regulations. However, a variety of these provisions will be addressed in documents such as the O&M Plan, Soil Management Plan prepared under EIR mitigation measure HAZ-2c, and the Security Plan prepared under EIR mitigation measure CUL-1a-3b. Waste analysis procedures will be addressed in standard operating procedures for the treatment/conditioning process that will be developed.
77	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 2, §66262.20, §66262.22	ARAR Applicable	A generator of hazardous waste who transports or offers hazardous waste for transportation shall prepare a manifest. Substantive requirements will be applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Preparation of offsite shipment of hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.

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78	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, §66262.33	ARAR Applicable	Before transporting hazardous waste or offering hazardous waste for transportation off-site, the generator must do the following in accordance with DOT regulations: package the waste, label and mark each package of hazardous waste, and ensure that the transport vehicle is correctly placarded.	Preparation of offsite shipment of hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste will be managed in accordance with Title 22 CCR Div 4.5, Ch 12, Article 3, §66262.30, §66262.31, §66262.32, and §66262.33..
79	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 3, §66262.34	ARAR Applicable	Requirements with respect to accumulation of waste on-site.	Accumulation of hazardous waste onsite	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration, Operations documents (e.g., manifests, inspection records)	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste generated onsite will meet the accumulation requirements of 22 CCR §66262.34.
80	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 4, §66262.40, §66262.41	ARAR Applicable	Establishes requirements for record keeping of manifests, test results, waste analyses, and Biennial Reports. Any substantive requirements shall be attained.	Activity generating hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration, Operations documents (e.g., manifests, waste profiling records)	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures. Hazardous waste generated onsite will meet the recordkeeping requirements of 22 CCR §66262.40, §66262.41.
81	California Action-Specific	Corrective Action - Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.100 (a) through (d), (f), (g)(1), and (h)	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action under Title 22, CCR, §66264.91 to remediate releases from the regulated unit and to ensure that the regulated unit achieves compliance with the water quality protection standard. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IME Facility prior to construction activities. These plans will describe spill control and response procedures and will incorporate requirements of mitigation measure HAZ-1a, HAZ-1b, and HYDRO-1for spill prevention, control, and cleanup during O&M, construction, and decommissioning activities.. In addition the O&M Plan will include a sampling and monitoring plan for groundwater.
82	California Action-Specific	Corrective Action for Waste Management Units - Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.101	ARAR Relevant and Appropriate	The owner or operator is required to take corrective action to remediate releases from any solid or hazardous waste management unit at the facility to protect public health and the environment. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	PG&E will prepare O&M Plan and a Construction/ Remedial Action Work Plan. These plans will describe spill control and response procedures and will incorporate requirements of mitigation measure HAZ-1a, HAZ-1b, and HYDRO-1for spill prevention, control, and cleanup during O&M and construction activities.. In addition, the O&M Plan will include a sampling and monitoring plan for groundwater.
83	California Action-Specific	Closure and post-closure care - Title 22, CCR, Div 4.5, Ch 14, Article 7, §66264.111, §66264.112, §66264.115 through 120	ARAR Applicable	Owners and operators shall close a facility and perform post-closure care when contaminated subsurface soil cannot be practically removed or decontaminated. Contaminated soil, residues, or groundwater from remedial action at a site will achieve clean closure; otherwise, post-closure care requirements will be relevant and appropriate.	Decommissioning	PG&E	Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration, Decommissioning Plan for Remedy Facility and Site Restoration	PG&E will prepare a Decommissioning Plan for Remedy Facility and Site Restoration. Achievement of RAOs will be considered clean closure and that will remove any post-closure care obligations.

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84	California Action-Specific	Use and management of containers - Title 22, CCR, Div 4.5, Ch 14, Article 9	ARAR Applicable	Containers used for the transfer or storage of hazardous waste must be in good condition, compatible with the waste, kept closed except to add or remove materials and be inspected weekly. The area used to store the containers must provide adequate secondary containment and be designed with runoff controls. Also, appropriate closure of the containers must take place.	Design and management of hazardous waste containers	PG&E	Design Submittals; O&M Plan; Corrective Measure/Remedial Action Construction Work Plan.	PG&E will prepare an O&M Plan, and a Corrective Measure/Remedial Action Construction Work Plan. These plans will describe waste management procedures. Containers used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.171-§66262.179.
85	California Action-Specific	Tank systems - Title 22, CCR, Div 4.5, Ch 14, Article 10	ARAR Applicable	The remedial activities may involve storage and/or treatment in tanks. These tanks are required to have secondary containment, be monitored and inspected, be provided with overfill and spill protection controls, and operated with adequate freeboard. Also, appropriate closure must take place.	During project design, operation and maintenance activities where tank systems are used to transfer, store or treat hazardous waste	PG&E	Design Submittals; O&M Plan; Corrective Measure/Remedial Action Construction Work Plan.	PG&E will prepare O&M Plan, and Corrective Measure/Remedial Action Construction Work Plan. Tank systems used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.192-§66262.195.
86	California Action-Specific	Waste piles - Title 22, CCR, Div 4.5, Ch 14, Article 12	ARAR Applicable	The waste piles should be placed upon a lined foundation or base with a leachate system, protected from precipitation and wind dispersal, designed to prevent run on and run off. Also, closure and post-closure care requirements. Remedial action may involve soil excavation and the compiling of soil in a temporary waste pile. This requirement is applicable if the excavated waste meets RCRA hazardous waste criteria.	Under broad application, a triggering event could be any temporary stockpiling of haz soil	PG&E	Soil Management Plan	PG&E will prepare a Soil Management Plan in conformance with EIR mitigation measures HAZ-2 and HAZ-2f to describe management procedures in the event that evidence of contaminated soil is identified during ground disturbing activities (e.g., noxious odors, discolored soil). It is not anticipated that regulated waste piles will be constructed.
87	California Action-Specific	Landfills - Title 22, CCR, Div 4.5, Ch 14, Article 14	ARAR Relevant and Appropriate	The requirements for landfills include the design and operation, action leakage rate, monitoring and inspection, response actions, surveying and recordkeeping and closure and post-closure care.	Design, construct, O&M, and closure of landfills (66260.10 defines "Landfill" as a disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a pile, a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit.)	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action is required. The preliminary (30%) design does not include construction of a landfill.
88	California Action-Specific	Miscellaneous Units - Title 22, CCR, Div 4.5, Ch 14, Article 16	ARAR Applicable	Applies to waste management unit not otherwise regulated under RCRA. It may include pumps, auxiliary equipment, air strippers, etc. The substantive requirements include design, construction, operation, maintenance and closure of the unit that will ensure protection of human health and the environment. The actions include general inspections for safety and operation efficiency, testing and maintenance of the equipment (including testing of warning systems). Applicable if pumps are used for extraction and treatment of leachate that meets RCRA hazardous waste criteria.	Design, construct, O&M, and closure of waste management units not otherwise regulated under RCRA	PG&E	Design Submittals; O&M Plan; Corrective Measure/Remedial Action Work Plan	No further action is required. The preliminary (30%) design assumes that the only pumps used for extraction of groundwater meeting RCRA hazardous waste criteria are submersible well pumps in the IRZ wells along National Trails Highway.

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89	California Action-Specific	Land Disposal Restrictions (LDR) for RCRA wastes and non-RCRA wastes - Title 22, CCR, Div 4.5, Ch 18, Articles 1, 3, 4, 10, 11	ARAR Applicable	Movement of hazardous waste to new locations and placed in or on land will trigger LDR. General applicability, dilution prohibited, waste analysis and record keeping, and special rules apply for wastes that exhibit a characteristic waste. Best Demonstrated Available Technology (BDA) standards for each hazardous constituent in each listed waste, if residual is to be disposed. Utilize treatment standards table when necessary. Where applicable, hazardous waste generated from remedial activities must comply with LDR and meet the treatment standards or notify the disposal facility of the treatment standards before disposal at an appropriate offsite disposal facility.	Activity that generates hazardous waste	PG&E	O&M Plan, Construction/ Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare an O&M Plan, a Construction/ Remedial Action Work Plan, and a Plan for Decommissioning of IM-3 Facility prior to construction activities. These plans will describe waste management procedures during construction, operation, and decommissioning . The remedy is not expected to involve onsite placement of hazardous waste that will trigger the LDR requirements. Hazardous waste generated will be characterized to determine if LDR treatment standards are exceeded. A notification will be submitted to the disposal facility indicating whether the waste is restricted from land disposal and whether it exceeds an applicable treatment standard.
90	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards for owners and operators of hazardous waste transfer and TSD facilities, Title 22, CCR, Div 4.5, Ch 14, Articles 3 and 4	ARAR Applicable	Establish requirements for a facility to plan for emergency conditions. In addition, the design and operation of the facility must be done to prevent releases. Other requirements include testing and maintenance of equipment and incorporation of communication and alarm systems and contingency plan. The requirements may be applicable if CERCLA response action includes treatment, storage, or disposal as defined under RCRA, or may be relevant and appropriate if the requirements address problems or situations sufficiently similar to the specific circumstances at the site that their usage will be well suited.	Design, construction, operation and maintenance of the remedy	PG&E	Design submittals; Project-specific HMBP; O&M Plan; Construction/Remedial Action Work Plan	PG&E will prepare a Project-specific HMBP; an O&M Plan; and a Construction/Remedial Action Work Plan that will address procedures for emergencies.
91	California Action-Specific	Hazardous Waste Control Act (HWCA) - Groundwater monitoring and response, Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.91 (a) and (c)	ARAR Relevant and Appropriate	Owners or operators of a RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, construction, operation and maintenance of the remedy	PG&E	Design submittals, O&M Plan (sampling and monitoring plan, contingency plan); Construction/ Remedial Action Work Plan, Progress Reports	PG&E will prepare a Project-specific HMBP; an O&M Plan (include sampling and monitoring plan); and a Construction/Remedial Action Work Plan. The preliminary (30%) design does not include regulated units.
92	California Action-Specific	Hazardous Waste Control Act (HWCA) - Monitoring, Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.97 (b), (c), (d) and (e)(1) through (e)(5)	ARAR Relevant and Appropriate	Requirements for monitoring groundwater, surface water, and vadose zone. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, operation and maintenance of the remedy	PG&E	Design submittals, O&M Plan (sampling and monitoring plan, contingency plan); Progress Reports	PG&E will prepare an O&M Plan and Progress Reports. The O&M Plan will include a sampling and monitoring plan for groundwater and surface water.
93	California Action-Specific	Hazardous Waste Control Act (HWCA) - Detection Monitoring Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.98	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop a detection monitoring program that will provide reliable indication of a release. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, operation and maintenance of the remedy	PG&E	Design submittals, O&M Plan (sampling and monitoring plan, contingency plan); Progress Reports	PG&E will prepare an O&M Plan and Progress Reports. The O&M Plan will include a sampling and monitoring plan for groundwater and surface water that provides a level of protection equivalent to a detection monitoring program that will provide reliable indication of a release

TABLE 7-3
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94	California Action-Specific	Hazardous Waste Control Act (HWCA) - Evaluation Monitoring, Title 22, CCR, Div 4.5, Ch 14, Article 6, §66264.99	ARAR Relevant and Appropriate	Requires the owner or operator of a regulated unit to develop an evaluation monitoring program that can be used to assess the nature and extent of a release from the unit. Substantive technical requirements are potentially relevant and appropriate for remedial action including groundwater monitoring.	Design, operation and maintenance of the remedy	PG&E	Design submittals, O&M Plan (sampling and monitoring plan, contingency plan); Progress Reports	PG&E will prepare an O&M Plan and Progress Reports. The O&M Plan will include a sampling and monitoring plan for groundwater and surface water that provides a level of protection equivalent to an evaluation monitoring program, based on site-specific conditions.
95	California Action-Specific	Discharges of Waste to Land - Title 23 CCR, Div 3, Ch 15	ARAR Relevant and Appropriate	The regulations in this chapter pertain to water quality aspects of hazardous waste discharge to land, establishing waste and site classifications and waste management requirements for waste treatment, storage, or disposal in landfills, surface impoundments, waste piles, and land treatment facilities. Requirements in this chapter are minimum standards for proper management of each waste category. Pursuant to Section 2511 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	Activities involve (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.
96	California Action-Specific	Consolidated Regulations for Storage, Treatment, Processing, or Disposal of Solid Waste - Title 27 CCR, Div 2, Subdivision 1	ARAR Relevant and Appropriate	The regulations in this subdivision (promulgated by the State Water Resources Control Board (SWRCB)) pertain to water quality aspects of discharges of solid waste to land for treatment, storage, or disposal. Pursuant to Section 20090 (Exemptions), because this remediation constitutes actions taken by public agencies to cleanup unauthorized releases of waste, these regulations will only apply if the proposed remedial activities include (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	Activities involve (1) removal of waste from the immediate place of release, or (2) keeping some contamination in place.	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action is required. The remedy design does not involve removal of waste from the immediate place of release and is not designed to keep some contamination in place.

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97	California Action-Specific	Requirements for land-use covenants - Cal. Code Regs. Title 22, § 67391.1	ARAR Applicable	This regulation requires appropriate restrictions on use of property in the event that a proposed remedial alternative results in hazardous materials remaining at the property at levels which are not suitable for unrestricted use of the land. This is an ARAR with respect to PG&E-owned land at the Topock site.	A decision document finding that hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land.	DTSC	A land use covenant imposing appropriate limitations on land use shall be executed and recorded when hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land. The land use restrictions must be clearly stated in any response action decision document approved by DTSC. The following information must be specified: (1) the limitations or controls that will be incorporated into an appropriate land use covenant and (2) a description of the implementation and enforcement provisions, including but not limited to frequency of inspections and reporting requirements, necessary to ensure the integrity and long-term protectiveness of the land use covenant.	The final groundwater remedy includes restrictions on use of the groundwater for potable use, based on the conclusions of the groundwater risk assessment. The land use covenant (institutional controls) are described in Section 5.0.
98	California Action-Specific	California Water Code - Section 1380[c], California Well Standards, Bulletin 74-90 (Supplement to Bulletin 74-81)	ARAR Applicable	These standards for water, cathodic, and monitoring wells will be applicable if the remediation requires use of such wells.	Design, construction, decommission of groundwater wells	PG&E	Design submittals, Construction/ Remedial Action Work Plan, Plan for Decommissioning of IM-3 Facility and Site Restoration, Decommissioning Plan for Remedy Facility and Site Restoration.	PG&E will prepare Design submittals, a Construction/ Remedial Action Work Plan, Plan for Decommissioning of IM-3 Facility and Site Restoration, and a Decommissioning Plan for Remedy Facility and Site Restoration. The remedy will include water and monitoring wells, and will adhere to the standards specified in this ARAR. Well construction and decommissioning standards will be described in the Construction /Remedial Action Work Plan.

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99	California Action-Specific	State Water Resources Control Board Resolution No. 88-63 Adoption of Policy Entitled "Sources of Drinking Water"	ARAR Applicable	With certain exceptions, all surface and ground waters of the State of California are to be considered suitable, or potentially suitable, for municipal or domestic water supply. The Regional Water Quality Control Board and State Water Resources Board have designated the beneficial use of the ground and surface waters in the Topock Site area as "municipal and domestic water supply." This designation is set forth in the Basin Plan.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer to a concentration below the federal and state MCLs of 100 µg/L and 50 mg/L respectively which represent the chemical concentrations in drinking water considered safe for human consumption. There are no MCLs or MCLGs for Cr(VI) and the RAO has been established based on the regional background concentration of 32 µg/L Cr(VI) at the conclusion of remedy implementation. The establishment of RAOs (see Section 1.2.1) is based on the conclusions of the groundwater risk assessment which assumed a hypothetical future use of groundwater within the plume as a drinking water supply. The final groundwater remedy includes an institutional control to restrict use of the groundwater for potable use until the remedy is complete. Groundwater monitoring will be used to track performance of the remedy and verify that the RAOs have been achieved at the conclusion of remedy implementation and prior to removing the institutional control.
100	California Action-Specific	Water Quality Control Plan; Colorado River Basin-Region 7, June 2006 (Basin Plan)	ARAR Applicable	This Basin Plan designates the Colorado River and the Colorado Hydrologic unit as having the beneficial use of "MUN" (or, municipal or domestic water supply). The Basin Plan also prescribes General Surface Water Objectives and Ground Water Objectives, in addition to Specific Surface Water Objectives for the Colorado River, which include a flow-weighted average annual numeric criterion for salinity for the portion of the Colorado River on the Topock Site of 723 mg/L. This TDS value must not be exceeded in any remedial alternative being considered	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	Surface water sampling in the Colorado River near the site show concentrations of Cr(T) less than the federal and state MCLs of 100 µg/L and 50 mg/L (drinking water supply standards). Surface water sampling in the Colorado River also show concentrations of Cr(VI) less than the California Toxics Rule criteria of 11 µg/L (protection of freshwater aquatic life). Reducing Cr(VI) concentrations in groundwater by implementation of the remedy will increase the level of certainty that surface water quality will continue to remain below these levels. PG&E will prepare an O&M Plan, Progress Reports, and a Corrective Measure/Remedial Action Completion Report. The remedy is intended to restore groundwater to the regional background Cr(VI) concentration of 32 µg/L, thereby addressing any contribution by PG&E affecting potential beneficial uses. The operation of the River Bank Extraction Wells will prevent migration of contaminants to the Colorado river that could impact beneficial uses or result in a failure to meet surface water quality objectives.

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101	California Action-Specific	State Water Resources Control Board Resolution No. 68-16 ("Antidegradation Policy") - Statement of Policy with respect to Maintaining High Quality of Waters in California	ARAR Applicable	Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.	Remedy implementation	PG&E	O&M Plan (sampling and monitoring plan, contingency plan), Progress Reports, Corrective Measure/Remedial Action Completion Report	PG&E will prepare an O&M Plan, Progress Reports, and a Corrective Measure/Remedial Action Completion Report. Although constituent concentrations will fluctuate inside the footprint of the remedy during implementation, at the conclusion of the remedy the RAOs will achieve background levels for chromium. Therefore, the remedy will comply with the substantive provisions of the SWRCB Resolution 68-16 that requires maintenance of the highest water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require restoration of background water quality.
102	California Action-Specific	State Water Resources Control Board Resolution No. 92-49 -- Policies and Procedures for investigation and Cleanup and Abatement of Discharges under Water Code Section 13304	ARAR Relevant and Appropriate	Section III.A of this Resolution states that the Regional Water Board shall" "concur with any investigative and abatement proposal which the discharger demonstrates and the Regional Water Board finds to have a substantial likelihood to achieve compliance within a reasonable time frame…"	Remedy implementation	PG&E	Corrective Measure/Remedial Action Completion Report	PG&E will prepare a Corrective Measure/Remedial Action Completion Report. Because RAOs will achieve background levels for chromium, the remedy will comply with the substantive provisions of the SWRCB Resolution 68-16 that requires maintenance of the highest water quality consistent with maximum benefit to the people of the State, and with the substantive provisions of SWRCB Resolution 92-49 that require restoration of background water quality.
Location Specific								
5	Federal Location-Specific	Federal Land Policy and Management Act - (FLPMA); 43 USC § 1701, et seq.; 43 CFR 2800	ARAR Applicable	In managing public lands, BLM is directed to take any action necessary to prevent unnecessary or undue degradation of the lands. Actions taken on the public land (i.e. BLM-managed land) portions of the Topock site should provide the "optimal balance between authorized resource use and the protection and long-term sustainability of sensitive resources."	Activities on public lands	BLM	Design submittals, Construction/ Remedial Action Work Plan, O&M Plan, Progress Reports, Decommissioning Plan	The preliminary (30%) design was submitted by PG&E to DOI on November 18, 2011, and includes proposed facilities on BLM land. PG&E will prepare future design submittals, a Construction/ Remedial Action Work Plan, an O&M Plan, Progress Reports, and a Decommissioning Plan for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with BLM.
7	Federal Location-Specific	National Wildlife Refuge System Administration Act, as amended - 16 USC §§ 668dd-ee; 50 CFR Part 27	ARAR Applicable	This Act governs the use and management of National Wildlife Refuges. The Act requires that USFWS evaluate ongoing and proposed activities and uses to ensure that such activities are appropriate and compatible with both the mission of the overall National Wildlife Refuge System, as well as the specific purposes for which the Havasu National Wildlife Refuge (HNWR) was established. The Topock site includes portions of the HNWR. Prior to selection of a remedial action by DOI/USFWS, that remedial action must be found by the Refuge Manager to be both an appropriate use of the HNWR and compatible with the mission of the HNWR and the Refuge System as a whole. Any remedial action proposed to be implemented on the HNWR that was not selected by DOI/USFWS would be subject to the formal appropriate use/compatibility determination process.	Activities on the HNWR	USFWS/DOI	Design submittals, Construction/ Remedial Action Work Plan, O&M Plan, Progress Reports, Decommissioning Plan	The preliminary (30%) design was submitted by PG&E to agencies on November 18. 2011 and includes proposed facilities on HNWR land. PG&E will prepare future design submittals, a Construction/ Remedial Action Work Plan, an O&M Plan, Progress Reports, and a Decommissioning Plan for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with USFWS.

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13	Federal Location-Specific	Fish and Wildlife Coordination Act - 16 USC §§ 661-667e	ARAR Applicable	This Act requires that any federally-funded or authorized modification of a stream or other water body must provide adequate provisions for conservation, maintenance, and management of wildlife resources and their habitat. Necessary measures should be taken to mitigate, prevent, and compensate for project-related losses of wildlife resources. Any remedial action selected for the Topock site that includes any modification of a water body will be subject to these requirements.	Any modification of a water body	PG&E	N/A. No further action required unless design change triggers; reconfirm in design submittals.	No further action is required. The preliminary (30%) design does not include modification of a water body.
14	Federal Location-Specific	National Historic Preservation Act - 16 USC § 470, et seq.; 36 CFR 800.1, et seq.	ARAR Applicable	This statute and the implementing regulations direct federal agencies to consider the effects of their undertakings on historic properties included in or eligible for inclusion in the National Register of Historic Places and to consult with certain parties before moving forward with the undertaking. The agency must determine, based on consultation, if an undertaking's effects would be adverse and consider feasible and prudent alternatives that could avoid, mitigate, or minimize such adverse effects on a National Register or eligible property. The agency must then specify how adverse effects will be avoided or mitigated or acknowledge that such effects cannot be avoided or mitigated. The Topock site includes historic properties in or eligible for inclusion in the National Register and remedial action selected for the Topock site qualifies as an undertaking pursuant to the NHPA. Measures to avoid or mitigate adverse effects of any selected remedial action that are adopted by the agency through consultation must be implemented by the remedial action to comply with the NHPA.	Remedial action selected for the Topock site qualifies as an undertaking under NHPA	BLM, Advisory Council on Historic Preservation, California and Arizona State Historic Preservation Offices, USFWS and PG&E are parties to the PA	PA, CHPMP, Design Submittals, Construction/Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Decommissioning Plan for Remedy Facilities and Restoration, Documents related to ongoing consultation, Brochure, Annual Report, Tribal Access Plan	Documents led by BLM include the PA, the CHPMP, the Brochure, the Annual Report, and the Tribal Access Plan. The PA has been completed. The Brochure to notify other state and federal agencies of the Signatories and Invited Signatories with the actions to be taken within the vicinity of the Topock Remediation Project, and the Topock Maze, is completed. The CHPMP, which is a requirement of the PA, is under preparation and the goal is to have a plan in place by January 20, 2012. BLM distributed a draft CHPMP on November 1, 2011. Comments on the draft CHPMP are due December 5, 2011. The Tribal Access Plan is also under preparation and the goal is to complete the Plan by November 26, 2011 (note that the PA-required Tribal Access Plan will be coordinated with the EIR-required Access Plan).Annual reports of cultural resources activities will be prepared and submitted to all Signatories, Tribes, and Invited Signatories as directed in the PA. Documents led by PG&E include design submittals, a Construction/Remedial Action Work Plan, a Plan for decommissioning, removal, and restoration of IM-3 facility, and a Decommissioning Plan for Remedy Facilities and Restoration. The preliminary (30%) design was submitted on November 18, 2011. The other documents will be prepared and submitted.
17	Federal Location-Specific	National Archaeological and Historic Preservation Act - 16 USC § 469, et seq.; 36 CFR 65	ARAR Applicable	This statute requires the evaluation and preservation of historical and archaeological data which might otherwise be irreparably lost or destroyed through any alteration of terrain as a result of federal construction projects or a federally-licensed activity. The Topock site includes historical and archaeological data. Any remedial action selected for the Topock site must include measures for the evaluation and preservation of historical and archaeological data that might be lost or destroyed as a result of the remedial action.	Alteration of terrain that threatens significant scientific, historical or archaeological data.	Federal Agencies, PG&E	PA, CHPMP, Design Submittals, Construction/Remedial Action Work Plan	Requirements in the PA and the forthcoming CHPMP will be adhered to.. Documents led by PG&E include design submittals, a Construction/Remedial Action Work Plan, a Plan for decommissioning, removal, and restoration of IM-3 facility, and a Decommissioning Plan for Remedy Facilities and Restoration. The preliminary (30%) design was submitted on November 18, 2011. The other documents will be prepared and submitted.

TABLE 7-3
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18	Federal Location-Specific	Archaeological Resources Protection Act - 16 USC § 470aa-ii, et seq.; 43 CFR 7.1, et seq.	ARAR Applicable	This statute provides for the protection of archeological resources located on public and tribal lands. The Act establishes criteria which must be met for the land manager's approval of any excavation or removal of archaeological resources if a proposed activity involves soil disturbances. The Topock site includes archaeological resources on public land. Any remedial action selected for the Topock site must satisfy the criteria applicable to excavation or removal of archaeological resources that might be affected as a result of the remedial action.	Disturbance of archaeological and historical sites	Federal Agencies, PG&E	PA, CHPMP, Design Submittals, Construction/Remedial Action Work Plan	Requirements in the PA and the forthcoming CHPMP will be adhered to. PG&E will prepare and submit design submittals and the Construction/Remedial Action Work Plan. The preliminary (30%) design was submitted on November 18, 2011.
19	Federal Location-Specific	Historic Sites Act - 16 USC 461-467	ARAR Applicable	Pursuant to this Act, federal agencies are to consider the existence and location of historic sites, buildings, and objects of national significance using information provided by the National Park Service to avoid undesirable impacts upon such landmarks. There are no designated historic landmarks within the APE, although 16 USC 461, through Public Law 106-45, provides for a cooperative program "for the preservation of the Route 66 corridor" through grants and other measures. Undesirable impacts on this site that might result from any remedial action selected for the Topock site will be evaluated and mitigated to the maximum extent practicable.	Existence of a historic landmark	Federal Agencies	Reevaluate in design documents if designated historic landmark exist	There are no historic landmarks in the APE. No further action is required.
21	Federal Location-Specific	Native American Graves Protection and Repatriation Act (NAGPRA) - 25 USC § 3001, et seq.; 43 CFR 10.1, et seq.	ARAR Applicable	NAGPRA establishes requirements regulating the removal and trafficking of human remains and cultural items, including funerary and sacred objects. The Topock site may contain human remains. If remediation activities result in the discovery of Indian human remains or related objects, NAGPRA requirements must be met.	Federal Lands only - Discovery of human remains	PG&E	PA, CHPMP	Requirements of the PA and the forthcoming CHPMP (led by BLM) will be adhered to during the implementation of the remedy.
22	Federal Location-Specific	American Indian Religious Freedom Act - 42 USC § 1996, et seq.	ARAR Relevant and Appropriate	The United States must "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise [their] traditional religions..." Any remedial action selected for the Topock site must satisfy this requirement.	Remedy selection	Federal Agencies (BLM Lead), PG&E	Tribal Access Plan	BLM leads the preparation of the Tribal Access Plan. Goal is to complete the plan by November 26, 2011. Note that the EIR-required Access Plan will be coordinated with the PA-required Access Plan.

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27	Federal Location-Specific	Resource Conservation and Recovery Act - 42 USC § 6901, et.seq.; 40 CFR 264.18	ARAR Applicable	These regulations promulgated under RCRA establish Seismic and Floodplain considerations which must be followed for treatment, storage, or disposal facilities constructed, operated, or maintained within certain distances of fault lines and floodplains. Portions of the Topock site are located on or near a 100-year floodplain.	Infrastructure in 100-year floodplain/ regulatory floodway	PG&E	Design submittals	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 at River Mile (RM) 234 of the Colorado River. The effective Flood Insurance Study (FIS) for San Bernardino County lists a regulatory base flood elevation of 463.90. This design uses the more conservative elevation of 464 as the base flood elevation. Wells and pipelines are included in the preliminary (30%) design in areas of the Colorado River floodplain necessary for capture and treatment of the chromium plume. The infrastructure in this preliminary (30%) design (wells, pipes) is mostly outside the 100-year floodplain, see Sheet C-2, well FP-EX-5.
43	Arizona Location-Specific	Archeological Discoveries - A.R.S. § 41-841 through 847	ARAR	This Act prohibits any person from knowingly excavating on Arizona State or State agency owned land which is a historic or prehistoric ruin, burial ground, archaeological or paleontological site. These requirements will apply if the selected remedy involves excavation in Arizona.	Only if remedy in Arizona - Discovery of any archaeological, paleontological or historical site or object (including human remains) that is at least fifty years old	PG&E	PA, CHPMP, Construction/ Remedial Action Work Plan	Requirements from the PA and the forthcoming CHPMP (led by BLM) will be adhered to during implementation of the remedy. PG&E will prepare and submit the Construction/Remedial Action Work Plan.
44	Arizona Location-Specific	Historic Preservation - A.R.S. § 41-865	ARAR	This Act restricts any person from disturbing human remains or funerary objects on lands other than lands[2] owned or controlled by the State. These requirements will apply if the selected remedy involves excavation in Arizona.	Only if remedy in Arizona on private lands - Discovery of human remains/funerary objects	PG&E	PA	Requirements from the PA and the forthcoming CHPMP will be adhered to during implementation of the remedy.

TABLE 7-3
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63	California Location-Specific	Seismic and Floodplain standards - Title 22, CCR, Div 4.5, Ch 14, Article 2, §66264.18	ARAR Relevant and Appropriate	These standards are relevant and appropriate for TSD facilities constructed, operated, or maintained within certain distances of fault lines, floodplains, or the maximum high tide.	Infrastructure in 100-year floodplain/ regulatory floodway	PG&E	Design submittals, Construction/ Remedial Action Work Plan	The groundwater remedial facilities are not a permitted RCRA treatment, storage or disposal facility. Seismic load design criteria and geotechnical design criteria are described in Appendix C. The 100-year floodplain is defined in the Flood Insurance Rate Map (FIRM), Panel 5705 of 9400 for San Bernardino County, California and Unincorporated Areas, Revised August 28, 2008. The base flood elevation shown on the current FIRM is 464 at River Mile (RM) 234 of the Colorado River. The effective Flood Insurance Study (FIS) for San Bernardino County lists a regulatory base flood elevation of 463.90. This design uses the more conservative elevation of 464 as the base flood elevation. Wells and pipelines are included in the preliminary (30%) design in areas of the Colorado River floodplain necessary for capture and treatment of the chromium plume. The infrastructure in this preliminary (30%) design (wells, pipes) is mostly outside the 100-year floodplain, see Sheet C-2, well FP-EX-5.

Notes:

[1] Source: Table 2 of the Groundwater Record of Decision, Pacific Gas and Electric Company Topock Compressor Station, Needles, San Bernardino County, California, December 2010 (DOI 2010).

[2] As corrected by the Department of the Interior.

TABLE 8-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which Future Documents will Contain or Satisfy This Requirement	Target Submittal Schedule to Agencies
CMI Work Plan	• Introduction/Purpose • Media cleanup standards • Conceptual model of contaminant migration • Description of Corrective Measures • Data sufficiency • Project management • Project schedule • Conceptual process/schematic diagrams • Site plan showing preliminary plant layout and/or treatment area	This CMI/RD Work Plan	Draft – May 2011 Final – September 2011
	• Design criteria • Design basis • Tables listing number and type of major components with approximately dimensions • Tables giving preliminary mass balances • Required permits • Long-lead procurement considerations • Appendices including design data, equations, sample calculations, laboratory or field test results	Preliminary, Intermediate, and Final Design Submittals (see Table 4-5 for content)	Preliminary – November 2011 Intermediate – March 2012 Final – August 2012 Revised Final – November 2012
	• Waste management practices	O&M Plan, Construction/ Remedial Action Work Plan (see Table 4-5 for content)	See O&M Plan, Construction Work Plan
	• Site safety and security provisions	Intermediate and Final Design Submittals (see Table 4-5 for content)	Intermediate – March 2012 Final – August 2012

TABLE 8-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which Future Documents will Contain or Satisfy This Requirement	Target Submittal Schedule to Agencies
Draft Plans and Specs	• General site plans • Process flow diagrams • Mechanical/electrical/structural drawings • Piping and instrumentation diagrams • Excavation and earthwork drawings • Equipment list • Site preparation and field work standards	Preliminary and Intermediate Design Submittals	Preliminary – November 2011 Intermediate – March 2012
	• Preliminary specs for equipment and materials	Preliminary Design – List of specs and a sample spec format Intermediate Design – Draft specifications	
Final Plans and Specs	• General site plans • Process flow diagrams • Mechanical/electrical/structural drawings • Piping and instrumentation diagrams • Excavation and earthwork drawings • Equipment list • Site preparation and field work standards • Construction drawings • Installation drawings • Detailed specs for equipment and materials	Final Design Submittals	Final – August 2012 Revised Final – November 2012
Operations and Maintenance Plan	• Project management • System description • Personnel training • Startup procedures • O&M procedures • Equipment replacement schedule • Waste management practices • Sampling and monitoring • Corrective measure completion criteria • O&M contingency procedures • Data management and documentation requirements	Operations and Maintenance Plan	Draft – March 2012 Final – August 2012

TABLE 8-1

Cross Reference of 1996 CACA Requirements and Future Documents

Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which Future Documents will Contain or Satisfy This Requirement	Target Submittal Schedule to Agencies
Construction Work Plan	• Project management • Construction QA/QC program • Waste management procedures • Sampling and monitoring • Construction contingency procedures • Data management and documentation requirements	Construction/Remedial Action Work Plan	Draft – August 2012 Final – November 2012
	• Project schedule • Cost estimates	Preliminary, Intermediate, Final Design Submittals , and Construction/Remedial Action Work Plan	See submittal schedule for corresponding plans
Health and Safety Plan	• See Attachment 2 of CACA	Health and Safety Plan for O&M Health and Safety Plan for Construction	See submittal schedules for O&M Plan and Construction/ Remedial Action Work Plan
Construction Completion Report	• Purpose • Synopsis of the final corrective measure, design criteria, and certification that the final corrective measure was constructed in accordance with the final design plans and specifications • Explanation and description of any modifications to the final design plans and specifications and why the modifications were necessary • Results of any operational testing and/or monitoring which may indicate how initial operation of the final groundwater remedy compares to the design criteria • Summary of significant activities that occurred during construction • Summary of any inspection findings • As-built drawings • A schedule indicating when treatment systems will begin full scale operations	Corrective Measure/Remedial Action Construction Completion Report	Submittal schedule will be established in the Construction/Remedial Action Work Plan

TABLE 8-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which Future Documents will Contain or Satisfy This Requirement	Target Submittal Schedule to Agencies
Corrective Measure Completion Report	• Purpose • Synopsis • Corrective measure completion criteria, including a description of the process and criteria for determining when corrective measures, maintenance, and monitoring may cease. • Demonstration that the completion criteria have been met including results of testing and monitoring • Summary of work accomplishments • Summary of significant activities that occurred during operations • Summary of inspection findings • Summary of total O&M costs	Corrective Measure/Remedial Action Completion Report	Submittal schedule will be established in the Construction/Remedial Action Work Plan

Source:
Revised Groundwater Corrective Measure Implementation/Remedial Design Work Plan for SWMU 1/AOC 1 and AOC 10, Table 4-1A (CH2M HILL 2011f).

TABLE 8-2
Cross Reference of 2009 Model Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Model CD-required Documents	2009 Model Consent Decree Requirements	Which Future Documents will contain or satisfy this requirements	Target Submittal Schedule
Remedial Design Work Plan	• Plans and schedules for implementation of all remedial design and pre-design tasks identified in the SOW, including but not limited to, plans and schedules for the completion of a list based on site-specific factors including: • Design sampling and analysis plan (including but not limited to, a RD QAPP) • Treatability study • Pre-design work plan • Preliminary design submission • Intermediate design submission • Pre-final/final design submission • Schedule for completion of the RAWP	This CMI/RD Work Plan *(Note that treatability study and pre-design work plan are not anticipated for this project)*	Draft – May 2011 Final – September 2011
	• Construction Quality Assurance Plan	Construction/Remedial Action Work Plan (see Table 8-3 for content)	Draft – August 2012 Final – November 2012
Preliminary Design (30%)	• Design Criteria • Basis of Design (design assumptions, permit plans, prelim easements/access requirements, prelim process & instrumentation diagrams [P&IDs]) • Results of treatability studies • Results of additional field sampling and pre-design work • Project delivery strategy • Preliminary plans, drawings and sketches • Required specifications in outline form • Results of value engineering screen • Prelim construction schedule/cost estimates	Preliminary Design Submittals (see Table 8-3 for content) *(Again, note that treatability study is not anticipated for this project)* *(Again, preliminary specs include a list of specifications and a sample spec format.)*	November 2011
Intermediate Design (60%)	• Basis of Design (design assumptions, permit plans, prelim easements/access requirements, P&IDs) • Drawings/specs (incl. O&M requirements) • RA schedule/cost estimates	Intermediate Design Submittals (see Table 8-3 for content)	March 2012
Pre-Final (90%) and Final Design (100%)	• Final Basis of Design • Final plans and specifications • RA schedule • Refined cost estimates	Final Design Submittals (see Table 8-3 for content)	Final – August 2012 Revised Final – November 2012

TABLE 8-2
Cross Reference of 2009 Model Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Model CD-required Documents	2009 Model Consent Decree Requirements	Which Future Documents will contain or satisfy this requirements	Target Submittal Schedule
Operations and Maintenance Plan	• See 2009 Model CD (USEPA 2009)	Operations and Maintenance Plan (see Table 8-3 for content)	Draft – March 2012 Final – August 2012
Field Sampling Plan	• See 2009 Model CD (USEPA 2009)	Operations and Maintenance Plan, Construction/Remedial Action Work Plan	See submittal schedule for corresponding plans
Contingency Plan	• See 2009 Model CD (USEPA 2009)	Operations and Maintenance Plan, Construction/Remedial Action Work Plan	See submittal schedule for corresponding plans
Health and Safety Plan	• See 2009 Model CD (USEPA 2009)	Health and Safety Plan for O&M Health and Safety Plan for Construction	See submittal schedules for O&M Plan and Construction/ Remedial Action Work Plan
Construction Quality Assurance and Control (CQA/QC) Plan	• See 2009 Model CD (USEPA 2009)	Construction/Remedial Action Work Plan	See submittal schedule for corresponding plan
Remedial Action Work Plan	• Revised HSP • Schedule for completion of RA tasks • Method for selecting contractor • Schedule for submitting other RA-required plans • Groundwater monitoring plan • Method for implementing CQAPP/O&M Plan/Contingency Plan • Methods for satisfying permit requirements • Tentative formulation of the remedial action team • Contractor construction quality assurance plan • Decontamination procedures and disposal of materials • Requirements for project closeout	Construction/Remedial Action Work Plan, Health and Safety Plan	Draft – August 2012 Final – November 2012
Post-Achievement O&M Plan	• See 2009 Model CD (USEPA 2009)	Post-remediation monitoring report	Submittal schedule to will be established in the Construction/RA Work Plan

TABLE 8-2
Cross Reference of 2009 Model Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

Model CD-required Documents	2009 Model Consent Decree Requirements	Which Future Documents will contain or satisfy this requirements	Target Submittal Schedule
Progress Reports	• Include a summary of all results of sampling and tests and all other data received or generated since the last progress report • Identify all plans, reports, and other deliverables required by the Consent Decree that were completed since the last progress report. • Describe all actions, including but not limited to, data collection and implementation of work plans, which are scheduled before the next progress report is due and provide other information related to the progress of construction, including, but not limited to critical path diagrams, Gantt charts, and Pert charts • Include information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule for implementation, and a description of the efforts made to mitigate those delays. • Include any modifications to the work plans or other schedules that have been proposed or approved. • Describe all activities undertaken in support of the Community Relations Plan since the last progress report and upcoming activities.	Performance monitoring reports	Submittal schedule to will be established in the Construction/RA Work Plan
RA Construction Completion Report	• Purpose • Synopsis • Corrective measure completion criteria, including a description of the process and criteria for determining when corrective measures, maintenance, and monitoring may cease. • Demonstration that the completion criteria have been met including results of testing and monitoring • Summary of work accomplishments • Summary of significant activities that occurred during operations • Summary of inspection findings • Summary of total O&M costs	Corrective Measure/Remedial Action Construction Completion Report Corrective Measure/Remedial Action Completion Report	Submittal schedule will be established in the Construction/RA Work Plan
Certification of Completion of RA	• Documentation of pre- certification inspection and completion of all work. • Statement that the remedial action has been completed in full satisfaction of the requirements of the Consent Decree. • As built drawings	Corrective Measure/Remedial Action Completion Report	Submittal schedule will be established in the Construction/RA Work Plan

Source:
Revised Groundwater Corrective Measure Implementation/Remedial Design Work Plan for SWMU 1/AOC 1 and AOC 10, Table 4-2A (CH2M HILL 2011f).

TABLE 8-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

A. Submittals Required by 1996 CACA/2009 Model CD/Settlement Agreement (see Figure 4-1 and Tables 4-1a/4-2a for submittal schedule)

Preliminary Design Package (For Review/Comment Only)	Intermediate Design Package (For Review/Comment Only)	Final Design Package (For DTSC/DOI Approval)
• **Prelim Basis of Design Report** - Design assumptions, calculations - Design criteria - O&M provisions - Additional design data mapped, surveyed, or collected post Corrective Measures Study/Feasibility Study (CMS/FS) - Equipment list - Long-lead procurement considerations - Updated schedule and cost estimates • **Prelim Plans** - Site plans - Engineering/architectural drawings - Process flow diagrams (PFDs) - Process and instrumentation diagrams (P&IDs) • **Prelim Specifications** - List of specifications/Format of specifications	• **Intermediate Basis of Design Report** - Design assumptions, calculations - Design criteria - Additional design data mapped, surveyed, or collected post CMS/FS - Equipment list - Long-lead procurement considerations - Updated schedule and cost estimates • **Intermediate Plans** - Site plans - Engineering/architectural drawings - Excavation/earthwork drawings - PFDs - P&IDs • **Intermediate Specifications** - Draft specifications	• **Final Basis of Design Report** - Design assumptions, calculations - Design criteria - Additional design data mapped, surveyed, or collected post CMS/FS - Equipment list - Long-lead procurement considerations - Updated schedule and cost estimates • **Final Plans** - Site plans - Engineering/architectural drawings - Excavation/earthwork drawings - Construction/installation drawings - PFDs - P&IDs • **Final Specifications** - Detailed specifications

TABLE 8-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

	Draft O&M Plan (For Review/Comment Only – To be submitted concurrently with Intermediate Design Package)	**Final O&M Plan (For DTSC/DOI Approval – To be submitted concurrently with Final Design Package)**
	• Project management and organization • Communication procedures and protocols • System description • Personnel training • Start-up procedures • O&M procedures - description of tasks for operation and maintenance, description of prescribed treatment or operation conditions, O&M schedule • Equipment replacement schedule • Waste management practices, including types of wastes to be generated and how each type of waste will be managed • Sampling and monitoring plan during system operation (including data quality objectives, Quality Assurance Project Plan) • O&M Quality Assurance Project Plan (QAPP) • Corrective measure completion criteria • O&M contingency plans to address potential failure modes, e.g., - Related to attainment of RAOs and ARARs compliance - Related to system breakdowns and operational problems - Related to major operational problems and is not performing to design specifications - Related to unforeseen events that prevent the operation of the final groundwater remedy (e.g., acts of God like earthquakes, flooding, fires) • Data management and documentation requirements, including a description of how analytical data and results will be evaluated, documented, and managed • Details for the collection/maintenance of information • Summary of access, approvals, and substantive requirements of ARARs associated with permits (e.g., Report of Waste Discharge)	• Project management and organization • Communication procedures and protocols • System description • Personnel training • Start-up procedures • O&M procedures - description of tasks for operation and maintenance, <u>including well rehabilitation methods and chemicals use,</u> description of prescribed treatment or operation conditions, O&M schedule • Equipment replacement schedule • Waste management practices, including types of wastes to be generated and how each type of waste will be managed • Sampling and monitoring plan during system operation (including data quality objectives, Quality Assurance Project Plan) • O&M Quality Assurance Project Plan (QAPP) • Corrective measure completion criteria • O&M contingency plans to address potential failure modes, e.g., - Related to attainment of RAOs and ARARs compliance - Related to system breakdowns and operational problems - Related to major operational problems and is not performing to design specifications - Related to unforeseen events that prevent the operation of the final groundwater remedy (e.g., acts of God like earthquakes, flooding, fires) • Data management and documentation requirements, including a description of how analytical data and results will be evaluated, documented, and managed • Details for the collection/maintenance of information • Summary of access, approvals, and substantive requirements of ARARs associated with permits (e.g., Report of Waste Discharge)

TABLE 8-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

		Draft/Final Construction/Remedial Action Work Plan **(For DTSC/DOI Approval – To be submitted concurrently with Final Design Package)**

		• Project management and organization (including method for selecting contractor)
		• Communication procedures and protocols
		• Project schedule, including timing of key elements for bidding purposes, timing of the initiation and completion of all major tasks, and when the construction completion report will be submitted
		• Construction QAPP which is intended to ensure that the final groundwater remedy will meet all design criteria, plans, and specifications
		• Waste management procedures, including addressing how wastes generated during construction will be managed
		• Site preparation and field work standards(including decontamination procedures)
		• Sampling and monitoring plan during construction
		• Construction contingency plans to address potential failure modes, e.g.,
		  - Related to changes to the design and/or specifications due to issues that may arise during construction
		  - Related to unforeseen events that prevent the construction of the final groundwater remedy (e.g., acts of God like earthquakes, flooding, fires)
		• Data management and documentation requirements, including a description of how analytical data and results will be evaluated, documented, and managed
		• Details for the collection/maintenance of information
		• Summary of access, approvals, and substantive requirements of ARARs associated with construction
		• Health and Safety Plan for O&M (**For DTSC Concurrence/DOI Review) –** To be submitted concurrently with Final Design Package)
		• Health and Safety Plan for Construction (**For DTSC Concurrence/DOI Review) –** To be submitted concurrently with Final Design Package)
		• Documents required to establish institutional control(s)[1]

TABLE 8-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Preliminary (30%) Design
PG&E Topock Compressor Station, Needles, California

B. Submittals to meet substantive requirements of ARARs (not otherwise included in the above documents) (see Figure 4-1a and Tables 4-1a/4-2a for submittal schedule)

Key ARARs Compliance Submittals Concurrent with Preliminary Design Package	Key ARARs Compliance Submittals Concurrent with Intermediate Design Package	Key ARARs Compliance Submittals Concurrent with Final Design Package/ Final Construction/Remedial Action Work Plan
	• Other documents with substantive information normally contained in permit applications (as identified and developed during the design) <u>Submittals where there are potential overlaps between substantive requirements of ARARs and EIR requirements:</u> • Delineation of waters and wetlands field survey addendum (ARAR #27, 32, 63)	• Tribal Access Plan (PA) (BLM Lead) • Plan for decommissioning and removal of IM No. 3 facility and site restoration (ARAR #14) • Storm Water Pollution Prevention Plan (SWPPP)/BMP plans and Monitoring & Reporting (ARAR #34) • Injection well inventory (ARAR #31) • Other documents with substantive information normally contained in permit applications (as identified and developed during the design) <u>Submittals where there are potential overlaps between substantive requirements of ARARs and EIR requirements:</u> • Health and Safety Plan for Construction (ARAR #76) • Health and Safety Plan for O&M (ARAR #76) • Grading and Erosion Control Plan (ARAR #34) • Soil Management Plan (ARAR #86) • Site Security Plan (ARAR #76, 90) • Project-specific hazardous materials business plan (ARAR #90) • Programmatic Biological Agreement (ARAR #40) • Avoidance and minimization plan for special status birds (ARAR #40, 41) • Habitat restoration plan for sensitive habitats (ARAR #27, 32, 63) • Habitat restoration plan for special-status species (ARAR #27, 32, 40, 41, 63)

C. Submittals to meet EIR MMRP requirements (see Figure 4-1a and Tables 4-1a/4-2a for submittal schedule)

EIR Compliance Submittals Concurrent with Preliminary Design	EIR Compliance Submittals Concurrent with Intermediate Design Package/ Draft O&M Plan	EIR Compliance Submittals Concurrent with Final Design Package/Final O&M Plan/Final Construction/Remedial Action Work Plan
• Aerial map of disturbed areas (CUL-1a-9) • Map of mature plant species (AES-1a/AES-2) • Map of ordinary high water mark (AES-2a)	• Map of indigenous species listed in Appendix PLA of the EIR (CUL-1a-5) • Delineation of waters and wetlands field survey addendum (BIO-1) **(for USACE Verification)** • Hydrologic analysis (WATER-1)	• Health and Safety Plan for Construction (HAZ-2) **(for DTSC Concurrence)** • Health and Safety Plan for O&M (HAZ-2) **(for DTSC Concurrence)** • Grading and Erosion Control Plan (GEO-1a-a) **(for DTSC Approval)** • Soil Management Plan (HAZ-2c) **(for DTSC Approval)** • Site Security Plan (CUL-1a-3b) • Access Plan (CUL-1a-2) • Storm Water Pollution Prevention Plan (SWPPP)/BMP plans and Monitoring & Reporting (HYDRO-1) • Fueling SOPs and Contingency Plan for Onsite Fueling Areas (HAZ-1b-b) • Project-specific hazardous materials business plan (HAZ-1a-c) • Paleontological investigation report (CUL-3) • Avoidance and minimization plan for special status birds (BIO-2a) **(Agreed upon by DTSC)** • Habitat restoration plan for sensitive habitats (BIO-1) **(Agreeable to USACE, DFG, BLM, USFWS)** • Habitat restoration plan for special-status species (BIO-2c) **(Agreeable to DFG, BLM, USFWS)** • Revegetation plan (AES-1b/1c/1e, AES-2c/d/f) • Cultural resources study/Geoarchaeological investigation report (CUL-1b/c-2, CUL-2) **(for DTSC review/evaluation)** • Cultural resources treatment plan (if needed) (CUL-2) (**for DTSC Approval)** • CIMP (include plan for decommissioning and removal of IM No. 3 facility and site restoration, plant transplantation/ monitoring plan (if needed)) (CUL-1a-8) (**for DTSC Approval)**

Notes:
[1] The target timing for institutional controls (ICs) or their equivalent, where available, is prior to remedy construction.
Source: *Revised Groundwater Corrective Measure Implementation/Remedial Design Work Plan for SWMU 1/AOC 1 and AOC 10*, Table 4-5 (CH2M HILL 2011f).