Pacific Gas and Electric Company

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April 5, 2013

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: Basis of Design Report/Intermediate (60%) 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 CERCLA Remedial Design/Remedial Action Consent Decree (lodged with the U.S. District Court for the Central District of California in January 2013; effective upon court approval), this letter transmits the *Basis of Design Report/Intermediate (60%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California*. PG&E looks forward to the opportunity to review the remedy pipeline alignment/design features with the Agencies, interested Tribes, and Stakeholders during the April 18, 2013 Technical Work Group Meeting/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

Topock Project Executive Abstract

Document Title: Basis of Design Report/Intermediate (60%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California Submitting Agency: DTSC, DOI Final Document? ☐ Yes ☒ No	Date of Document: 04/05/2013 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 Return to: N/A By Date: As specified by DTSC and DOI ☐ Other / Explain:
Type of Document: ☒ Draft ☐ Report ☐ Letter ☐ Memo ☐ 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 2013 CERCLA Remedial Design/Remedial Action 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 Basis of Design Report/Intermediate (60%) Design (60% BOD) Submittal is a continuation and expansion of the preliminary (30%) BOD submittal, and contains the intermediate design details, drawings, specifications, and appendices for implementation of the remedy including the Draft O&M Manual (Appendix L).

This Basis of Design Report/Intermediate (60%) Design Submittal has been prepared to comply with DTSC's December 31, 2012 directive, to incorporate responses to comments received on the 30% BOD Submittal, to incorporate data that has been collected since issuance of the 30% BOD Submittal in November 2011, and to bring the design details to a 60% detail level. Pending additional agency guidance regarding water quality requirements for injection, arsenic and fluoride treatment for the freshwater source is included in this design document. The freshwater source details will be included in an addendum to the Intermediate (60%) Design, after such requirements are determined and completion of planned source water studies.

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:

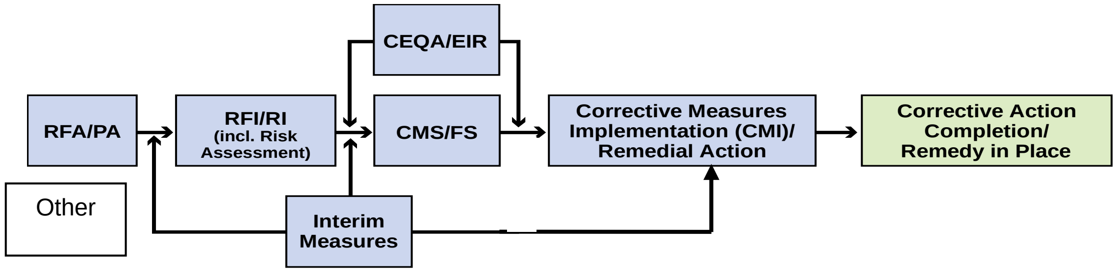
This submittal presents the intermediate design basis, design criteria, list of specifications, and additional information required for the final groundwater remedy.

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®

PG&E Topock
Compressor Station
Needles, California

Basis of Design Report / Intermediate (60%) Design Submittal for the Final Groundwater Remedy

April 2013

CH2MHILL®

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Draft Report

Basis of Design Report/Intermediate (60%) Design Submittal for the Final Groundwater Remedy

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas & Electric Company

April 2013

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.

Executive Summary

Pacific Gas and Electric Company (PG&E) is implementing the selected groundwater remedy for chromium in groundwater at the PG&E Topock Compressor Station (TCS, or the Compressor Station) in San Bernardino County, California. The existing chromium contamination in groundwater is largely attributable to historical wastewater discharge from Compressor Station operations to Bat Cave Wash, designated as Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1, and within the East Ravine, designated as AOC 10. Remedial activities at the Topock site are being performed in conformance with the requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action pursuant to a Corrective Action Consent Agreement (CACA) entered into by PG&E and the California Department of Toxic Substances Control (DTSC) in 1996. In addition, PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree (CD) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 2012, which was lodged with the U.S. District Court for the Central District of California in January 2013 and will be effective upon approval by the court.

Implementation of the selected groundwater remedy consists of several phases, including design, construction, start-up, operation and maintenance (O&M), post-remediation monitoring, decommissioning, and restoration. Figure ES-1 (figures are located at the end of this executive summary) illustrates the site cleanup process and the various phases for groundwater remedy implementation. The project is currently in the remedial design phase and at the intermediate (60%) design stage. Figure ES-2 shows the schedule for the groundwater remedy design, construction, and initial start-up schedule. As shown, inputs from Interested Tribes and Stakeholders were solicited and received on the preliminary (30%) Basis of Design Submittal (30% BOD; PG&E 2011a) and are being solicited again at this 60% design stage. Inputs will also be solicited at the 90%/100% design stages. DTSC and DOI issue direction to PG&E prior to the start of each stage.

This Basis of Design Report/Intermediate (60%) Design (60% BOD) Submittal is a continuation and expansion of the preliminary (30%) BOD Submittal, and contains additional design details, drawings, specifications, and appendices for implementation of the remedy (including the new Appendix L, the Draft O&M Manual, which is presented under separate cover but is included on the CD-ROM version of this report located inside the front binder cover). Per DTSC's direction in a letter dated December 31, 2012 (DTSC 2012), this 60% BOD includes a pre-treatment system to polish Arizona groundwater to California standards prior to injection. The decision by the State Water Resources Control Board (SWRCB) is anticipated to guide further direction from DTSC regarding the ultimate use of the freshwater source and what level of treatment, if any, will be required for various constituents. As such guidance is still forthcoming, in this 60% BOD report PG&E has made the conservative assumption for freshwater pre-injection treatment goals, specifically that the arsenic treatment goal will be to reduce concentrations below the federal/state Maximum Contaminant Level (MCL) of 10 micrograms per liter (µg/L) and that the fluoride treatment goal will be concentrations below the state MCL of 2 milligrams per liter (mg/L). The freshwater source details will be included in an addendum to the 60% BOD Submittal after such requirements are determined and following completion of planned source water studies.

Other requirements of the CACA and CD, including the plans and schedules for construction and implementation of the remedy set forth in the remedial design plans and specifications, will be addressed in the Corrective Measure Construction/Remedial Action Work Plan and other future documents (as outlined in Section 7 of this document).

ES.1 Overview

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. The surrounding project site includes land owned and/or managed by a number of government and private entities including PG&E, the U.S. Bureau of Reclamation (BOR) (managed by the U.S. Bureau of Land Management [BLM]), the U.S. Fish and Wildlife Service (USFWS) (managing the Havasu National Wildlife Refuge [HNWR]), San Bernardino County, BNSF Railroad, Fort Mojave Indian Tribe (FMIT), and the

Southern California Metropolitan Water District (see Figure ES-3). In addition, several other entities have easements and/or rights-of-way (ROWs) including the California Department of Transportation (Caltrans), Southern California Gas Company, Transwestern Pipeline Company, Mojave Pipeline Company, PG&E, City of Needles Electric, Southwest Gas Corporation, and Frontier Communications. Landowners/leaseholders in Arizona where pipelines for fresh water may be located include Kinder Morgan, BNSF Railroad, Arizona Department of Transportation, Mohave County, and private property owners. Ownership of land beneath the Colorado River includes the California State Lands Commission and the Arizona State Lands Department.

The Topock site is contained within a larger geographic area that is considered sacred by the FMIT 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 Environmental Impact Report (EIR; DTSC 2011d) that the 779.2-acre 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, within the current Area of Potential Effect (APE), consisting of 1,600 acres of surface area and a section of the Colorado River.

Thousands of years of human history are evident in the area surrounding the Compressor Station. Among the larger and better known cultural resources on the site is an expansive desert geoglyph or intaglio known as the Topock Maze. Although the Maze is viewed as one contiguous element of a larger area having unique value to some Tribes, archaeological documents refer to three geographically-distinct parts, two of which overlie the groundwater plume. Prominent historic-era features in the landscape, several of which intrude upon the Maze and also overlie the groundwater plume, include segments of historic U.S. Route 66, the National Trails Highway (NTH; also known as the National Old Trails Highway), and the ROW of the BNSF Railway. A broad spectrum of archaeological resources is also present within the project area and on adjacent lands. Properties on and near the Topock site that are eligible for or listed on the National Register of Historic Places include Native American cultural resources and elements of the historic "built environment."

A large portion of the site and surrounding area is the Havasu National Wildlife Refuge. The *Lower Colorado River National Wildlife Refuges Comprehensive Management Plan 1994-2014* (USFWS and BOR 1994), adopted in 1994, currently guides land management at the HNWR. The Comprehensive Management Plan emphasizes that the HNWR should be used in a manner that will facilitate protection of (1) the endangered and threatened species found in the HNWR, (2) marsh and wetland habitat for both endangered and threatened species, and (3) habitat for migratory, wintering, and nongame avian species. Portions of the Topock site are also located in a Riparian and Cultural Area of Critical Environmental Concern (ACEC) and the Topock-Needles Special Cultural Resource Management Area (SCRMA), designated under the BLM Resource Management Plan (BLM 2007).

In recognition of the above, all remedial activities at the Compressor Station 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 Mitigation Monitoring and Reporting Program (MMRP; DTSC 2011c) adopted by DTSC in 2011 as part of the certified EIR (DTSC 2011d). In addition, mitigation measures will be implemented in accordance with the Programmatic Agreement (PA; BLM 2010), the Cultural and Historic Properties Management Plan (CHPMP; BLM 2012), and in consultation with the Tribes throughout the design process. The work will be conducted in a manner that recognizes and respects these resources and the spiritual values of the area.

The existing chromium plume encompasses 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 below ground surface, 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 300 feet near the northern end of the NTH. The volume of groundwater containing hexavalent chromium (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 formation is believed to represent less than 2 percent of the total plume. Data collected during the East Ravine Groundwater Investigation indicate that groundwater in bedrock occurs in irregularly distributed, highly localized, and discontinuous water-bearing zones, which is characteristic of fractured crystalline rocks. 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.

ES.2 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the selected groundwater remedy at the Topock site are to:

1. Prevent ingestion of groundwater as a potable water source having Cr(VI) in excess of the regional background concentration of 32 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 the applicable or relevant and appropriate requirements (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.

ES.3 Summary of Engineering Design Parameters and Features/Key Changes from 30% to 60% Design

The intermediate (60%) design for the groundwater remedy includes the following key features:

- An In-situ Reactive Zone (IRZ) along the 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 Cr(VI) to trivalent chromium (Cr[III]).
- An Inner Recirculation Loop (IRL) that comprises of:
  - Extraction wells near the Colorado River (referred to as the River Bank Extraction Wells) to provide hydraulic capture of the deep Cr(VI) groundwater concentrations, accelerate cleanup of the floodplain, enhance the flow of contaminated groundwater through the IRZ line, and control migration of IRZ-generated by-products toward the Colorado River.
  - Injection wells to re-inject groundwater extracted from the River Bank extraction wells, which may be amended with an organic carbon source, in the upgradient portion of the Cr(VI) plume to flush the plume through the IRZ.
- A TCS Recirculation Loop that comprises of:
  - East Ravine Extraction Wells in the eastern (downgradient) end of the East Ravine to provide hydraulic capture of contaminated groundwater in bedrock.
  - TCS injection wells located upgradient of the TCS for the re-injection of groundwater extracted from the East Ravine extraction wells and Transwestern Bench (TW) extraction wells, which will be amended with an organic carbon source, to promote reduction of the Cr(VI) to Cr(III) and remove elevated Cr(VI) groundwater concentrations from the alluvial aquifer in the vicinity of the TCS.
- Injection of freshwater 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.
  - As previously mentioned, pending additional agency guidance regarding water quality requirements for injection, this 60% BOD includes a freshwater pre-injection treatment system (FWPTS) for the removal of

arsenic and fluoride to conservative treatment goals -- specifically arsenic treatment goal is to below the Federal/State MCL of 10 µg/L and fluoride treatment goal is to below the State MCL of 2 mg/L.

The groundwater remedy also includes supporting features within the project footprint that are not aimed specifically at attaining RAOs, but are needed to make the remedy effective and safe over its projected decades-long operation. The key supporting features include a Remedy-produced Water Conditioning System to manage wastewater produced from operation and maintenance of the remedy (e.g., maintenance of wells and piping, sampling and monitoring of wells, etc.), utilities (e.g., power supply for the remedy and distribution conduits, communication and data network, fire water, etc.), site safety and security (e.g., alarms, gates/fences, security cameras, etc.), access roads for installation and long-term O&M needs, and a central maintenance/storage facility that will house site operation and field staff, remote control and monitoring equipment, an on-site laboratory, a document repository center, a training/conference room, equipment storage, etc.

Table ES-1 (located at the end of this executive summary) provides a summary of the remedy design parameters/ quantity at this intermediate (60%) design stage. Figure ES-4 shows the location of key remedy features. Conceptual visualizations of select features were prepared and are presented in Figures ES-5 through ES-7 to facilitate visualization of these remedy features. Based on inputs from Agencies, Interested Tribes, and Stakeholders and through further design development, a number of key adjustments were made between the preliminary (30%) and this intermediate (60%) design. Figures ES-8 through ES-11 illustrates the key changes graphically to facilitate visualization and understanding of these changes; detailed descriptions are provided in the body of this report.

ES.4 Summary of Institutional Controls

In addition to the remedy features described above, institutional controls (ICs) are also a component of the 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.

ICs in the form of a recorded covenant will not be likely be implemented for the federally administered parcels composing the majority of the Topock site. Rather, the DOI’s Record of Decision (ROD; DOI 2010) indicated that the ICs adopted by the selected groundwater remedy for the Topock site are specified in the *BLM Record of Decision and Lake Havasu Field Office Approved Resource Management Plan* issued in May 2007 (BLM 2007) and in the *1994 Lower Colorado River National Wildlife Refuges Comprehensive Management Plan 1994-2014* (USFWS and BOR 1994). These plans restrict surface uses and use of the groundwater on federal lands. The DTSC’s Statement of Basis (SOB; DTSC 2011a) states 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 states 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.

Based on the principles and directives outlined in the ROD and the SOB, potential future restrictions are 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. There are currently no municipal or private wells in the chromium plume area, to PG&E’s knowledge. 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 of PG&E to monitor, operate, and maintain the remedy.

Section 5 of this BOD Report describes in detail the key parameters used to establish ICs, the technical evaluation conducted to define the areas over which to apply ICs, the identification of appropriate mechanisms needed to impose the controls on each property within the area of the ICs, and a listing of potential ICs associated with federal and non-federal lands. PG&E will work with the government agencies, property owners, and/or parties with other land use interests, where appropriate, to advance the establishment of IC covenants according to each specific property where ICs will be required. With respect to privately-owned lands, PG&E will obtain Covenants from existing landowners or employ other similar mechanisms, as appropriate. The next step in this process will be to determine and process land issues such as survey of alignments, legal description of the alignments, easements, and encroachment permits after the remedy locations have been settled on specific parcels.

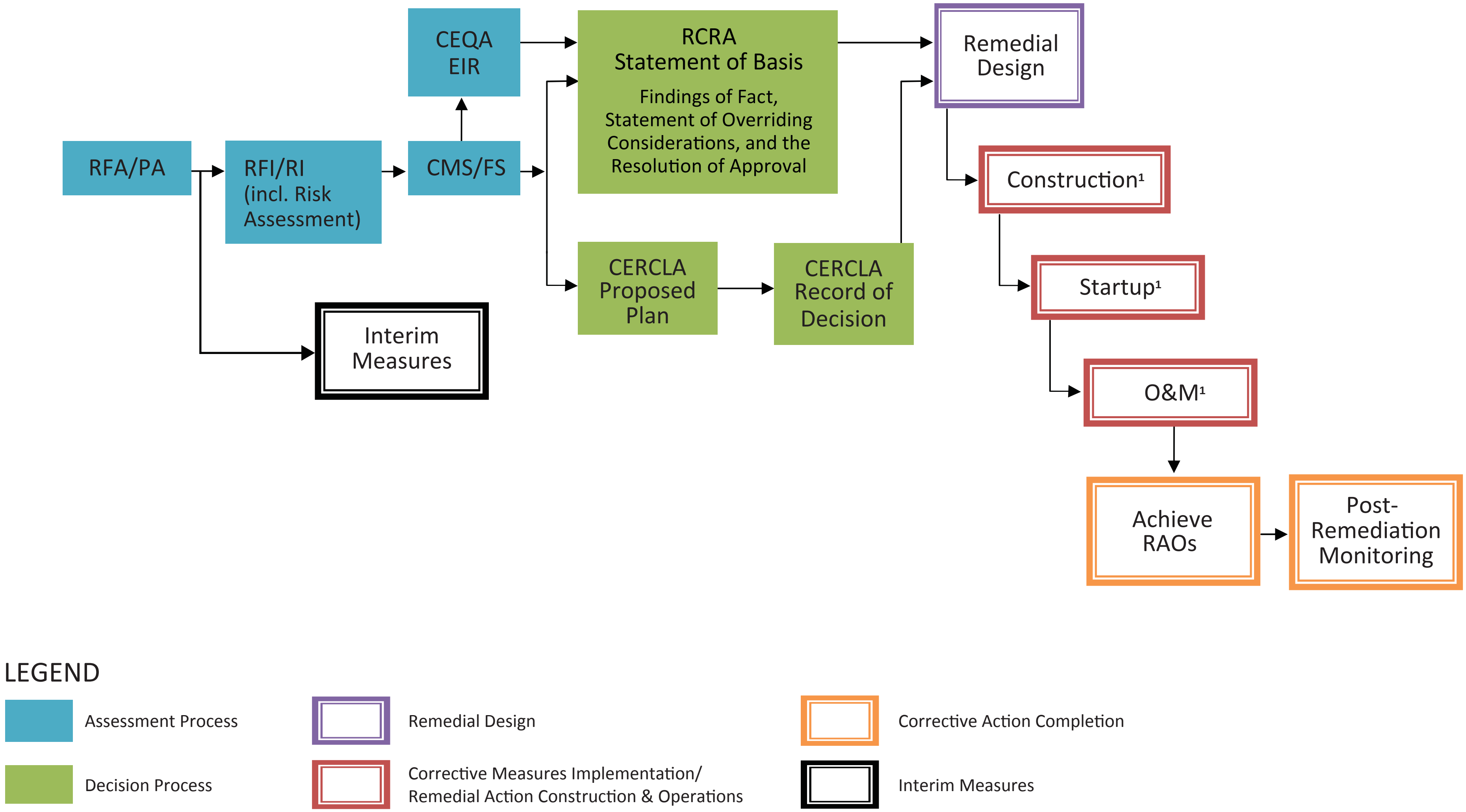
TABLE ES-1
Summary of Engineering Design Parameters and Key Features
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
Remediation wells	A total of 48 remediation wells (plus 37 future provisional): • **NTH IRZ** – 24 IRZ injection wells (plus 30 future provisional) – *total nominal flow rate is 300 gallons per minute (gpm) with a range of 200-400 gpm (see Table 3.2-1 for details)* – 4 IRZ extraction wells (plus 1 future provisional) – *total nominal flow rate is 300 gpm with a range of 200-400 gpm* • **Inner Recirculation Loop** – 5 Riverbank Extraction (RB) wells – *total nominal extraction flowrate is 150 gpm with a range of 150-500 gpm (see Table 3.2-2 for details)* – 4 Inner Recirculation Loop (IRL) injection wells (plus 3 future provisional) – *total nominal injection flowrate is 450 gpm average with a range of 150-900 gpm* • **TCS Recirculation Loop** – 5 East Ravine extraction wells (plus 1 future provisional) – *total nominal extraction flowrate is 5 gpm, with a range of 4-104 gpm (see Table 3.2-3 for details)* – 2 Transwestern (TW) Bench extraction wells (plus 2 future provisional) – *total nominal extraction flowrate is 22 gpm with a range of 2-60 gpm* – 2 TCS injection wells – *total nominal injection flowrate is 27 gpm, with a range of 10-75gpm* • **Freshwater Injection** – 2 Freshwater (FW) injection wells – *total nominal injection flowrate is 150 gpm, with a range of 75-300 gpm (see Table 3.3-1 for details)*	See Figure ES-4 for general locations
Monitoring wells	• 19 new monitoring well locations *(See Table 3.6-2 for design details)* • Reuse existing monitoring wells	See Figure ES-4 for general locations
Carbon amendment and carbon storage facilities	• One 3,000-gallon aboveground carbon storage tank and carbon amendment facility at the Transwestern (TW) Bench • One 15,000-gallon aboveground carbon storage tank and carbon amendment facility at the MW-20 Bench	See Figure ES-4 for general locations of the two bench areas, and Figures ES-5 and ES-6 for conceptual visualizations of equipment on the bench areas.
Freshwater source/ supply well/pre-injection treatment/ storage	• Freshwater supply will be from the existing well HNWR-1, located on the Refuge in Arizona (plus one contingent well located north of HNWR-1, and associated contingent pipeline). If needed, freshwater can be supplemented from the existing supply wells to TCS, namely, Topock-2/3 wells. • One Fresh Water Pre-Injection Treatment System (FWPTS)[1] and associated tanks/chemical storage located at the Compressor Station – *flowrate is 450gpm average, 900gpm maximum (see Exhibit 3.4-4 for details)* • Shared use of existing Compressor Station freshwater storage tanks	See Figure ES-4 for general locations. See Figure ES-7 for conceptual visualization of the Fresh Water Pre-Injection Treatment System in TCS.
Piping corridor (water pipes, electrical conduits, fibers, etc.)	• Approximately 105,000 feet (ft) of water/liquid/utility pipes, and approximately 70,000 ft of electrical conduits and cables. Over 85% of conveyance pipes/conduits will be belowground. • Approximately 2,200 feet of double-walled pipe.	See Figure ES-4 for general piping layout

TABLE ES-1
Summary of Engineering Design Parameters and Key Features
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
Supporting facilities	• The primary power supply source for remedy facilities in California will be power generated by the TCS or supplied from the City of Needles. Secondary power supply will be power generated from small photovoltaic solar panels at various locations such as at the Central Maintenance Facility at the TW Bench and at select remote well locations. Power will be transmitted at 480 VAC to 12K VAC along pipeline corridor, six load centers are planned with a transformer/distribution equipment at each one (plus one future provisional load center to serve the future provisional well IRL-7 if this well is needed to be installed/operated). • For the freshwater supply well (HNWR-1) in Arizona, the power supply source will be power provided by Mohave Electric Cooperative. • One Remedy-produced Water Conditioning System[2] and associated tanks located at the Compressor Station – *flowrate is 20gpm average, 35gpm maximum (see Exhibit 3.4-5 for details)* • One central maintenance building (approx. 10,000 sq.ft.) and one storage building (approx. 900 sq.ft.) at the TW Bench. Shared use of existing TW Bench with Transwestern. • A Supervisory Control and Data Acquisition (SCADA) system located at the central maintenance building at the TW Bench.	See Figure ES-4 for general location. See Figure ES-7 for conceptual visualization of the Remedy-produced Water Conditioning System in TCS.
Access pathways and roadways	• Reuse all existing access pathways and roadways. • Two new graded access roads will be needed in the Upland area to allow for installation and maintenance of wells IRL-2 and IRL-4. • To allow for shared use of the TW Bench by the Topock remediation project and Transwestern, one new access road east of the TW bench will be needed for access to Transwestern's gas transmission equipment.	
Other ancillary facilities	• Two aboveground pipe bridges for aerial crossing of Bat Cave Wash • Small photovoltaic solar panels at various locations such as at the Central Maintenance Facility at the TW Bench and at select remote well locations. Small communication radios at remote monitoring well locations to allow for remote data collection. • Security equipment (e.g., gate, security cameras) for remote facilities	See Figure ES-4 for general locations of the two pipe bridges.

Notes:
[1] System used to remove arsenic to below the Federal/State MCL of 10 µg/L and fluoride to below State MCL of 2 mg/L.
[2] System used to condition water produced from well maintenance activities (backwash, well rehab, etc.), sampling purge water, rainwater collected in secondary containment pads, etc.



[1] Construction, Startup, and O&M activities overlap

RFA/PA: RCRA Facility Assessment/Preliminary Assessment

RFI/RI: RCRA Facility Investigation/CERCLA Remedial Investigation

CMS/FS: RCRA Corrective Measure Study/CERCLA Feasibility Study

CEQA EIR: California Environmental Quality Act Environmental Impact Report

RAOs: Remedial Action Objectives

O&M: Operations & Maintenance

FIGURE ES-1
SITE CLEANUP PROCESS
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.

Groundwater Remedy Design, Construction, and Initial Start-Up Schedule

PG&E Topock Compressor Station | Needles, California
April 2013

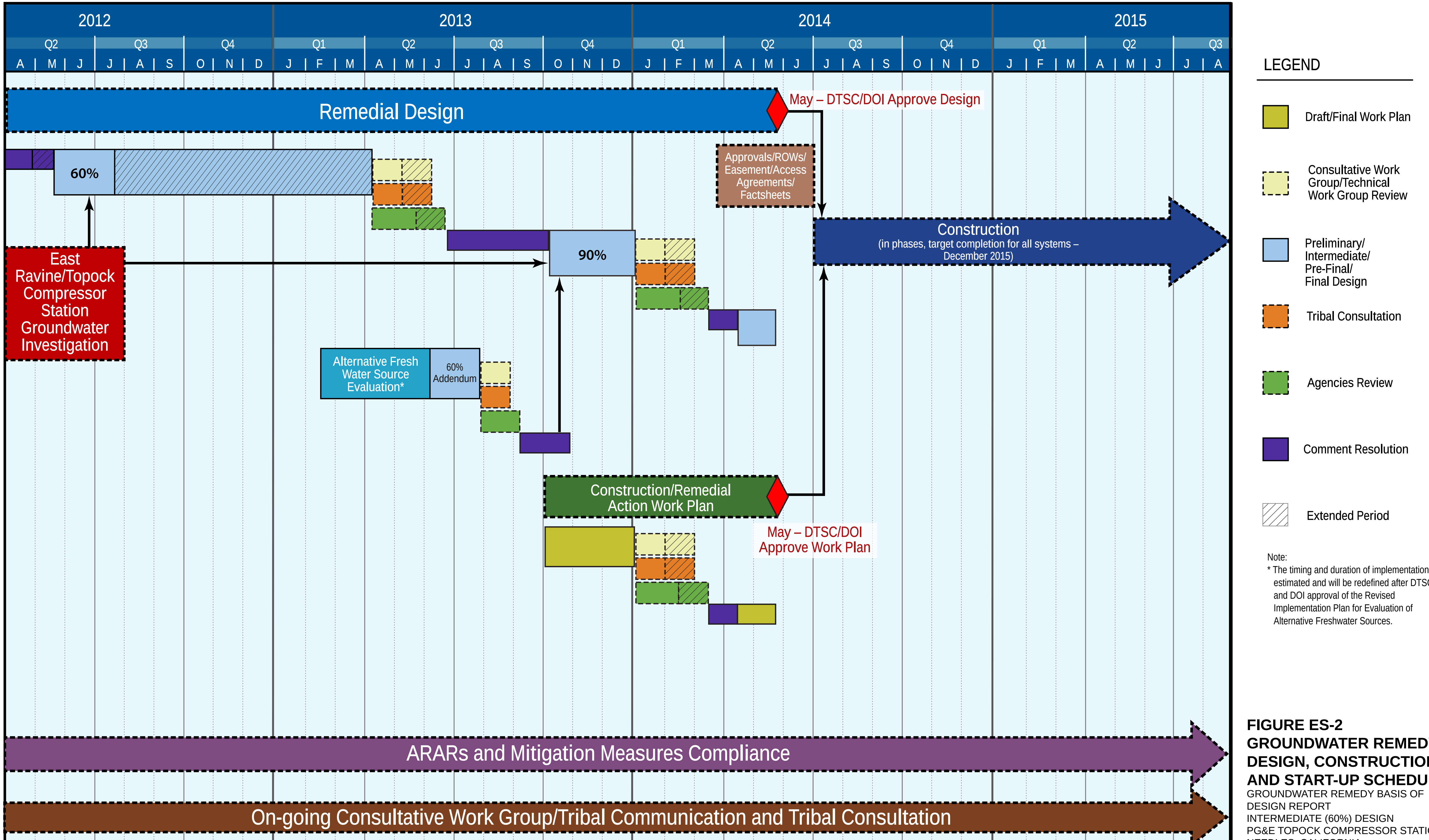
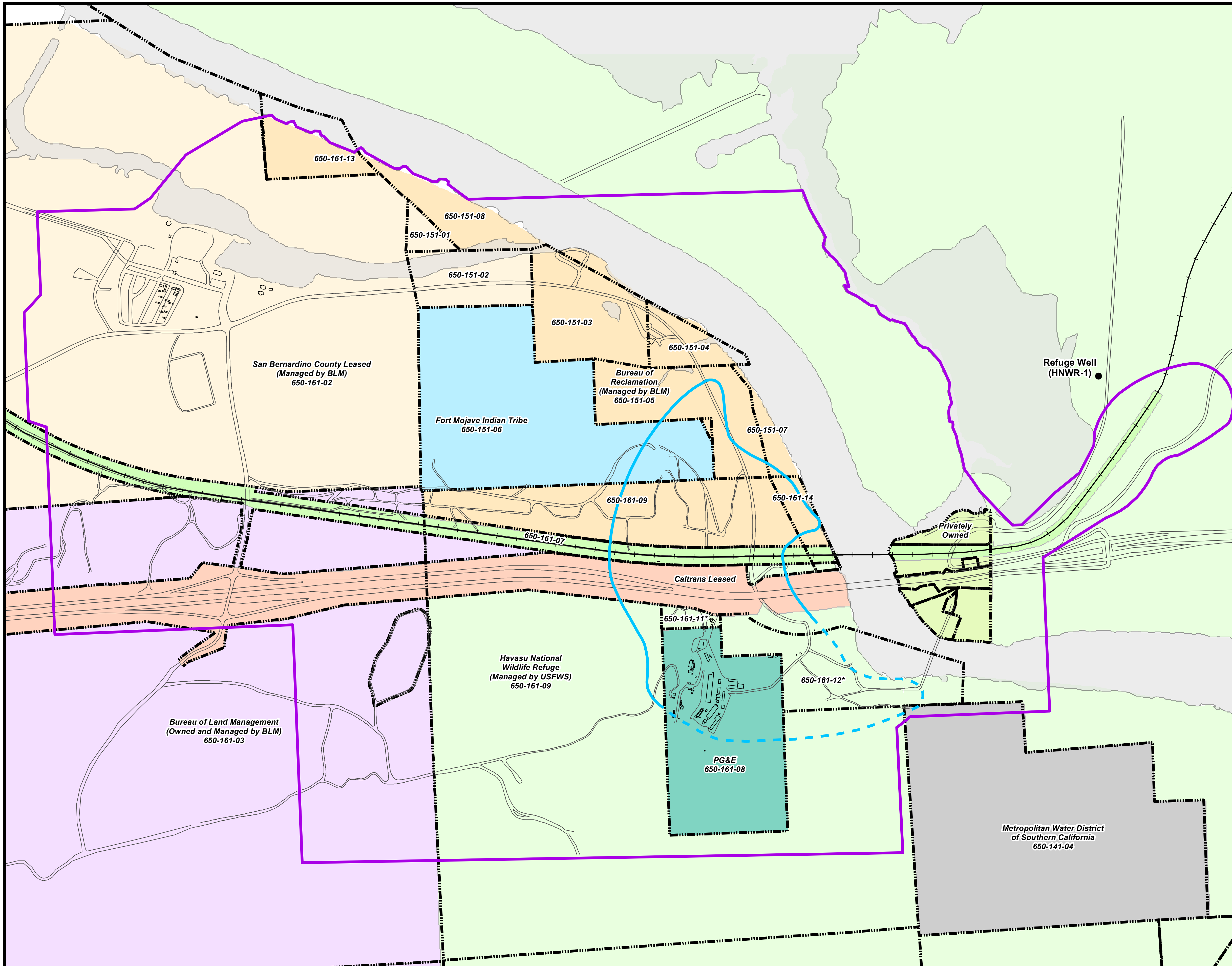


FIGURE ES-2
GROUNDWATER REMEDY DESIGN, CONSTRUCTION, AND START-UP SCHEDULE
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA



LEGEND

Refuge Well

Area of Potential Effects (APE)

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Property Owner

- BNSF Railroad
- Bureau of Land Management (owned and managed by BLM)
- Bureau of Reclamation (managed by BLM)
- Caltrans Leased From Underlying Federal Owner
- Fort Mojave Indian Tribe Owner in Fee, With PG&E Easement and Access for Remediation
- Havasu National Wildlife Refuge
- Metropolitan Water Dirstrict of Southern California
- PG&E
- Privately Owned
- San Bernardino County Leased (managed by BLM)

Note:
1. * = PG&E has a possessory interest on these parcels (650-161-11,650-161-12) for the operation of a compressor station and associated pipelines.

FIGURE ES-3
SURROUNDING PROPERTY MAP

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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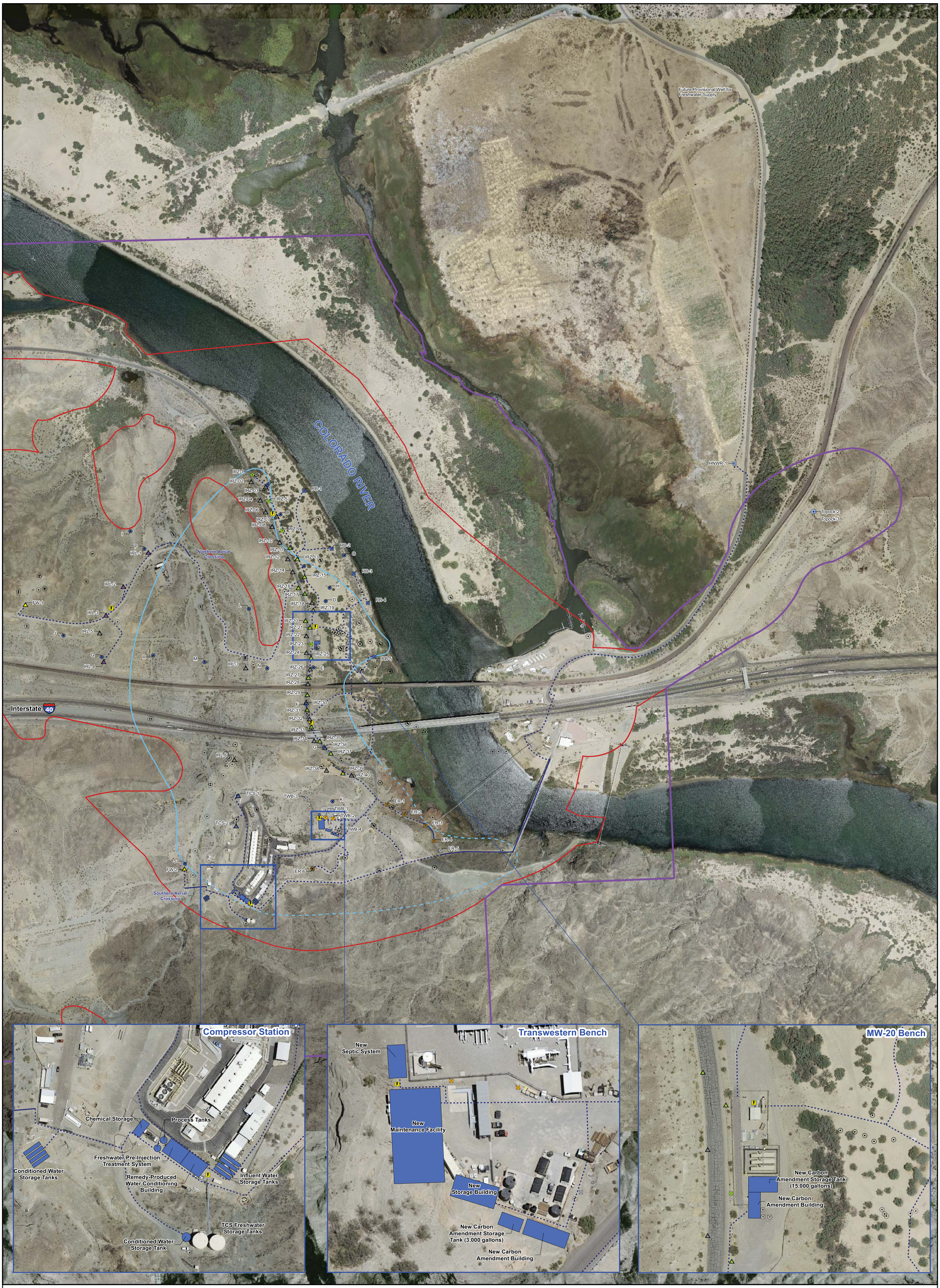

LEGEND

- Existing Monitoring Well
- Existing Freshwater Supply Well
- Area of Potential Effects (APE)
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Remedy Wells

- Contingent Freshwater Source
- Freshwater Source
- Remedy Monitoring Well
- Extraction Well (East Ravine)
- Extraction Well (NTH IRZ)
- Extraction Well (Riverbank)
- Extraction Well (Transwestern Bench)
- Freshwater Injection Well
- Injection Well (Inner Recirculation Loop)
- Injection Well (NTH IRZ)
- Injection Well (Topock Compressor Station)
- Future Provisional Extraction Well
- Future Provisional Injection Well

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/Contingent Fresh Water Pipe

Remedy Facilities

- Proposed New Remedy Structure
- Future Provisional Electrical Transformer
- Proposed Electrical Transformer Location

Note:
Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures .

N

0 300 600 1,200 Feet

FIGURE ES-4
GENERAL REMEDY SYSTEM LAYOUT

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

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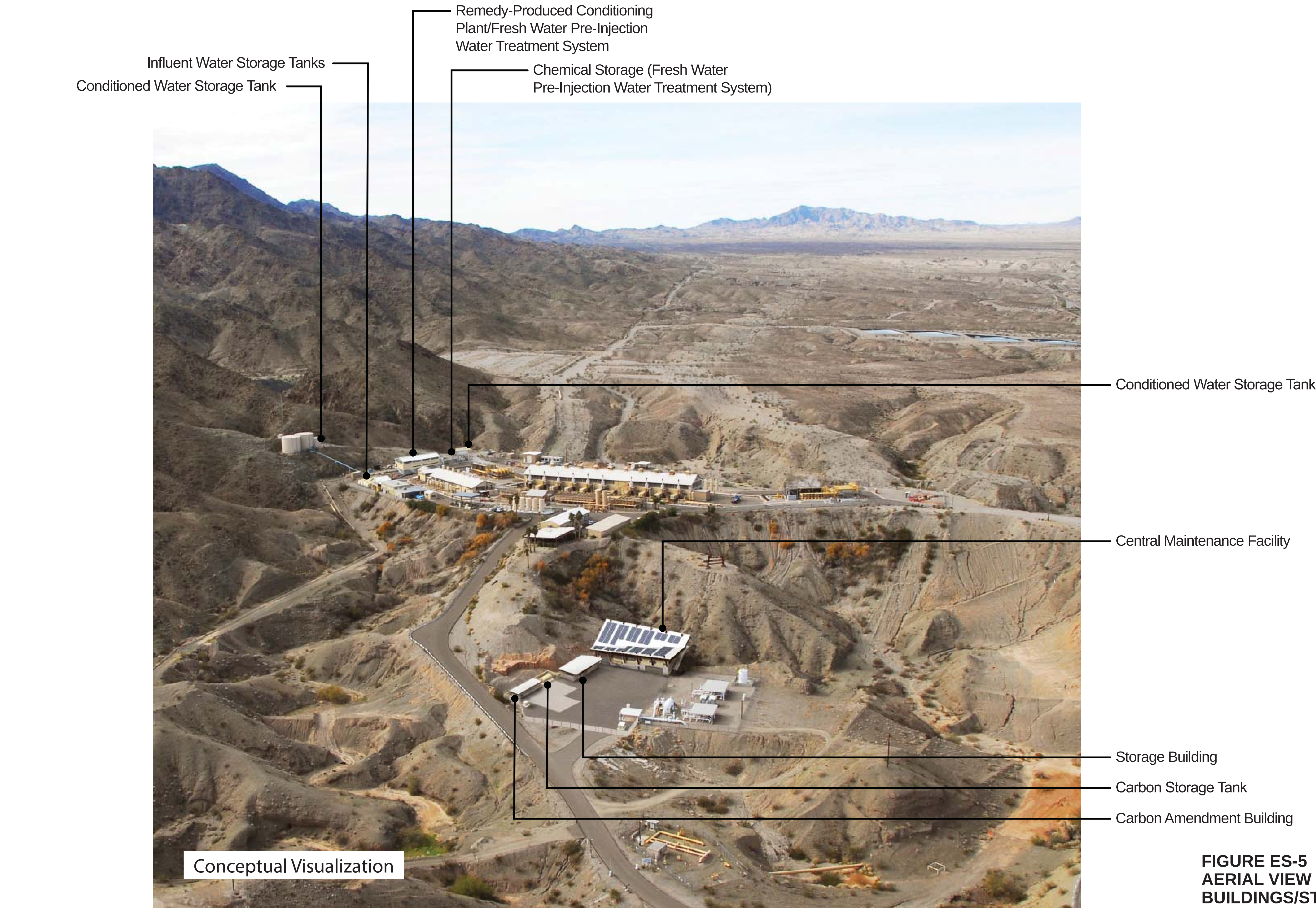
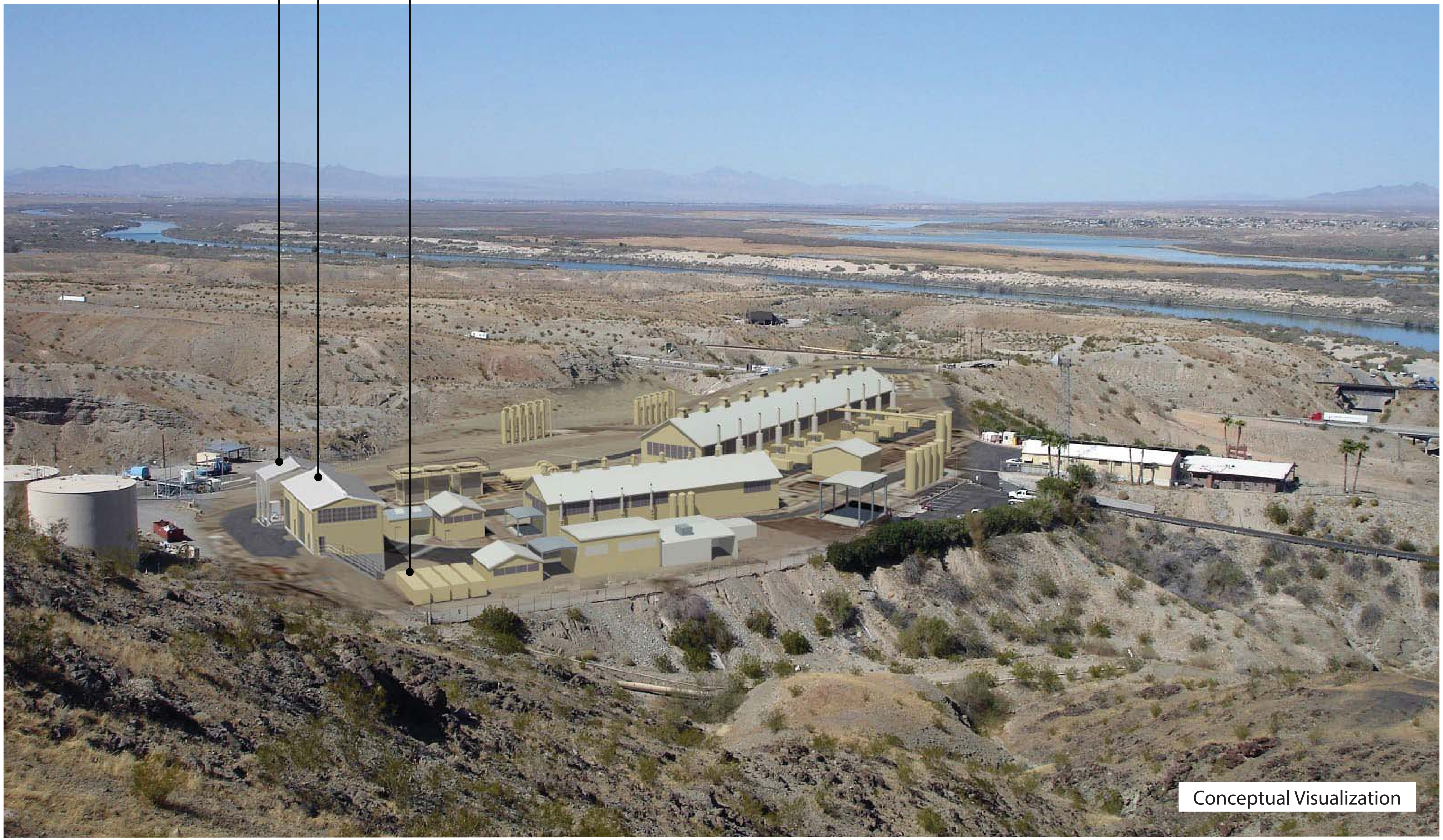


Source: IDC Architects 2013.

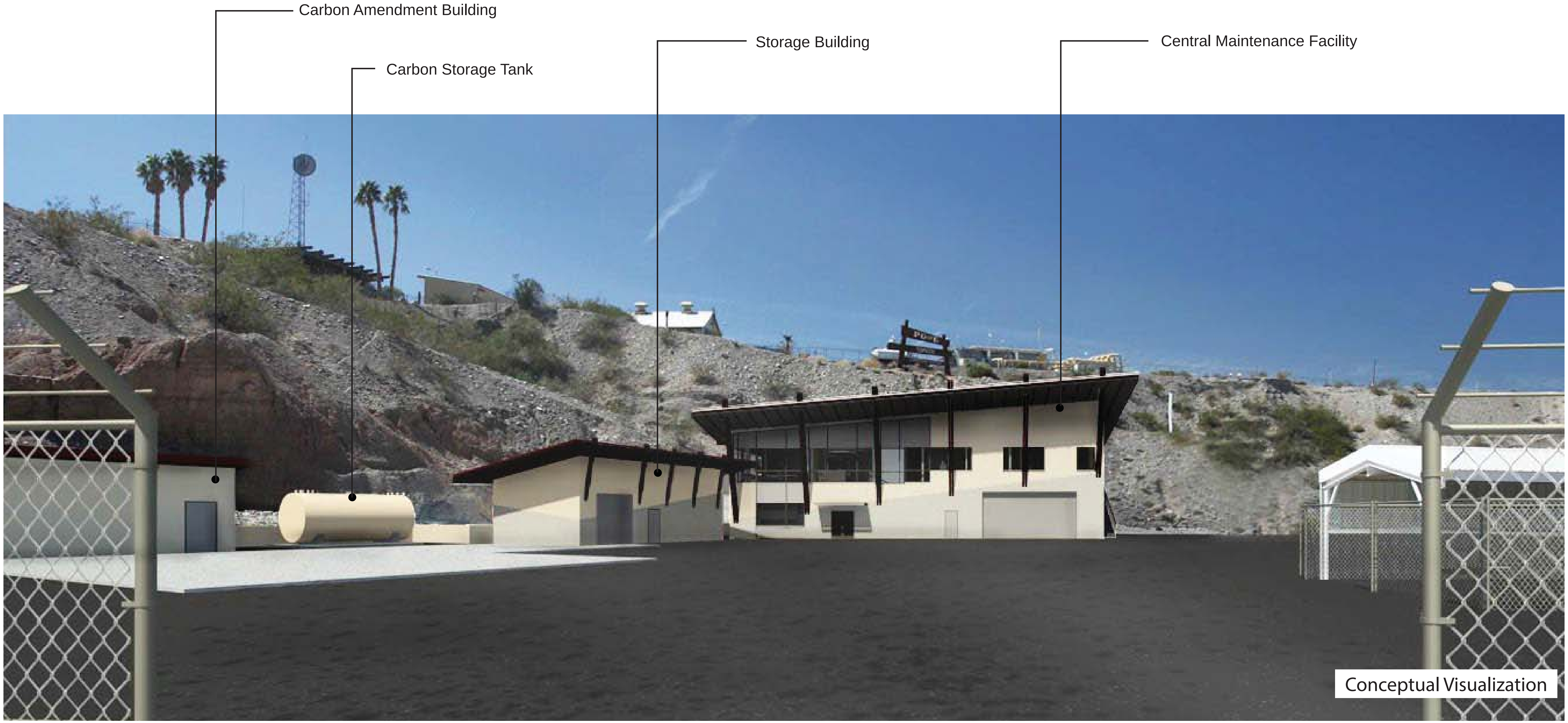
FIGURE ES-5
AERIAL VIEW OF NEW REMEDY BUILDINGS/STRUCTURES IN COMPRESSOR STATION AND TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



Source: IDC Architects 2013.

FIGURE ES-6
NEW REMEDY BUILDINGS AND STRUCTURES IN THE COMPRESSOR STATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.



Source: IDC Architects 2013.

FIGURE ES-7
NEW REMEDY BUILDINGS AND STRUCTURES AT THE TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Source: IDC Architects, April 2013.

FIGURE ES-8
NEW REMEDY BUILDING AT THE MW-20 BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.

KEY CHANGES

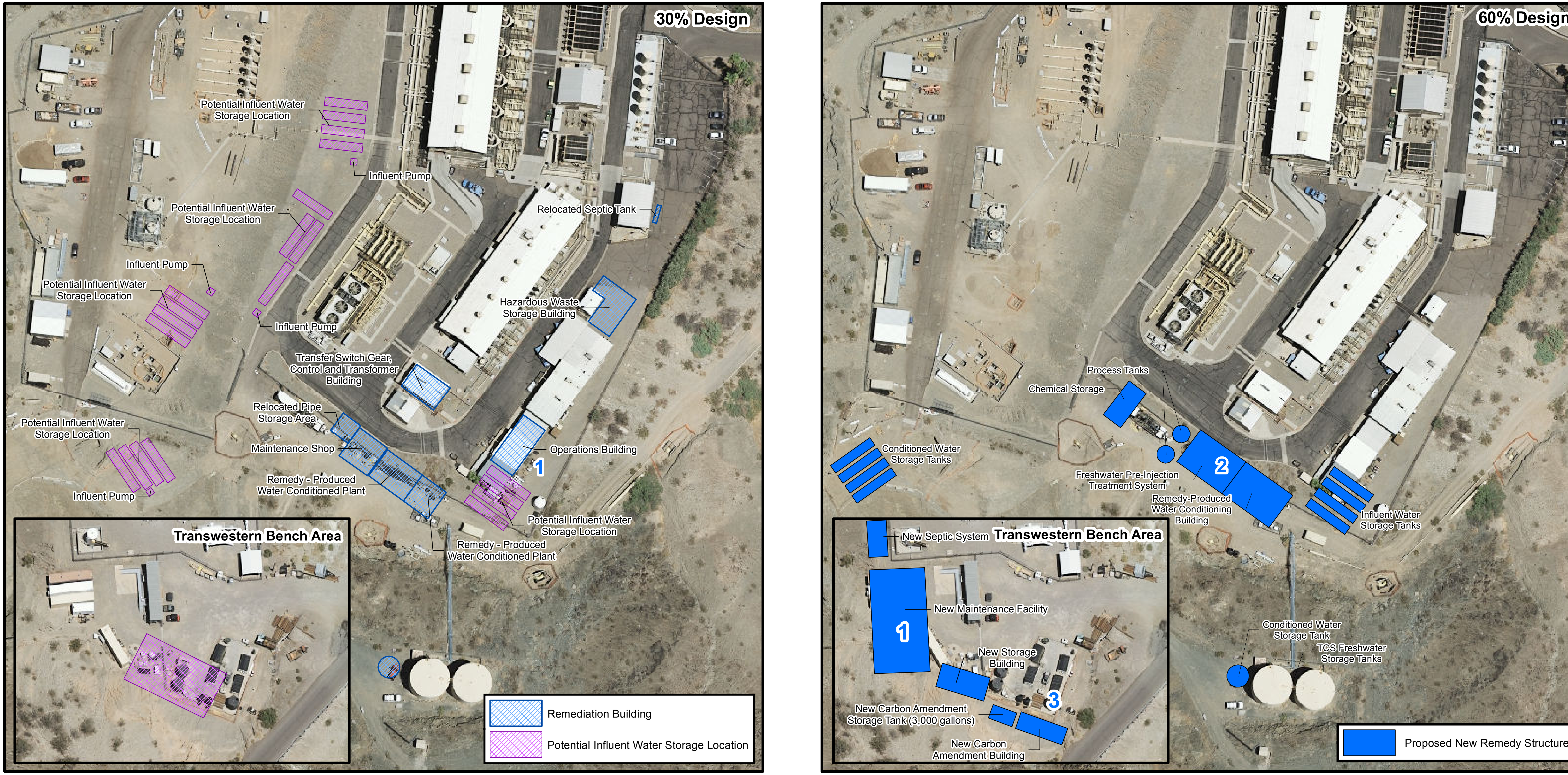
1. Eliminated piping corridor in Bat Cave Wash and rerouted piping through the National Trails Highway.
2. Eliminated two additional piping corridors:
   2a. Corridor between TW Bench and TCS.
   2b. Corridor associated with former Freshwater Injection well (north of NTH IRZ).
3. Added two pipe bridges for aerial crossing of Bat Cave Wash
   3a. One bridge to carry pipes/conduits to/from well FW-2
   3b. One bridge to carry pipes/conduits across the wash segment, north of the IM-3 treatment plant.
4. Placed piping and conduits along the old Route 66 segment in the Upland area in underground trenches or direct buried.
5. Brought piping near a bedrock outcrop in the East Ravine aboveground.
6. Combined the new main freshwater pipe and the existing 6-inch pipe into one single pipe, and direct buried the water pipe and 12kV conduit in the road. Added underground piping to well ER-6 in East Ravine.
7. Revised piping corridors in floodplain.
8. Added a future provisional pipeline to connect to the contingent well for HNWR-1.

N

FIGURE ES-9
ILLUSTRATION OF KEY CHANGES FROM 30% TO 60% DESIGN – PIPELINE ALIGNMENT

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL



Key Changes

1. Consolidated maintenance functions dispersed in the 30% design into one central location on PG&E property (the TW Bench); to minimize footprint outside of PG&E property and reduce interference with Compressor Station operations (safety concern).

2. Added a Fresh Water Pre-Injection Treatment System at the Compressor Station.

3. Coordinated the layout of TW Bench to allow for sharing of space between Topock Remediation Project and Transwestern Gas Operations.

N

0 35 70 140 Feet

FIGURE ES-10
ILLUSTRATION OF KEY CHANGES FROM THE 30% TO 60% DESIGN - REMEDY FACILITIES AT THE COMPRESSOR STATION AND TRANSWESTERN BENCH

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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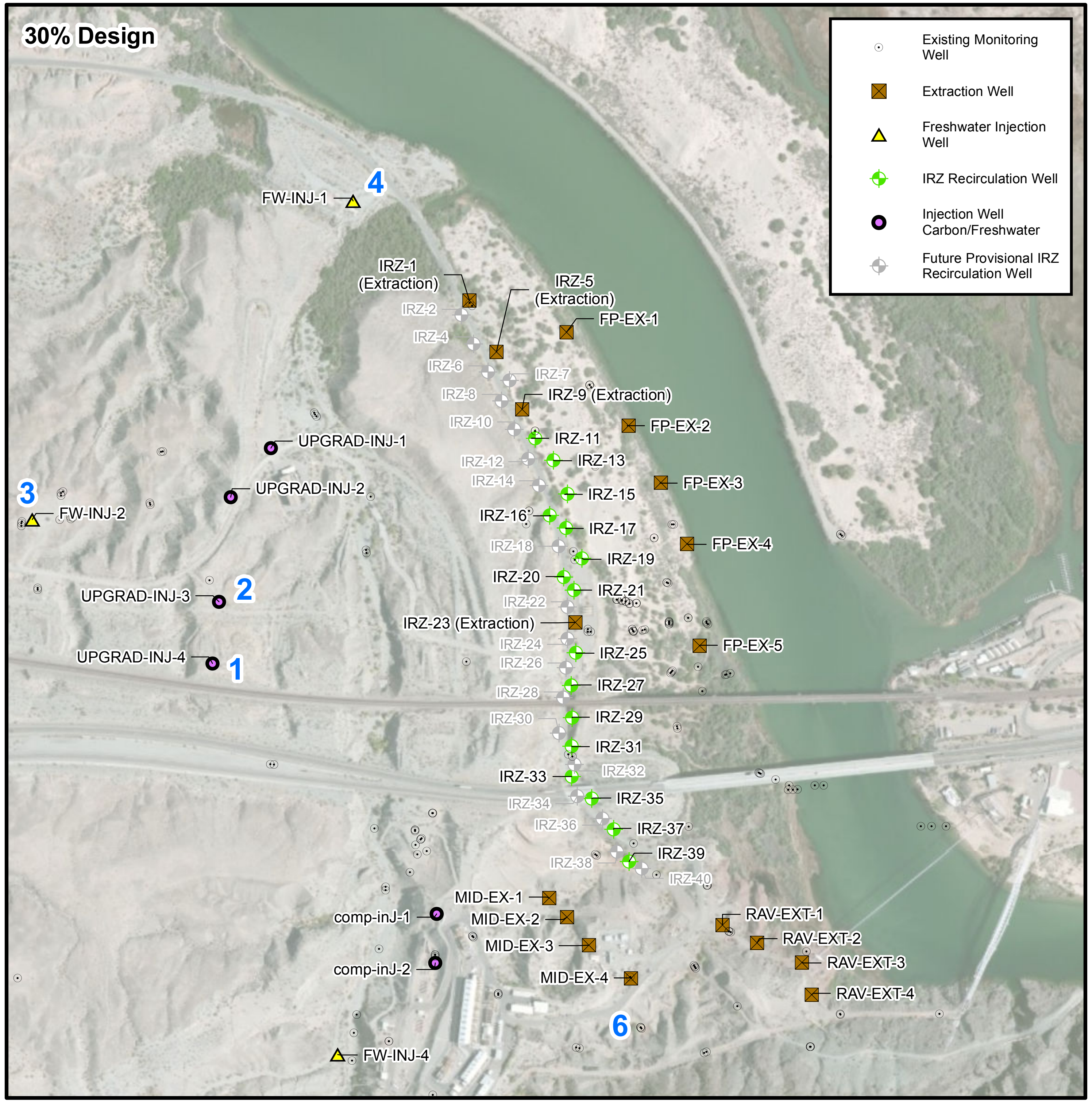
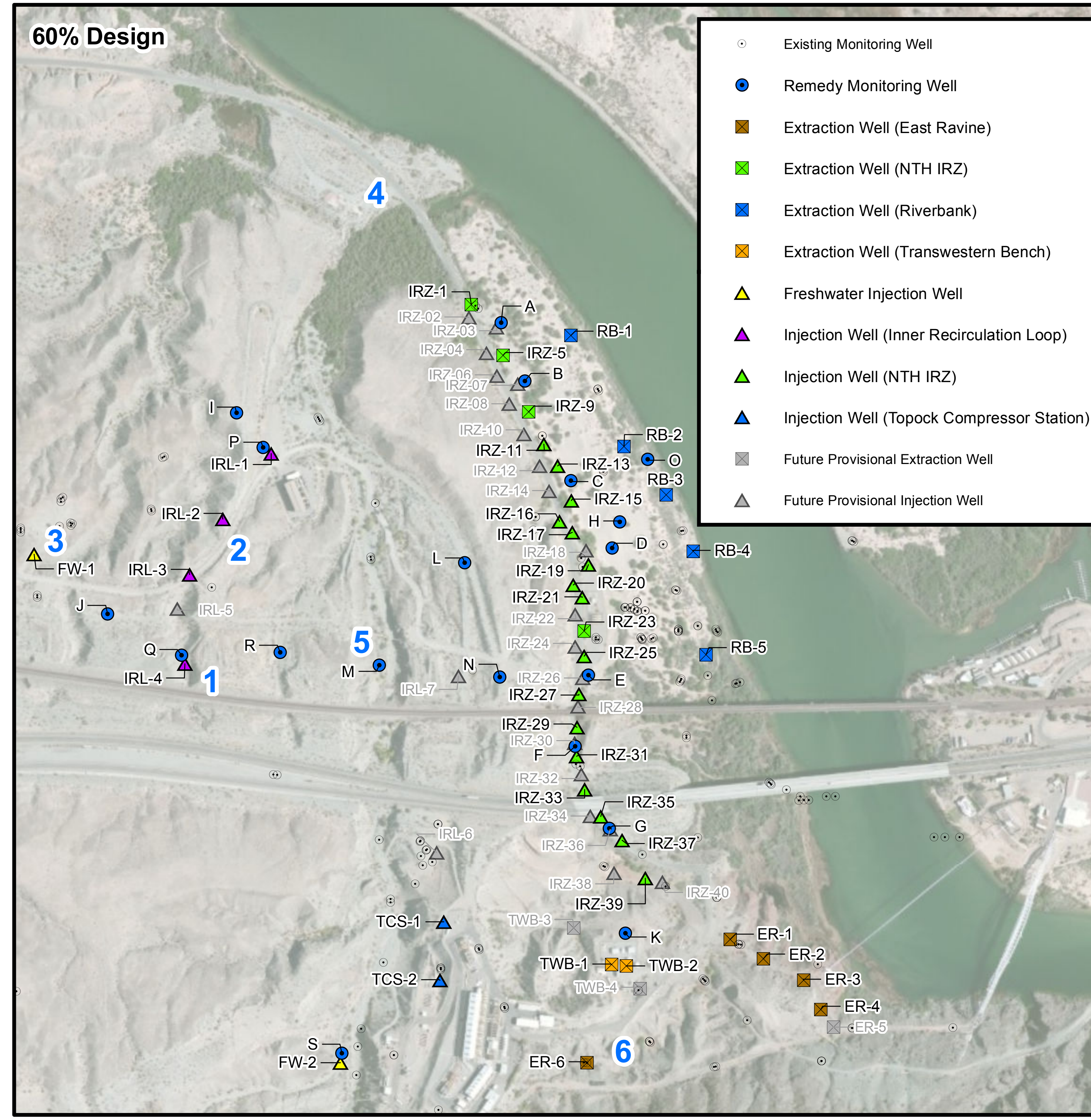




KEY CHANGES:

1. Relocated Inner Recirculation Loop (IRL) well IRL-4 (former UPGRAD-INJ-4) off a plateau, and to the bottom of a wash.
2. Relocated well IRL-3 (former UPGRAD-INJ-3) off a plateau, and closer to the existing access road.
3. Relocated well FW-1(former FW-INJ-2) further south, to outside of the Fort Mojave Indian Tribe property.
4. Eliminated fromer FW-INJ-1.
5. Added 19 new monitoring well locations; all existing monitoring wells are incorporated into the network.
6. Eliminated former MID-EX-1 and MID-EX-2. Added ER-6.
7. HNWR-1 and Contigency Well in Arizona are not shown on this figure.

N

0 300 600 1,200 Feet

FIGURE ES-11
ILLUSTRATION OF KEY CHANGES FROM 30% TO 60% DESIGN - WELL NETWORK

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: D:\Projects\Topock\MapFiles\2013\CMS\3060CompareWellNetwork.mxd

Contents

Exhibits

Tables (located at the end of each section)

Figures (located at the end of each section)

Appendices

Acronyms and Abbreviations

µg/L	micrograms per liter
30% BOD	Draft Basis of Design Report/Preliminary (30%) Design
60% BOD	Basis of Design Report/Intermediate (60%) Design
AA	activated alumina
ACEC	Area of Critical Environmental Concern
ADOT	Arizona Department of Transportation
AE	Applied Earthworks
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
AWWA	American Water Works Association
bgs	below ground surface
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BNSF	Burlington Northern Santa Fe
BOD	Basis of Design
BOR	U.S. Bureau of Reclamation
CACA	Corrective Action Consent Agreement
Caltrans	California Department of Transportation
CD	Consent Decree
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
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
CIMP	Cultural Impact Mitigation 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
CCQAPP	Contractor Construction Quality Assurance Project Plan
CRIT	Colorado River Indian Tribes
CRMP	Cultural Resources Management Plan
CWG	Consultative Working Group
DOI	United States Department of the Interior
DTSC	California Department of Toxic Substances Control
EIR	Environmental Impact Report
EPNG	El Paso Natural Gas Company
ER	East Ravine
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
FWPTS	Freshwater Pre-injection Treatment System
ft w.c.	feet of water column
ft/ft	feet per foot
gpd	gallons per day
GHG	greenhouse gas
gpm	gallons per minute
GREM	Green Remediation Evaluation Matrix
HDPE	high-density polyethylene
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
MCLG	maximum contaminant level goal
MG	million gallons
mg/L	milligrams per liter
MMRP	Mitigation Monitoring and Reporting Program
Mn(II)	divalent manganese
Mn(III)	trivalent manganese
Mn(IV)	quadravalent manganese
MNA	monitored natural attenuation
MWD	Metropolitan Water District of Southern California
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NTH	National Trails Highway (also called National Old Trails Highway)
O&M	operation and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OHWM	ordinary high water mark
OPS	Operating Properly and Successfully
OWS	oil/water separator
P/V	pressure/vacuum
PA	Programmatic Agreement
PBA	Programmatic Biological Assessment
PG&E	Pacific Gas and Electric Company
PHG	public health goal
PLC	programmable logic controller
ppb	parts per billion
PVC	polyvinyl chloride
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
RO	reverse osmosis
ROD	Record of Decision
ROW	right-of-way
RTU	remote terminal unit
RWQCB	Regional Water Quality Control Board
SCADA	Supervisory Control and Data Acquisition
SCRMA	Special Cultural Resource Management Area
SHPO	State Historic Preservation Officer
SOB	Statement of Basis
SOP	standard operating procedure
SWMU	Solid Waste Management Unit
SWRCB	California State Water Resources Control Board
TCS	Topock Compressor Station
TDH	total dynamic head
TDS	total dissolved solids
TOC	total organic carbon
TRC	Technical Review Committee
TW Bench	Transwestern Bench; Transwestern Meter Station Bench
TWG	Technical Working Group
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
USGS	U.S. Geological Survey
UTL	upper tolerance limit
VAC	volts alternating current

SECTION 1

Introduction

This Basis of Design Report/Intermediate (60%) Design (60% BOD) Submittal presents the intermediate design basis, design criteria, drawings, draft specifications, and appendices (including Appendix L, the Draft Operations and Maintenance [O&M] Manual, which is presented under separate cover but is included on the CD-ROM version of this report located inside the front binder cover) 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 intermediate 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; DTSC 1996) pursuant to Section 25187 of the California Health and Safety Code. The DOI is the lead federal agency overseeing response actions for 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). In addition, PG&E and the United States executed a Remedial Design/Remedial Action Consent Decree (CD) under CERCLA in 2012, which was lodged with the U.S. District Court for the Central District of California in January 2013 and will be effective upon approval by the court.

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; DTSC 2011d), the Final Statement of Basis (SOB), the Statement of Decision, and the Resolution of Approval (DTSC 2011a), as well as a directive letter to PG&E on January 31, 2011 (DTSC 2011b). 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/Intermediate (60%) 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."

In conformance with the 1996 CACA and the 2013 CD (DOI 2013) requirements, this submittal is the intermediate (60%) design submittal that provides design detail, drawings, draft specifications, and appendices (including the O&M Manual) for implementation of the remedy. As shown in the Groundwater Remedy Design, Construction, and Initial Start-Up Schedule (see Exhibit 1.0-1), the intermediate (60%) design will continue to be refined with input from the stakeholders, Agencies, and Tribes through the pre-final (90%) and final design (100%) stages, which are scheduled to continue through early 2014.

On November 18, 2011, PG&E submitted the Draft Basis of Design Report/Preliminary (30%) Design (30% BOD) Submittal (PG&E 2011a) for review and comment. More than 300 comments were received from DOI, DTSC, Fort Mojave Indian Tribe (FMIT), Hualapai Indian Tribe, the Technical Review Committee (TRC) on behalf of the Tribes, and the Metropolitan Water District of Southern California (MWD). Comment resolution occurred from late February through mid-May 2012. Responses to the comments were provided to stakeholders and Tribes in two parts: Part 1 is a Response to Comments table transmitted on April 13, 2012 (see Appendix I), and Part 2 is the Fresh Water Source Evaluation Technical Memorandum transmitted on April 27, 2012 (CH2M HILL 2012d; see

Appendix J). Technical Work Group (TWG) meetings were held on April 19, 2012 in Henderson, Nevada and on May 16, 2012 via WebEx to discuss responses to comments.

In the preliminary (30%) design, PG&E presented a plan to obtain freshwater from a well on the Havasu National Wildlife Refuge (HNWR)—well HNWR-1. As part of the response to comments to the 30% design, PG&E prepared a memo that provided additional detail on this potential freshwater source. Following their review of this Freshwater Source Evaluation Technical Memorandum, the California Regional Water Quality Control Board, Colorado River Basin Region (RWQCB), subject to its invitation for PG&E to seek review by the State Water Resources Control Board (SWRCB), indicated that the HNWR-1 water would likely need treatment to remove naturally occurring arsenic prior to injection. In addition to the slightly elevated levels of arsenic in the HNWR-1 water, fluoride is present at slightly elevated levels. Water quality data at the area of injection exhibits high levels of naturally occurring fluoride. Due to the elevated levels of fluoride at the point of injection the groundwater basin is not considered a high quality water for that constituent and as a result treatment to remove fluoride is not anticipated to be required by either the RWQCB or the SWRCB pursuant to California standards. On August 14, 2012, PG&E requested and was granted a 3-month extension of the intermediate (60%) design submittal to allow for continued discussion with DTSC and the RWQCB about arsenic treatment and to explore other fresh water sources, and as such, will be able to produce a more complete design document. In addition, with the RWQCB's consent, PG&E has opened discussions with the SWRCB regarding the need to treat naturally occurring arsenic. As the SWRCB has not yet made a decision on this matter, PG&E continued to evaluate options for freshwater supply by seeking location(s) for new well(s) that could supply an adequate quantity of water of sufficient quality to not require treatment prior to use for remedy operation, and on November 20, 2012, submitted an Implementation Plan for Alternative Fresh Water Sources Evaluation (Implementation Plan) (CH2M HILL 2012g). Comments from Tribes, Agencies, and Stakeholders were received, and a Revised Implementation Plan was submitted to DTSC and DOI on January 28, 2013 (CH2M HILL 2013a). Comments on the Revised Implementation Plan were received from DTSC on February 21, 2013. Further directions were received from DOI on March 26, 2013. As directed by DOI, a comment resolution meeting will be held prior to finalizing responses to comments and the Implementation Plan.

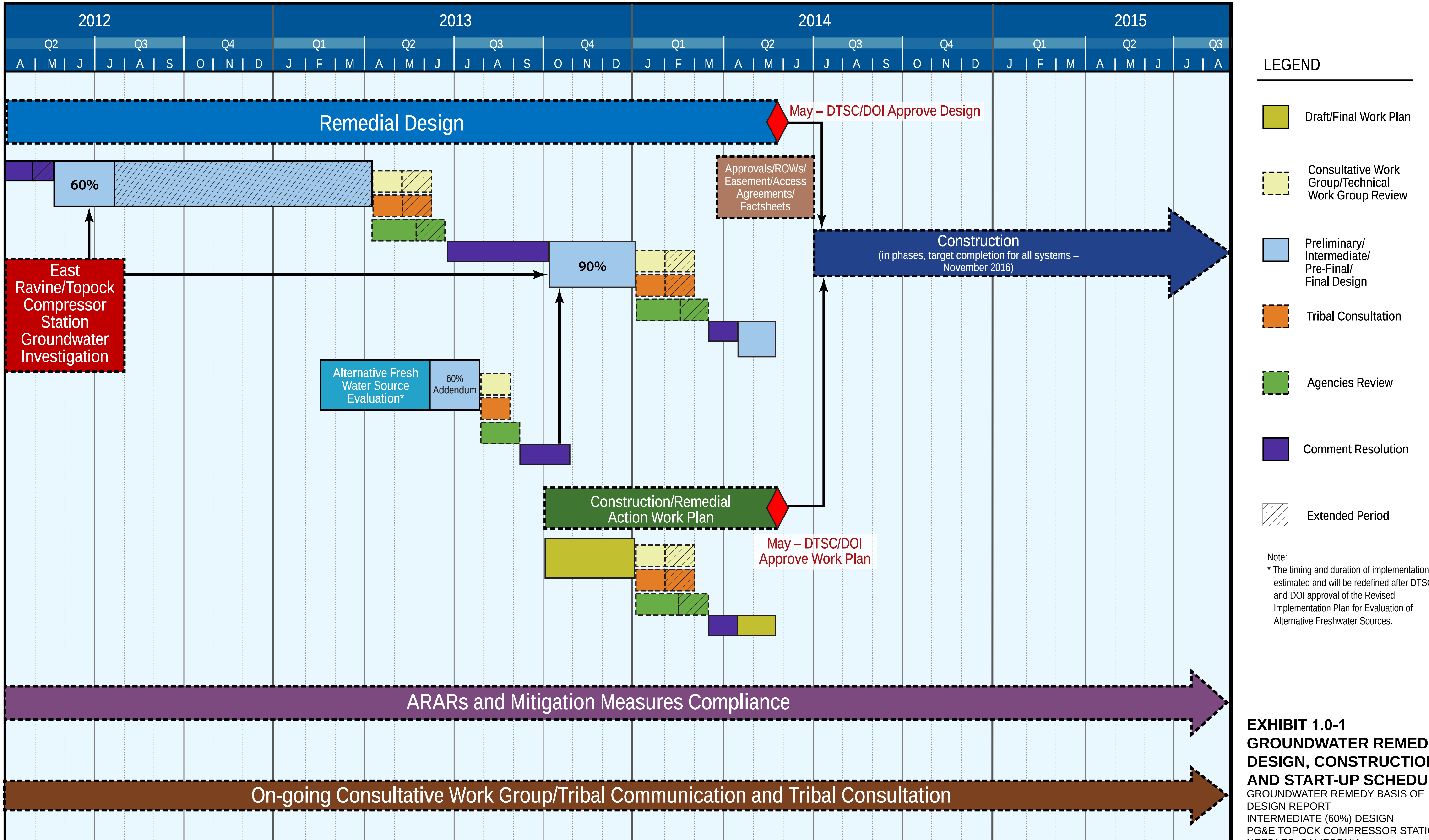
On November 30, 2012, PG&E requested a second extension (6-month) of the intermediate (60%) design submittal to allow additional time for the SWRCB's decision on arsenic treatment and for PG&E to complete its evaluation of freshwater source and incorporate the results into the 60% design. On December 31, 2012, DTSC responded by granting a 3-month extension and directed PG&E to bifurcate the fresh water source details from the 60% design (DTSC 2012). More specifically, DTSC directed PG&E to add into the 60% design, a pre-treatment system to polish Arizona groundwater to California standards prior to injection. The decision by the SWRCB is anticipated to guide further direction from DTSC regarding the ultimate use of the fresh water source and what level of treatment if any will be required for various constituents. As such guidance is still forthcoming, in this 60% design BOD, PG&E has made the conservative assumption for freshwater treatment goals, specifically that arsenic treatment goal is to below the Federal/State MCL of 10 micrograms per liter (µg/L) and fluoride treatment goal is to below the State MCL of 2 milligrams per liter (mg/L). The freshwater source details will be included in an addendum to the Intermediate (60%) Design, after such requirements are determined and completion of planned source water studies.

This Basis of Design Report/Intermediate (60%) Design Submittal has been prepared to comply with DTSC's December 31, 2012 directive, to incorporate responses to comments received on the 30% BOD Submittal, to incorporate data that has been collected since issuance of the 30% BOD Submittal in November 2011, and to bring the design details to a 60% detail level.

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 60% BOD Submittal.

Groundwater Remedy Design, Construction, and Initial Start-Up Schedule

PG&E Topock Compressor Station | Needles, California
April 2013



Note:
* The timing and duration of implementation is estimated and will be redefined after DTSC and DOI approval of the Revised Implementation Plan for Evaluation of Alternative Freshwater Sources.

EXHIBIT 1.0-1
GROUNDWATER REMEDY DESIGN, CONSTRUCTION, AND START-UP SCHEDULE
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
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 1.1-1; figures are located at the end of each document section). The selected groundwater remedy addresses existing chromium contamination from past discharges of wastewater into the Former Percolation Bed (SWMU 1) and the area around the Former Percolation Bed within Bat Cave Wash (AOC 1) near the Compressor Station. The groundwater remedy also addresses groundwater within the East Ravine (AOC 10) and under the Compressor Station. The following presents a description and history of SWMU 1/AOC 1 and AOC 10 (CH2M HILL 2009d), and description of the cultural, historical, and ecological resources in the project area.

1.1.1 Description and History of SWMU 1/AOC 1 and AOC 10

SWMU 1 was formerly the site of wastewater percolation within Bat Cave Wash. AOC 1 is defined as areas affected by flow of wastewater from the percolation bed, including the floor of Bat Cave Wash in the area surrounding the location of the discharge area (SWMU 1) as well as the floor of Bat Cave Wash downstream from the discharge area towards the Colorado River. From 1951 to 1970, facility wastewater was discharged to this area and allowed to percolate into the ground and/or evaporate. In addition, there have been several incidental releases of facility wastewater, a few of which have resulted in wastewater released to Bat Cave Wash.

Wastewater discharged to Bat Cave Wash consisted primarily of cooling tower blowdown (about 95 percent) and a minor volume of effluent from an oil/water separator (OWS) and other facility maintenance operations (about 5 percent). From 1951 to 1964, cooling tower blowdown was not treated prior to being released to the wash. During that period, the cooling tower blowdown contained hexavalent chromium (Cr[VI]). From 1964 to 1969, the cooling tower blowdown was treated with a one-step system to reduce Cr(VI) in the wastewater to trivalent chromium (Cr[III]) prior to discharge to the wash. Beginning in late 1969, cooling tower blowdown was treated with a two-step system to reduce Cr(VI) to Cr(III) and then to remove Cr(III) from the wastewater prior to discharge to Bat Cave Wash. The continuous discharge of wastewater to Bat Cave Wash ceased in May 1970 when injection well PGE-08 was brought online. From May 1970 to September 1971, however, some treated wastewater may have been temporarily discharged to the percolation bed in Bat Cave Wash when injection well PGE-08 was offline for repairs or maintenance. All wastewater discharges to the percolation bed in Bat Cave Wash stopped when the first of four single-lined evaporation ponds was installed in September 1971. Since 1989, industrial wastewater from the Compressor Station has been disposed of at the Class II (double-lined) evaporation ponds.

AOC 10 (East Ravine) is located southeast of the Compressor Station and includes four subareas, designated as AOC 10a, 10b, 10c, and 10d. Subarea 10a is the location of the termination of a storm drain leading from the southeastern portion of the Compressor Station. The remaining subareas are locations within the East Ravine where water and sediment have collected within low-lying areas or behind one of three earthen embankments. Two historical aerial photographs of this portion of the site show a low-lying area within the AOC 10c subarea that apparently contained liquids behind the largest embankment. While the composition of the liquids is not known, it is noted that this is the location of elevated chromium concentrations detected in soil. Thin layers of white powdery materials have also been identified in the East Ravine area. Drainage to this ravine includes minor runoff from the access road to the facility, runoff from the mountains to the south, and some runoff from the Compressor Station.

1.1.2 Cultural and Historical Resources

The Topock site is contained within a larger geographic area that is considered sacred by the FMIT 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 779.2-acre 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, within the Area of Potential Effect (APE), consisting of 1,600 acres of surface area and a section of the Colorado River (DTSC 2011d).

The Topock site is also located in a Riparian and Cultural Area of Critical Environmental Concern (ACEC), designated under the BLM Resource Management Plan (BLM 2007). Thousands of years of human history are evident in the area surrounding the Compressor Station. Among the larger and better known cultural resources on the site is an expansive desert geoglyph or intaglio known as the Topock Maze. Although the Maze is viewed as one contiguous element of a larger area having unique value to some Tribes, archaeological documents refer to three geographically-distinct parts, two of which overlie the groundwater plume. Prominent historic-era features in the landscape, several of which intrude upon the Maze and also overlie the groundwater plume, include segments of historic U.S. Route 66, the National Old Trails Highway, and the right-of-way (ROW) of the BNSF Railway. A broad spectrum of archaeological resources is also present within the project area and on adjacent lands. Properties on and near the Topock site that are eligible for or listed on the National Register of Historic Places include Native American cultural resources and elements of the historic "built environment."

1.1.3 Ecological Resources

A large portion of the site and surrounding area is the Havasu National Wildlife Refuge (HNWR). The *Lower Colorado River National Wildlife Refuges Comprehensive Management Plan 1994-2014* (USFWS and BOR 1994), adopted in 1994, currently guides land management at the HNWR. The Comprehensive Management Plan emphasizes that the HNWR should be used in a manner that will facilitate protection of (1) the endangered and threatened species found in the HNWR, (2) marsh and wetland habitat for both endangered and threatened species, and (3) habitat for migratory, wintering, and nongame avian species. Portions of the Topock site are also located in a Riparian and Cultural ACEC and the Topock-Needles Special Cultural Resource Management Area (SCRMA), designated under the BLM Resources Management Plan (BLM 2007).

In recognition of this, all remedial activities at TCS 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 Mitigation Monitoring and Reporting Program (MMRP; DTSC 2011c) adopted by DTSC in 2011 as part of the certified EIR (DTSC 2011d). In addition, mitigation measures will be implemented in accordance with the Programmatic Agreement (PA; BOR 2010), the Cultural and Historic Properties Management Plan (CHPMP; BLM 2012), and in consultation with the Tribes throughout the design process. The work will be conducted in a manner that recognizes and respects these resources and the spiritual values of the area.

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; also called National Old Trails Highway) 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 Cr(VI) to 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 2011a) and the ROD (DOI 2010), based on the conclusions of the Groundwater Risk Assessment (ARCADIS 2009) 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 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 complete (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 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 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 APE as shown on Figure 1.2-1. In conformance with Stipulation VII of the PA, BLM developed a CHPMP (BLM 2012) that specifies how cultural and historic properties within the APE are to be treated during the groundwater remedy implementation. The CHPMP includes 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 6.

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 (DTSC 2011d). The project area as defined by the EIR for evaluation of impacts and assessment of remedy implementation is shown on Figure 1.2-1. 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 an MMRP (DTSC 2011c) 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 (DTSC 2011c).

Identification and demonstration of how the identified ARARs and EIR mitigation measures are being incorporated into the design are discussed in Section 6 of this Basis of Design Report/Intermediate (60%) Design Submittal.

1.3 Organization and Content of Basis of Design Report/Intermediate (60%) Design Submittal

In conformance with the 1996 CACA and the 2013 CD requirements, this 60% BOD Submittal is organized into the sections listed below. Table 1.3-1 (tables are located at the end of each document section) highlights the changes made to the 30% BOD report that are reflected in this 60% BOD report.

- **Executive Summary** provides a brief summary of the 60% design and highlights the changes from the 30% to the 60% design.
- **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 document.
- **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 and pre-injection treatment, management of remedy-produced water, and other utilities and supporting facilities.
- **Section 4** discusses the application of green remediation practices.
- **Section 5** outlines the ICs required for the project and discusses applicable IC mechanisms, including anticipated approvals, permits, and agreements required for the remedy.
- **Section 6** summarizes how the design has complied and will continue to comply with the ARARs and EIR MMRP.
- **Section 7** discusses the project delivery strategy and provides an updated project schedule.
- **Section 8** includes a summary of the updated cost estimate.
- **Section 9** provides reference information for the works cited in this report.
- **Appendix A**
  - Appendix A1 contains analytical data (presented on CD-ROM).
  - Appendix A2 contains the draft aerial map of disturbed areas.
  - Appendix A3 contains the technical memorandum for the ordinary high water mark (OHWM) identification/mapping (presented on CD-ROM).
  - Appendix A4 contains technical memoranda on methodologies for mature plants survey and floristic survey, as well as the Mature Plants Survey Report (presented on CD-ROM).
  - Appendix A5 contains the Floristic Survey Report (presented on CD-ROM)
  - Appendix A6 contains the Instream Habitat Typing Survey Technical Memorandum (presented on CD-ROM).

  - Appendix A7 contains the Ethnobotany Survey Report (presented on CD-ROM).
  - Appendix A8 contains the Supplemental Baseline Sound Level Measurement Technical Memorandum (presented on CD-ROM).

- **Appendix B** contains the updated results of the groundwater modeling.
- **Appendix C** details the design criteria and includes various technical memorandum and relevant calculations such as carbon substrate selection, hydraulic analysis, remediation well design bulletin, and a geotechnical analysis.
- **Appendix D** includes the 60% design Engineering Plans and Drawings, and the equipment list (submitted under separate cover in a standalone volume, but included on the CD-ROM version of this report).
- **Appendix E** (presented on CD-ROM) provides a list of draft specifications.
- **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 evaluations by PG&E and Kinder Morgan of the Arched Bridge (structural integrity and available space) to support the freshwater pipeline.
- **Appendix H** presents the updated cost estimate.
- **Appendix I** contains the responses to comments on the Draft Basis of Design Report/Preliminary (30%) Design Submittal and indicates where in this revised 60% BOD report the changes resulting from responding to comments are reflected.
- **Appendix J** contains the Freshwater Supply Technical Memorandum and responses to comments, as well as supplemental information regarding the Topock-2/3 Pump Test Results.
- **Appendix K** is a placeholder for the forthcoming Revised Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation.
- **Appendix L** contains the Draft Operations and Maintenance Manual (submitted under separate cover in a standalone document, but included on the CD-ROM version of this report). The O&M Manual consists of the following five volumes:
  - Volume 1: Operations and Maintenance Plan
  - Volume 2: Sampling and Monitoring Plan
  - Volume 3: Contingency Plan
  - Volume 4: Soil Management Plan
  - Volume 5: Health and Safety Plan (to be provided with 90% Design)
- **Appendix M** contains the Fresh Water Pre-Injection Treatment System Design Basis Memorandum.

TABLE 1.3-1
Overview of Key Changes from 30% to 60% Basis of Design Submittals
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Preliminary (30%) Design Submitted: November 18, 2011	Intermediate (60%) Design Submitted: April 5, 2013
• **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, and a log of outreach/communications with Tribes. • **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.	• **NEW Executive Summary** provides a brief summary of the 60% design and highlights changes from the 30% design submittal to the 60% design submittal. • **Section 1** includes additional information on the project background/history in response to comments. • **Section 2** includes additional discussions regarding baseline conditions (e.g., a discussion on barium as an in-situ byproduct, summary of conclusions from the RFI Volume 2 Report on select compounds), and surveys conducted since the 30% design. • **Section 3** presents updated information on the design basis/assumptions in response to comments and to reflect the additional details at this 60% design stage. A **NEW Section 3.3.3.3** was added to discuss freshwater pre-injection treatment system. A **NEW Section 3.6** was added to discuss monitoring well design. • **Section 4** discusses incorporation of sustainability practices into the remedial design and implementation phase and provides a listing of Best Management Practices (BMPs) currently used in the design. • **Section 5** combines the content from Sections 5 and 6 of the 30% BOD Submittal; and includes a discussion about ICs and applicable IC mechanisms, preliminary approvals, permits, and easements/access requirements. • **Section 6** is the former Section 7 from the 30% BOD Submittal and presents the compliance status with ARARs, EIR MMRP, PA, and CHPMP at this 60% design stage. • **Section 7** is the former Section 8 from the 30% BOD Submittal. This section discusses the project delivery strategy and presents an updated project schedule. In response to comments, additional details were provided on the transition between Interim Measure and Final Remedy; and a **NEW Section 7.4** was added to discuss criteria for approval of IM-3 decommissioning. A **NEW Section 7.6** was also added to present potential locations within the project area identified as possible temporary staging locations for construction activities including a construction yard. • **Section 8** is the former Section 9 from the 30% BOD Submittal and includes an updated cost estimate. • **Section 9** is the former Section 10 from the 30% BOD Submittal which has been updated with new references cited in this document. • **Appendix A1** contains updated analytical data. • **Appendix A2** contains the draft aerial map of disturbed areas (this map remains unchanged since 30%). • **Appendix A3** still contains the technical memorandum on methodology for ordinary high water mark (OHWM) identification/mapping, but the technical memorandum on methodologies for mature plants

TABLE 1.3-1
Overview of Key Changes from 30% to 60% Basis of Design Submittals
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Preliminary (30%) Design Submitted: November 18, 2011	Intermediate (60%) Design Submitted: April 5, 2013
• **Appendix D** (submitted under separate cover in a standalone volume) includes the Engineering Plans and Drawings, and the equipment list. A total of 122 drawings was included in this appendix. • **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.	survey and floristic survey is now located in Appendix A4. These documents remain unchanged since 30%. • **New Appendix A4** contains technical memoranda on methodologies for mature plants survey and floristic survey (these documents remain unchanged since 30%). • **New Appendix A5** contains the Floristic Survey Report. • **New Appendix A6** contains the Instream Habitat Typing Survey Technical Memorandum. • **New Appendix A7** contains the Ethnobotany Survey Report. • **New Appendix A8** contains the Supplemental Baseline Sound Level Measurement Technical Memorandum. • **Appendix B** contains an updated write-up of the evolution of model development and the groundwater modeling efforts conducted to support the design. • **Appendix C** contains design criteria and includes various technical memorandum and relevant calculations such as carbon substrate selection, remediation well design bulletin, and a geotechnical analysis. • **Appendix D** (submitted under separate cover in a standalone volume) contains 60% design level engineering plans and drawings, and equipment list. Over 350 drawings are included in this appendix. • **Appendix E** provides the draft specifications. • **Appendix F** provides an update of the Remedy-produced Water Management Technical Memorandum that reflects a refinement of the estimated quantity of produced water and additional design details for the water conditioning process. • **Appendix G** includes a new evaluation, which is PG&E's own evaluation of the Arched Bridge (from a structural integrity and available space perspective) to support the planned freshwater pipeline. • **Appendix H** presents the updated cost estimate for 60% design. • **New Appendix I** contains the response to comments table for the Draft BOD/Preliminary (30%) Design submittal. • **New Appendix J** contains the Freshwater Supply Technical Memorandum and Responses to Comments. • Results of the East Ravine groundwater investigation were summarized in a technical memorandum entitled *Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation, Pacific Gas and Electronic Company, Topock Compressor Station, Needles, California*. The Addendum was submitted to DTSC and DOI on November 12, 2012 and results were discussed at the

TABLE 1.3-1
Overview of Key Changes from 30% to 60% Basis of Design Submittals
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Preliminary (30%) Design **Submitted: November 18, 2011**	**Intermediate (60%) Design** **Submitted: April 5, 2013**
	January 17, 2013 TWG meeting in Henderson, Nevada. Comments were received from DTSC and DOI on February 15, 2013. The Addendum is currently being revised to incorporate comments. The **new Appendix K** is a placeholder for the forthcoming revised Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation. • **New Appendix L** (submitted under separate cover in a standalone volume) contains the Draft Operations and Maintenance Manual. • **New Appendix M** contains the Fresh Water Pre-Injection Treatment System Design Basis Memorandum.

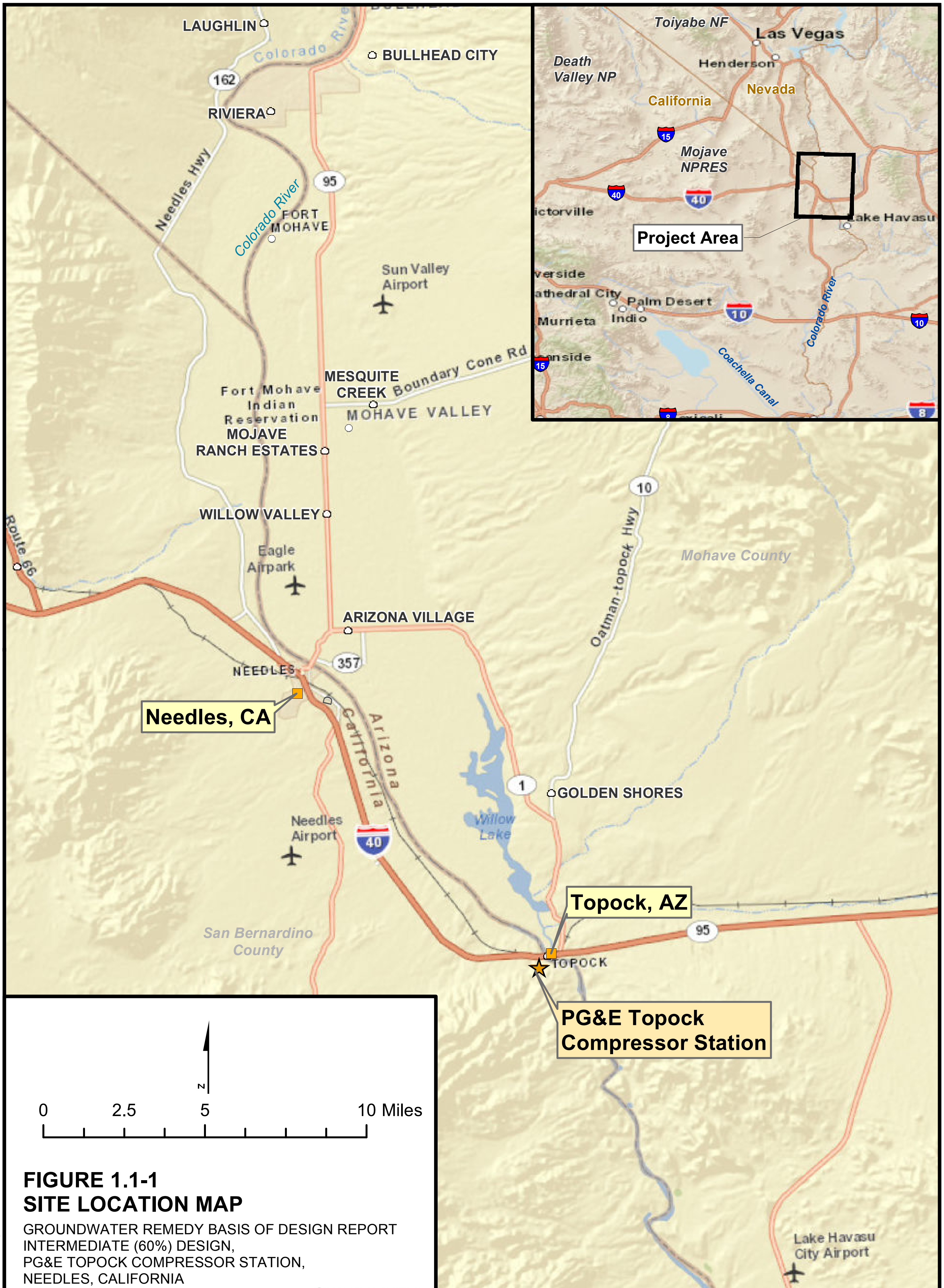


FIGURE 1.1-1
SITE LOCATION MAP

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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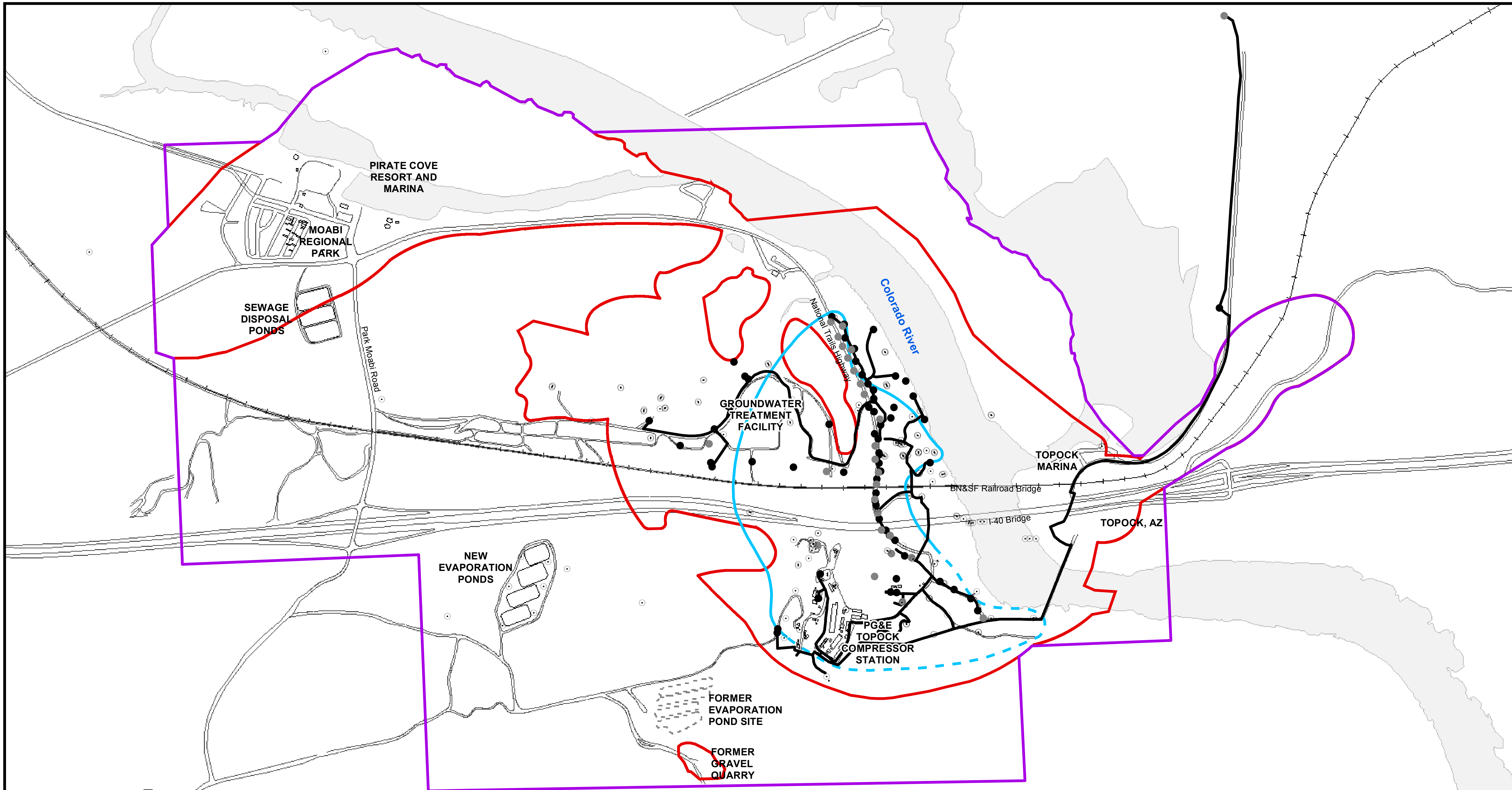

LEGEND

- Existing Monitoring Well
- Area of Potential Effects (APE)
- EIR Project Area
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.
- Future Provisional Wells
- Remedy Wells
- Pipeline For Remedy

Notes:

1. The locations of pipelines and existing infrastructure are approximate. The figure is not intended to be a comprehensive depiction of all existing infrastructure in the APE.
2. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

N

0 370 740 1,480 Feet

FIGURE 1.2-1
GROUNDWATER REMEDY PROJECT AREA AND SYSTEM LAYOUT

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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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 15-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 CMS/FS (CH2M HILL 2009d) and its forthcoming Addendum (the Addendum is currently being revised to incorporate comments from DTSC and DOI, and will be included in Appendix K of this report once final), 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 2.1-1) 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 2.1-1. 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 41 miles upstream. Parker Dam, which is about 42 miles downstream, plays a smaller role in the river fluctuation pattern, mainly during heavy rain/higher river flow conditions. River level predictions are tied to the Davis Dam release rates and Lake Havasu level behind Parker Dam. Most of the time, the Davis Dam releases are the dominant factor in determining river levels at Topock. 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. Of the 17 boreholes completed into the bedrock in the East Ravine and TCS areas, two boreholes, MW-57-185 and MW-70BR-225 (which are both located in close proximity to the approximate bedrock/alluvial aquifer contact at elevation 455 feet above mean sea level [MSL]) have yielded enough groundwater to sustain pumping for hydraulic testing. During the test at MW-57-185 (pumped at approximately 3 gallons per minute [gpm] for 7 hours) approximately 78 feet of drawdown was observed within the pumping well while drawdown was observed in only one of the seven observations wells (MW-58BR, 0.07 foot). Drawdown in the other six bedrock observation wells was less than 0.05 foot. During the test at MW-70BR-225 (pumped at approximately 9 gpm for 12 hours) approximately 34 feet of drawdown was observed in the pumping well while drawdown was observed in only one of the ten bedrock observation wells (MW-58BR, 0.18 foot)[1]. Drawdown in the other nine bedrock observation wells was less than 0.05 foot. During both tests the yield from the bedrock was insufficient to induce drawdown in the higher permeability alluvium. All other site bedrock monitoring wells yield very small quantities of groundwater, with several that have become dewatered during routine sampling. These data are consistent with the regional hydrogeology, in that there is no evidence to indicate any sizable potential for development of groundwater 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 2.1-2).

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. The hydraulic gradient imposed by IM-3 pumping is measured in three pairs of monitoring wells. Over the period from August 2007 through December 2011, the average landward gradient in these three well pairs was approximately 0.005 foot per foot (ft/ft).

- 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.

[1] This excludes drawdown observed in the water table well adjacent to the pumping well (MW-70-105), which showed a dewatering trend during the test.

Gradients are very small due to the limited recharge, with a typical value of 0.0005 ft/ft in the alluvial area. Under average conditions, groundwater velocity in the alluvial aquifer ranges from about 25 to 46 ft/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 2.1-1) 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, First Quarter 2012

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. The majority of the chromium plume is located in the Alluvial Aquifer, which includes the fluvial sediments along the river. A small portion of the chromium plume extends into the bedrock near the East Ravine.

Figure 2.2-1 illustrates the extent of Cr(VI) in the Alluvial Aquifer and bedrock based on groundwater monitoring data collected in the Fourth Quarter 2011 (October through December). Because not all site wells were sampled during the Fourth Quarter 2011 event, additional data collected through February 29, 2012 were used where needed to draw the 32 µg/L contours. With the exception of the early 2012 data collected from the new wells installed as part of the East Ravine Groundwater Investigation (the ER-TCS wells), the data used to prepare these maps were previously reported in the groundwater monitoring reports (CH2M HILL 2012a-c).

Table 2.2-1 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 December 2011 (with data through February 2012 for the ER-TCS wells) and includes comparisons to the calculated background UTL and chemical-specific ARARs. Table 2.2-2 summarizes sampling results for other Title 22 metals and available general minerals information over the same time period. Appendix A1 contains a complete listing of baseline analytical data collected from July 1997 through December 2011 (with data through February 2012 for the ER-TCS wells) at the site for 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 2012a-c).

Since the submittal of the CMS/FS Report (CH2M HILL 2009d), 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. 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 encompasses 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 300 feet near the northern end of 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 formation is believed to represent less than 2 percent of the total plume. Data collected during the East Ravine Groundwater Investigation indicate that groundwater in bedrock occurs in irregularly distributed, highly localized, and discontinuous water-bearing zones, which is characteristic of fractured crystalline rocks. 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.

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 December 2011 (with data through February 2012 for the ER-TCS wells) are discussed below. It should be noted that the COPCs (selenium, molybdenum, and nitrate) are not expected to impact remedy performance and, therefore, do not impact the remedy design. Further, the 2009 Groundwater Risk Assessment (ARCADIS 2009) concluded that selenium, molybdenum, and nitrate do not represent a significant health risk to future hypothetical users of the groundwater.

2.3.1.1 Selenium

Selenium is not expected to impact remedy performance and therefore does not impact remedy design. Wells TW-1 and MW-67-225 are two well locations where the average selenium concentrations during the baseline period of July 1997 through December 2011 exceeded the chemical-specific ARAR for selenium (50 µg/L) (Figure 2.3-1). In addition, there are eleven well locations where selenium exceeds the UTL of 10.3 µg/L: MW-17, MW-20-130, MW-21, MW-24A, MW-24B, MW-26, MW-51, MW-66-165, MW-67-185, MW-68-180, and MW-69-195. Note that the UTL for selenium was based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1). The wells with elevated selenium within the chromium plume correlate with some of the higher chromium concentrations on the site in the shallow, middle, and deep zones. These wells have chromium concentrations greater than 1,000 µg/L (see Figure 2.2-1), and are therefore considered central plume wells. The one exception is MW-17, a background study well that influenced the calculated UTL value.

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 around wells TW-1 and MW-67-225. The source of the elevated selenium around these wells 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); this will be verified through groundwater monitoring during remedy operation. 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 12.6 percent and the frequency of ARAR exceedances is 2 percent (Table 2.2-1). As stated in the RFI/RI Volume 2 Addendum Report (CH2M HILL 2009b), PG&E interprets the pattern of average selenium concentrations as influenced by colloidal material and not suggesting a clear source. DTSC interprets the selenium results to possibly form a pattern that suggests a plume. DTSC postulates that the updated average values further support their conclusion that selenium is a COPC related to SWMU 1/AOC 1 activities, and has directed PG&E to designate selenium as such (CH2M HILL 2009b).

2.3.1.2 Molybdenum

Molybdenum is not expected to impact remedy performance and therefore does not impact remedy design. The seventeen well locations with the highest average molybdenum results (greater than 70 µg/L) during the baseline period of July 1997 through December 2011 include: MW-10 (near the historical Cr[VI] discharge, average concentration of 129 µg/L), MW-33-40, MW-38D, MW-44-115, MW-44-125, MW-46-175, MW-57-185, MW-62-

190, MW-64-150, MW-64-205, MW-64-260, MW-67-260, MW-68BR-280, MW-70-105, MW-71-35, MW-74-240, and PGE-8 (Figure 2.3-2). 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 UTL for molybdenum was based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1).

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 30.9 percent (Table 2.2-1). While the elevated molybdenum distribution within the plume area is spatially variable, with very low levels in wells down the wash from SWMU 1, there are enough plume wells with elevated molybdenum to suggest that the potential for facility contribution to groundwater cannot be ruled out at this time.

As stated in the RFI/RI Volume 2 Addendum Report (CH2M HILL 2009b), several incidental spills have occurred at the facility, resulting in wastewater being temporarily released in Bat Cave Wash. The molybdenum concentration in the only available wastewater sample was 6,700 μg/L. Unlike arsenic, molybdenum is mobile under the aerobic geochemical conditions in the unsaturated zone, and would be expected to move with the water with relatively minimal attenuation. This will be verified via groundwater monitoring during remedy operation. Although molybdenum concentrations in numerous non-plume wells also exceed the UTL (Figure 2.3-2), it cannot be eliminated as a COPC in groundwater associated with SWMU 1/AOC 1.

2.3.1.3 Nitrate

Nitrate is not expected to impact remedy performance and therefore does not impact remedy design. 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) (Figure 2.3-3). 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 19.8 percent and the frequency of ARAR exceedances is 9.5 percent (Table 2.2-1). The UTL for nitrate was based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1).

As stated in the RFI/RI Volume 2 Addendum Report (CH2M HILL 2009b), there are several potential sources of nitrate, including concentration by lightning in rainfall, disruption of desert pavement, blasting materials from nearby quarries and roadway construction, animal grazing, and evaporative concentration in industrial wastewater. Mountain front recharge areas receive the most concentrated precipitation recharge from local thunderstorm events.

DTSC concluded that nitrate is a COPC related to SWMU 1/ AOC 1 activities, and has directed PG&E to designate nitrate as such (CH2M HILL 2009b). Although multiple potential sources exist for elevated nitrate in groundwater, DTSC maintains it cannot be eliminated as a COPC.

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, iron, and barium may exceed baseline and background concentrations during remedy implementation. Conditions that favor the existence of these species also favor the reduction of Cr(VI). The remedy is designed to control the generation and migration of these by-products.

Table 2.2-1 summarizes the potential in-situ by-products sampling results for the period of July 1997 through December 2011 (with data through February 2012 for the ER-TCS wells). 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 2.2-1 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 background UTLs were based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1).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. Arsenic is primarily in the pentavalent (As[V]) form in most areas of site groundwater. In the pH range of site groundwater, its form in solution is dominated by $HAsO_4^{2-}$. This anion tends to adsorb to the positively-charged surface of iron oxide minerals, which are present in the more oxidizing areas of the aquifer. This adsorption reaction maintains arsenic at concentrations below the UTL in most areas of the site. 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 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 released within the reducing zone. However, as the ferrous iron and arsenic move downgradient from the IRZ into more oxidizing conditions, reoxidation and precipitation of the iron will result in the reuptake of the liberated arsenic as it coprecipitates with the iron and/or adsorbs onto the surface of the newly-formed solid. The representation of these mechanisms in the solute transport model is described in Appendix B of this Basis of Design Report.

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 (MW-32-35), in the vicinity of the transportation corridors of I-40 and the BNSF Railway (MW-12; Figure 2.3-4), and in three bedrock wells (MW-58-205, MW-64-150, and MW-74-204) . Average concentrations of arsenic in the vast majority of monitoring wells are below the background UTL of 24.3 µg/L (note that the UTL for arsenic was based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1). The frequency of UTL exceedances for arsenic is 5 percent (Table 2.2-1), which is consistent with background concentrations based on a 95 percent UTL, where 5 percent of the population samples naturally exceed the UTL. The baseline arsenic concentration distribution shown on Figure 2.3-4 is consistent with the data distribution in prior groundwater RFI/RI Reports (CH2M 2009a and 2009b).

2.3.2.2 Manganese

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 (Figure 2.3-5). Ten wells have average manganese concentrations that are greater than the UTL of 1,320 µg/L: MW-22, MW-32-35, MW-42-65, MW-53D, MW-58-115, PT-1M, PT-3M, PT-5S, PT-6S, and PGE-7BR. Most of these wells are located in the floodplain adjacent to the Colorado River, where reducing conditions are prevalent, while a few are bedrock wells also showing reducing conditions. The UTL for manganese was based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1). The frequency of UTL exceedances for manganese is 5 percent (Table 2.2-1), which is consistent with background concentrations based on a 95 percent UTL, where 5 percent of the population samples naturally exceed the UTL. The baseline manganese concentration distribution shown on Figure 2.3-5 is consistent with the data distribution in prior groundwater RFI/RI Reports (CH2M 2009a and 2009b).

Manganese is present in the matrix in the form of various oxides, similar to those of iron (discussed below). Manganese is liberated around the IRZ in a similar reductive dissolution reaction to that of iron, with quadravalent manganese (Mn[IV]) and trivalent manganese (Mn[III]) in the oxide reduced to divalent manganese (Mn[II]) and released into solution. Manganese is slower to reoxidize than iron, so it will travel further downgradient before the reverse reaction occurs to remove it from groundwater.

During transport, Mn(II) is also attenuated by adsorption onto mineral surfaces. In general, Mn(II) adsorption increases with increasing pH, as the Mn^{2+} ion is attracted to increasing numbers of negatively charged mineral surfaces as pH rises. Floodplain groundwater ranges in pH between 6.5 and 8.5. Over this range, the degree of adsorption varies by a minor amount. This variation with pH has been accounted for in the geochemical and solute transport modeling, as described in Appendix B of this Basis of Design Report. Over this range, the degree of adsorption is not expected to vary greatly. Both pH and Mn will be closely monitored in this area during remedy activity.

A model was constructed to evaluate geochemical/hydrological processes governing manganese behavior in the hyporheic zone (groundwater-river interface) as groundwater flows toward the river. The modeling results and detailed discussions of the geochemical processes governing byproduct fate and transport are included in Appendix B (Groundwater Modeling) of this BOD Report.

2.3.2.3 Iron

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 (Figure 2.3-6). Ten wells have average iron concentrations that are greater than the UTL of 3,930 µg/L: 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. Most of these wells are located in the floodplain area. The UTL for iron was based on unconsolidated aquifer samples and not bedrock aquifer samples (Table 2.3-1). The baseline frequency of UTL exceedances for iron is 4.5 percent (Table 2.2-1), which is consistent with background concentrations based on the 95 percent UTL where 5 percent of the population samples naturally exceed the UTL. The iron concentration distribution shown on Figure 2.3-6 is consistent with the data distribution in prior groundwater RFI/RI Reports (CH2M 2009a and 2009b).

During the remedy operation of the IRZ, reducing conditions produced by the injection of organic carbon will dissolve iron oxide minerals in the surrounding matrix by reducing the Fe(III) in the oxide to Fe(II), which is soluble. The half-cell redox reaction may be written as:

$$Fe(OH)_3(s) + 3H^+ + e^- \rightarrow Fe^{2+} + 3H_2O$$

with e^- representing electron, $Fe(OH)_3(s)$ as iron oxide (many variations on this formula exist in nature), and Fe^{2+} representing reduced iron or Fe(II). Coupled with this reaction would be another half-cell reaction showing equal oxidation of an electron donor, in this case ethanol going to carbon dioxide:

$$1/12\ C_2H_6O + 1/4\ H_2O \rightarrow 1/6\ CO_2 + H^+ + e^-$$

where C_2H_6O is ethanol, a form of organic carbon that may be injected in the IRZ. The combination of organic carbon oxidation and iron reduction is a simplified model version of the family of reactions that occur in the IRZ, but effectively illustrates how iron and arsenic associated with iron minerals get released under these conditions.

As the liberated Fe(II) and arsenic move downgradient from the IRZ into more oxidizing conditions, the iron will undergo the reverse reaction of that shown above, and the arsenic will either coprecipitate with the iron or adsorb onto the surface of the newly-formed solid, or both. The representation of these mechanisms in the numerical transport model is described in Appendix B (Groundwater Modeling) of this BOD Report.

2.3.2.4 Barium

Barium will also be monitored within the plume for effects of the carbon injection during the operation of the remedy, in response to a comment received on the 30% design (see the response to comment #200 in Appendix I). Barium concentrations are normally maintained at low levels by the mineral barite (barium sulfate), which has a low solubility. At locations very close to the carbon injection points, sulfate may be temporarily reduced to sulfide, liberating barium in the process. This was observed in limited areas of the in situ pilot studies, where much greater amounts of organic carbon were introduced than are planned for injection during the final remedy. At short distances from the injection areas, barium concentrations returned to normal levels as it reprecipitated as barite. Based on these observations and planned organic carbon injection levels, barium is not expected to exist beyond the vicinity of the carbon injection points. As reported in the RFI/RI Volume 2 Report (CH2M HILL 2009a), when compared to the background value, the average barium concentrations did not exceed the site UTL in more than 5 percent of the data set.

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.

TDS and sulfate are not expected to impact remedy performance and therefore do not impact remedy design. Pilot test data indicate that Cr(VI) treatment is not affected by the presence of TDS and sulfate, as presented at the January 6 and January 19, 2012 TWG meetings. Additional discussions of the pilot test findings are included in Appendix B (Groundwater Modeling) of this Basis of Design Report.

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 2.3-7.

TDS in groundwater from shallow alluvial wells in the southwestern area of the site (e.g., New Ponds wells, MW-15, MW-16, MW-18) ranges between approximately 350 and 1,000 mg/L. Further east, TDS in groundwater beneath Bat Cave Wash ranges between 1,600 and 2,100 mg/L (wells MW-9, MW-10, and MW-11). The greater TDS in these wells is not believed to be due to their association with the plume footprint, since historical samples collected outside the RFI/RI from the Old Evaporation Ponds wells ranged between 500 and 10,000 mg/L. This shallow groundwater TDS along the southern area of the site likely represents mountain front recharge, which would be expected to vary with the local ephemeral recharge sources in the vicinity of each well (CH2M HILL 2009a).

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.

A historical source of high-TDS water was from the TCS blowdown water discharge. Though sparsely documented, the TDS of this water is assumed to be very high during early years of operation, with progressively lower values over time, by the late 1960s reaching values observed in non-plume wells (CH2M HILL 2009a). As described in the RFI Volume 2 Report, the apparent higher TDS in the plume well data set is related to the proximity of their screened intervals to the bedrock surface. Most plume wells are screened close to the bedrock surface. Wells screened closer to the bedrock surface tend to have higher TDS, regardless of whether the well is associated with the plume or not. The alluvial material at the base of the aquifer represents the oldest in the depositional sequence, which would be expected to have been segregated from the hydrologic cycle the longest and have accumulated the most dissolved solids. Many of the plume wells were constructed with screens closer to bedrock and may therefore be biased toward higher TDS compared to non-plume wells. Once the bias of screen height above bedrock is removed, there is no statistically significant difference between the average TDS of plume wells and non-plume wells (95 percent level) (CH2M HILL 2009a).

TDS is not expected to impact remedy performance nor impact the remedy design. In particular, Cr(VI) reduction was observed in the presence of elevated TDS concentrations, as presented at the January 19, 2012 TWG meeting. Additional discussions are included in Appendix B (Groundwater Modeling) of this BOD Report.

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. Because sulfate and TDS are well-correlated, the relationship of TDS concentrations with height above bedrock, as described above, also applies to sulfate. The distribution of sulfate in groundwater at the site is provided in Figure 2.3-8. 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. Similar to TDS and the COPCs (selenium, molybdenum, and nitrate), sulfate is not expected to impact remedy performance nor impact the design.

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 2.4-1 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 HNWR (managed by USFWS), San Bernardino County, BNSF Railroad, FMIT, and the Southern California Metropolitan Water District. In addition, several other entities have easements and/or ROWs in the California portion of the Project Area, including the California Department of Transportation (Caltrans, which has the I-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 2.4-1 include the HNWR (managed by USFWS), Kinder Morgan, BNSF Railroad, Arizona Department of Transportation (ADOT, 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 Marina on Historic Route 66. Ownership of land beneath the Colorado River includes the California State Lands Commission and the Arizona

State Lands Department. In addition, several other entities have easements and/or ROWs in the Arizona portion of the Project Area, including the Arizona Department of Transportation (ADOT, which has the I-40 ROW in Arizona), Mohave County (which has the ROW along Mohave County roads), Transwestern Pipeline Company, Mojave Pipeline Company, Kinder Morgan , PG&E, Mojave Electric Cooperative, Southwest Water Company, and Frontier Communications.

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. In addition, access and easements onto the FMIT property will be consistent with the 2006 Easement Agreement and 2006 Settlement Agreement between the FMIT and PG&E. Section 5 discusses anticipated 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. There are currently no municipal or private wells in the chromium plume area, to PG&E's knowledge. Section 5 also 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 in the MMRP (DTSC 2011c), 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 was in communication with and worked with interested Tribes on the aerial map. A current version of the map is included in Appendix A2 of this report. PG&E fully recognizes that the Disturbed Areas Map is currently a work in progress and as such, will only be used as a guide and that consultation with Tribes will be a prerequisite for such planning regardless of whether the land is categorized as disturbed or not on the map

An inventory of existing infrastructure related to the project area is ongoing. The inventory is 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:

- Kinder Morgan, the co-owner (along with PG&E) 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 the evaluation (originally conducted by El Paso Natural Gas Company [EPNG], the bridge's co-owner prior to EPNG's acquisition by Kinder Morgan) are included in a report presented in Appendix G of this BOD report. In its evaluation report, EPNG concluded that the proposed 12-inch freshwater line load is within the acceptable design loads for the bridge. EPNG recommended that equipment larger than 16 kips not be used in any 18.5-ftlong deck section and the bridge deck supports be visually inspected prior to construction. PG&E has also conducted its own due diligence evaluation of the arched bridge integrity (AECOM 2011) and the results are also included in Appendix G of this report. PG&E's evaluation identified brace members that exceeded allowable stress levels and recommended modifications to address the situation. PG&E is in discussion with Kinder Morgan to implement these recommendations.

- 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 groundwater remedy power distribution system and to evaluate the adequacy of the power supply options. To maximize reuse of the existing electrical infrastructure, the final groundwater remedy will use power from the Compressor Station and/or the City of Needles Electric system. The groundwater remedy design team has worked with the Compressor Station electrical engineering/operation staff to ensure that the Compressor Station power system and the groundwater remedy power distribution system will be integrated to maintain their integrity. Section 3.5 discusses the power supply design.
- Freshwater supply for the groundwater remedy requires certain storage capacity to minimize downtime. An 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 as well as enhance safety, the remedial design incorporates the results of a coordinated effort with Compressor Station engineering and operation staff. Section 3.5 presents the current layout for remedial facilities located within the Compressor Station fenceline, at the TW Bench, and at the MW-20 Bench.
- 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 in Summer 2011, the topographic map has been updated to 5-foot and 25-foot topographic contours. The topographic map, which has been incorporated into the design drawings, is included as Figure 2.4-2. This more detailed topographic map was used in the design of the piping networks and placement of facilities. In addition, the updated aerial photo has been and is being used for site survey/reconnaissance as well as for 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 the CMS/FS (CH2M HILL 2009d). The generalized surface geologic map in the RFI/RI was compiled from literature sources including Metzger and Loeltz (1973), John (1987), Howard et al. (1997), and PG&E historical reports. A geologic map of the site is included as Figure 2.4-3. Additional information on surface geology was not required for remedial design.

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, wells, and buildings are located 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 in the vicinity of AOC 11 and AOC 12 (see Figure 2.4-4).

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

2007a), 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 Final Soil RFI/RI Work Plan (CH2M HILL 2013b). 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. As discussed during the resolution of comments on the 30% Basis of Design Report (PG&E 2011a), the additional soil investigations will incorporate the possible use of an infiltration gallery in Bat Cave Wash for disposal of treated remedy produced water, and will include collection of relevant and adequate data to support the CMS/FS design.

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 (e.g., on the Compressor Station, at the Transwestern Bench), the Construction/Remedial Action Work Plan will describe appropriate procedures to address health and safety and best management practices (e.g., erosion and dust control measures) during groundwater remedy construction. The Soil Management Plan (see Volume 4 in the Draft O&M Manual) addresses protocols for assessing and handling of displaced soils from remedy construction, O&M, and decommissioning. Retention of displaced materials will be maximized. The approach and general protocols for displaced material handling are intended to minimize the amount of displaced material that leaves the site. Specific issues include handling and storage, contamination assessment, long-term disposition of displaced soil, etc.
- Where appropriate, the timing and scope of soil investigation activities will be coordinated to minimize interference with groundwater remedy implementation. For example, if the timing of the soil investigation and groundwater remedy construction coincides, the work will be carefully synchronized so as to minimize interference/obstruction.
- Access restrictions established to protect groundwater remedy infrastructure will consider the need to access soil investigation areas for additional investigation or remediation. For example, when access restrictions are established for the protection of groundwater remedy infrastructure (i.e., Category 2 ICs) in certain areas, consideration will also be given to the potential need to access the same area for additional soil 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. A field survey of the jurisdictional waters and wetlands occurred from February 13 through 18, 2012 and July 16 through 17, 2012 to update the 2005 identification of the U.S. Army Corps of Engineers (USACE) jurisdictional waters and wetlands and the California Department of Fish and Wildlife (CDFW) jurisdictional waters. Note that additional surveys related to freshwater source details were also conducted in 2013; results will be included with the next design deliverable associated with the freshwater source details. In compliance with EIR mitigation measure BIO-1, the wetlands delineation findings will be documented in a forthcoming report and submitted to DTSC. Delineation of the jurisdictional waters and wetlands has been 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. Figure 2.4-5 presents an overlay of planned remedial facilities on a map of jurisdictional waters and wetlands in the project area which was based on the identification made through July 2012.

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 2.4-6 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 have been combined with results of the February 13 to 18, 2012 survey (described above).

The site surface water monitoring program conducted to date has yielded an extensive chemical analytical dataset. More than 1,600 surface water samples have been collected from July 1997 through December 2011. Table 2.4-1 provides a statistical summary of the sampling results. Figure 2.4-7 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 2.4-1. 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 upgradient and downgradient of the site. PG&E will continue to monitor surface water quality during the implementation of the remedy and compare downgradient concentrations to upgradient 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, specifically from Key Views 5 and 11. In compliance with these mitigation measures, a comprehensive survey for mature plant species in the EIR project area was conducted in August 2011. Appendix A4 includes the technical memorandum on the mature plants survey methodology and the Mature Plants Survey report (CH2M HILL 2012e). Figure 2.4-8 is a map of mature plants from Key Views 5 and 11.

Additional information on vegetation communities was collected during the November 2011, March 2012, July 2012, and March 12-14, 2013 floristic surveys (see Section 2.4.6). Together, this information is being used to guide the design and construction of the remedy as well as the scope of future revegetation efforts. Figure 2.4-9 is an updated vegetation communities map based on the 2011/2012 plant surveys. Results from the 2011 and 2012 surveys are summarized in a report entitled *Topock Groundwater Remediation Project Floristic Survey Report* (CH2M HILL 2013e); also included in Appendix A5 of this 60% BOD report. The 2013 survey results will be included in the next design deliverable associated with the freshwater source details.

As shown in Figure 2.4-9, 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 a 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 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 allscale 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; now known as the California Department of Fish and Wildlife) as fully protected and/or species of special concern
- Plants considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered
- 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 Inventory of Rare and Endangered Plants, 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 (DTSC 2011d, pages 4.3-14 through 4.3-19):

Special-Status Wildlife

- Southwestern willow flycatcher (*Empidonax traillii extimus)* – Federal listed and legally protected
- Agassiz's desert tortoise (*Gopherus agassizii)*- Federal and State listed and legally protected
- Morafkai's desert tortoise (*Gopherus morafkai*)- Federal and State 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*) – covered 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)

Protocol surveys for the Yuma clapper rail and the California black rail occurred during six weekly visits in March 2012 (3/15, 3/22, and 3/28), April 2012 (4/26), and May 2012 (5/3 and 5/10). Protocol surveys for the SWFL occurred in May 2012 (5/21-5/25), June 2012 (6/4-6/8, 6/18-6/22, 6/26-6/30), and July 2012 (7/9-7/13). The SWFL Report was submitted to BLM and USFWS on January 31, 2013 (CH2M HILL 2013c). The Rail Survey report was submitted to BLM and USFWS on March 29, 2013 (CH2M HILL 2013g).

The 2012 protocol survey did not result in detections of Yuma clapper rail at the mouth of East Ravine or along the Colorado River. However, Yuma clapper rail was detected in the Topock Marsh (in Arizona) within the project area. In addition, there were sightings of transient SWFLs on the California side of the Colorado River; no bird nests were detected. In compliance with the EIR mitigation measure BIO-2a, a forthcoming Bird Avoidance and Minimization Plan is under preparation in consultation with the USFWS.

Mr. Gabriel Valdes (a biologist from CH2M HILL) and Ms. Melanie Day (a biologist from PG&E) were considered qualified biologists by the USFWS to conduct activities under mitigation measure BIO-2b including survey, inspect work areas and vehicles, direct activities to avoid impacts on desert tortoise and their potential habitat, and provide worker awareness training. Mr. Valdes has identified potential desert tortoise habitat shown on Figure 2.4-10 based on the 2011 and 2012 floristic surveys. It is important to note that five years of annual protocols survey for desert tortoise were conducted in the APE from 2005 to 2009. Only aged desert tortoise remains and inactive burrows were found during the five years of completed surveys. There was no CNDDB desert tortoise occurrence within 15 kilometers of the PG&E Topock survey area. The Topock site upland areas were considered marginal desert tortoise habitat. For those reasons, BLM approved PG&E's request to cease annual protocol surveys in 2010 (PG&E 2010). The pre-construction biological survey requirement under the Programmatic Biological Assessment (PBA; CH2M HILL 2007b) remains in effect to date. Survey for desert tortoise in Arizona will be performed in April or May 2013, in associated with freshwater source details; survey results will be included in the next design deliverable for freshwater source details.

In compliance with EIR mitigation measure BIO-3b, PG&E conducted an instream habitat typing survey on April 4, 2012. The purpose of the survey is to determine the preferred locations for spawning and rearing of the razorback sucker and bonytail chub. Both are Federally and State-listed as endangered and are covered under the LCR MSCP. Of special concern is the razorback sucker which is also a California Fully Protected Species. The Colorado River is also designated critical habitat for bonytail chub under federal law. During the survey, sites along the California bank of the Colorado River in the vicinity of the Compressor Station were examined in detail to characterize fish habitats in the shallow, shorezone region. Field methodology included documentation of bottom topography and depth using sonar and GPS, photo documentation of bank area, and visual inspection of substrate using a view box from a boat and a Ponar dredge. Survey results were summarized in a technical memorandum entitled *Instream Habitat Typing Survey Technical Memorandum, Topock Compressor Station, Colorado River* (CH2M HILL 2012f); the tech memo is included in Appendix A6 of this BOD report.

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 (DTSC 2011d, page 4.3-14). In compliance with the EIR mitigation measure CUL-1a-5, PG&E conducted ethnobotanical surveys in October and November 2011, March

2012, and March 2013. 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) were performed. 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 2011a)
- Listed by the Arizona Rare Plant Committee (2001)
- Listed under the California Desert Native Plants Act (CDNPA)

Figure 2.4-11 shows a map of ethnobotanical sensitive plants based on the 2011/2012 surveys. In addition, results from the 2011/2012 surveys described above and associated maps are included in a report entitled *Topock Groundwater Remediation Project Ethnobotany Survey Report* (CH2M HILL 2013f); also included in Appendix A7 of this 60% BOD report. The 2013 survey results will be included in the next design deliverable associated with the freshwater source details.

2.4.7 Cultural Resources

Environmental and cultural/historical resources and other tribal concerns are being considered and protected by the PA, EIR MMRP, CHPMP, and Cultural Impact Mitigation Plan (CIMP). Cultural resources in the area will affect design, construction and implementation of the final groundwater remedy. In compliance with the Cultural Resources Management Plan (CRMP), cultural monitoring events have been conducted annually with participation from Tribes, BLM, and PG&E. The 2011 annual cultural monitoring occurred on October 26, 2011. The 2012 annual monitoring occurred on November 5-7, in compliance with the CHPMP. Information collected during these monitoring events 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

Activities required by the PA (BLM 2010) are led by the BLM as the lead Federal Agency responsible for NHPA Section 106 compliance. The following are examples of activities taken or 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 completed the Tribal Access Plan on November 26, 2011.
- Stipulation VII requires that BLM develop a Cultural and Historic Properties Management Plan, 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 review by the Tribes, the California and Arizona SHPOs, the Advisory Council on Historic Preservation, and PG&E on November 1, 2011. Comments on the draft CHPMP were due December 5, 2011, and the BLM issued the CHPMP on January 20, 2012. By design the CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequent to the issuance of the CHPMP, BLM continues

to hold working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will continue to be developed throughout the design to address mitigation measures.

- Ongoing consultation with Tribes as required under NHPA Section 106 and the PA.

Activities required by the Environmental Impact Report Mitigation Monitoring and Reporting Program

Activities required by the MMRP (DTSC 2011c) are performed by PG&E in coordination with various agencies and in collaboration with Tribes, as required. Section 6 of this 60% BOD, specifically Tables 6.1-1 and 6.1-2, present a comprehensive summary of actions taken or being performed under each EIR mitigation measure. Examples of activities currently being performed by PG&E include the following:

- PG&E has been conducting and will continue to conduct outreach with Tribes regarding Topock project activities. 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 are summarized and reported to DTSC on a quarterly basis. The quarterly compliance reports may be accessed on the DTSC Topock website, www.dtsc-topock.com.
- Monthly Tribal/PG&E conference calls are scheduled for the fourth Thursday of each month from 10:00 a.m. to 12:00 p.m. (Pacific Standard Time). The purpose of the monthly calls is to provide current information on planned and ongoing studies, field activities, measures that are being taken to mitigate project impacts in accordance with the project EIR, and/or other project-related activities of interest to Tribes. Face-to-face meetings are also held in place of or as a supplement to the calls as the need arises or as may be requested.
- 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, which has responsibility for preparing the Access Plan required by the PA. BLM completed their Access Plan in November 2011. PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan.
- The EIR mitigation measure CUL-1a-3a requires that PG&E retain a qualified cultural resources consultant to implement the MMRP and to conduct yearly inspections of identified historical resources. PG&E has retained Applied EarthWorks, Inc. to implement the MMRP. DTSC accepted and approved PG&E's nomination of Applied EarthWorks, Inc. as the qualified cultural resources consultant in March 2012.
- 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 geoarcheaological investigations were completed on June 4 to 9, 2012. A summary report is forthcoming.
- The EIR mitigation measure CUL-1a-8 requires that a Cultural Impact Mitigation Plan be developed in coordination with Interested Tribes and the Federal Agencies with land management responsibilities in the project area. To date, PG&E has been working on several sub-measures of the CIMP in collaboration with Tribes.
    - **CUL-1a-8g**: Work is ongoing by the Displaced Material Subgroup on a draft protocol for management and handling of displaced site materials. A revised protocol was sent to Agencies and Tribes for review on August 28, 2012. The FMIT sent a comment letter on the revised protocol on September 7, 2012. DTSC responded to FMIT on September 18, 2012. Tribes and Agencies met on October 16, 2012 to further the response to comments (RTC) process. Subsequent to this meeting, DTSC issued directives for implementation of an updated RTC process. On January 14, 2013, the revised protocol was reissued along

with updated RTCs (that reflected the updated RTC process) as part of the Final Soil RCRA Facility Investigation/Remedial Investigation Work Plan (CH2M HILL 2013b).

- 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 completed a paleontological investigation on July 25, 2012. A paleontological report was prepared and submitted to DTSC on December 21, 2012; this report is currently being revised to incorporate comments.
- Information to be collected during the above forthcoming studies, investigations and inspections, in conjunction with existing information, will continue to be used to guide design and will be incorporated into the pre-final (90%) design.

2.4.8 Noise

To support remedy design and implementation, and in compliance with mitigation measures related to noise (e.g., CUL-1a-10, NOISE-2, and NOISE-3), supplemental baseline noise measurements were collected from August 3 through 16, 2012 and December 3, 2012 through January 15, 2013, near the three short-term (ST) noise measurement sites (ST-1, ST-2, and ST-3) identified in Exhibit 4.9-2 in the certified EIR (DTSC 2011d). Supplemental noise results are summarized in a technical memorandum entitled *PG&E Topock Groundwater Remediation Project Supplemental Baseline Sound Level Measurement* (CH2M HILL 2013d); the technical memorandum is included in Appendix A8 of this report.

TABLE 2.2-1
Summary Statistics of Groundwater Sampling Results for COCs, COPCs, and In-situ Byproducts, July 1997 through December 2011
Groundwater Remedy Basis of Design Report
Intermediate (60%) Design
PG&E Topock Compressor Station
Needles, California

Parameter	Results Summary for RFI/RI Wells[1]						Background Comparison[2]				Chemical-Specific ARAR[3]			
	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	219	4,459	2,728	61.2	813	22,000	31.8	87	101	1,705 / 4,459 (38.2%)	---	---	---	--- ---
Chromium (total)	219	4,532	3,025	66.7	812	23,000	34.1	91	108	1,699 / 4,532 (37.5%)	50	84	100	1,626 / 4,532 (35.9%)
Arsenic	189	1,100	775	70.5	7.2	157	24.3	4	20	55 / 1,100 (5.0%)	10	30	48	162 / 1,100 (14.7%)
Iron	202	1,400	482	34.4	831	110,000	3930	10	16	63 / 1,400 (4.5%)	300	54	53	223 / 1,400 (15.9%)
Manganese	204	1,570	801	51.0	340	9,260	1320	10	26	78 / 1,570 (5.0%)	50	168	145	620 / 1,570 (39.5%)
Molybdenum	140	1,027	953	92.8	32.3	301	36.3	49	74	317 / 1,027 (30.9%)	---	---	---	--- ---
Selenium	130	804	353	43.9	6.8	155	10.3	13	27	101 / 804 (12.6%)	50	2	4	16 / 804 (2.0%)
Nitrate (as nitrogen)	207	1,444	768	53.2	3.7	35	5.03	40	61	286 / 1,444 (19.8%)	10	24	33	137 / 1,444 (9.5%)

Notes:

1 Includes data through February 2012 for East Ravine-Topock Compressor Station wells; see Appendix A1 for details.

2 - 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.

3 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.

4 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).

5 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 2.2-2
Summary Statistics of Groundwater Sampling Results for Other Title 22 Metals and General Chemistry, July 1997 through December 2011
Groundwater Remedy Basis of Design Report
Intermediate (60%) Design
PG&E Topock Compressor Station
Needles, California

Parameter	Results Summary for RFI/RI Wells [1]					
	Number of Wells Sampled	Number of Primary Samples	Number of Detects	Detection Frequency %	Average Concentration	Maximum Concentration
Other Title 22 Metals						
Antimony	105	684	15	2.2	3.9	155
Barium	146	875	649	74.2	108	5,300
Beryllium	105	674	22	3.3	0.83	9
Cadmium	105	674	1	0.1	1.3	11
Cobalt	105	674	21	3.1	1.8	10
Copper	132	1,430	442	30.9	9.8	640
Lead	122	785	64	8.2	3.4	76
Mercury	105	680	3	0.4	0.12	0
Molybdenum	140	1,027	953	92.8	32.3	301
Nickel	132	1,430	514	35.9	10.1	500
Silver	105	674	115	17.1	3.0	87
Thallium	105	674	16	2.4	1.9	5
Vanadium	122	772	438	56.7	13.0	326
Zinc	132	1,430	853	59.7	56.5	2,200
General Chemistry						
Alkalinity, bicarb as CaCO3	210	1,427	1,418	99.4	150	1,000
Alkalinity, carb as CaCO3	210	1,440	22	1.5	2.8	210
Alkalinity, hydroxide	142	633	7	1.1	3.1	110
Alkalinity, total as CaCO3	202	1,420	1,420	100.0	149	1,000
Ammonia	32	96	67	69.8	2.9	180
Ammonia as nitrogen	166	849	214	25.2	0.44	12
Bicarbonate	5	5	5	100.0	66.4	79
Carbonate	80	81	1	1.2	2.6	12
Deuterium	156	574	574	100.0	-72	-37
Dissolved organic carbon	24	24	13	54.2	3.5	28
Dissolved oxygen	1	1	1	100.0	3.3	3
Iodide	24	48	12	25.0	1.5	13

TABLE 2.2-2
Summary Statistics of Groundwater Sampling Results for Other Title 22 Metals and General Chemistry, July 1997 through December 2011
Groundwater Remedy Basis of Design Report
Intermediate (60%) Design
PG&E Topock Compressor Station
Needles, California

Parameter	Results Summary for RFI/RI Wells [1]					
	Number of Wells Sampled	Number of Primary Samples	Number of Detects	Detection Frequency %	Average Concentration	Maximum Concentration
General Chemistry						
Orthophosphate	131	281	15	5.3	0.34	1
Oxidation reduction potential	38	338	338	100.0	229	529
Oxygen 18	156	574	574	100.0	-9.3	-3
Perchlorate	14	16	ND	ND	ND	ND
pH	130	1,923	1,923	100.0	7.7	13
Phosphate	38	123	103	83.7	0.57	34
Silica	109	146	146	100.0	19.9	39
Soluble silica	73	120	120	100.0	21.7	43
Specific conductance	177	3,127	3,127	100.0	9,509	65,300
Sulfide	113	257	17	6.6	0.53	4
Total dissolved solids	203	1,453	1,453	100.0	5,216	46,200
Total Kjeldahl Nitrogen	67	91	11	12.1	0.56	13
Total organic carbon	197	703	377	53.6	3.2	58
Total phosphorus as P	3	3	ND	ND	ND	ND
Total Suspended Solids	57	128	72	56.3	18.2	280
Turbidity	39	358	227	63.4	1.3	82

Notes:

[1] Includes data through February 2012 for East Ravine-Topock Compressor Station wells; see Appendix A1 for details.

Title 22 metals are the metals listed in California Code of Regulations, Title 22, Section 66261.24(a)(2)(A).
All metals results are dissolved concentrations in µg/L from field-filtered samples.
Metals are reported in ug/L. Nitrate reported as nitrogen in mg/L. Deuterium and oxygen 18 are reported in 0/00.
Turbiity reported in NTU. pH reported in pH units. Specific Conductance reported in µS/cm.
Oxidation reduction potential reproted in mV.
All other General Chemistry results are reported in mg/L.

µg/L	dissolved metals concentrations in micrograms per liter
µS/cm	micro Siemans per centimeter
mg/L	milligrams per liter
mV	millivolts
0/00	differences from global standards in ppt
ND	not detected at reporting limit
NTU	nephelometric turbidity units

TABLE 2.3-1
Calculated Site Background UTLs for Groundwater
Groundwater Remedy Basis of Design Report
Intermediate (60%) 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).

TABLE 2.4-1

Summary Statistics of Surface Water Sampling Results, July 1997 through December 2011

Groundwater Remedy Basis of Design Report

Intermediate (60%) 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 (µg/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	3.2	0 \ 0	---	2 \ 4	65.0	0 \ 1	ND	0 \ 0	---	2 \ 3	4.9	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 \ 15	ND	1 \ 15	0.55	3 \ 3	2.4	0 \ 3	ND	0 \ 3	ND	0 \ 3	5.2	0 \ 3	ND	1 \ 3	406	15 \ 15	973	15 \ 15	8.21
I-3	0 \ 70^	ND	7 \ 71	3.1	0 \ 0	---	3 \ 5	54.1	0 \ 2	ND	0 \ 0	---	3 \ 3	4.7	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	0.61	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	0.63	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 \ 19	ND	0 \ 19	ND	3 \ 3	2.4	0 \ 3	ND	0 \ 3	ND	0 \ 3	5.2	0 \ 3	ND	0 \ 3	ND	19 \ 19	954	19 \ 19	8.26
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	2.7	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	2.7	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 \ 85^	ND	7 \ 86	2.7	3 \ 3	2.4	0 \ 6	ND	0 \ 6	ND	0 \ 3	5.2	1 \ 4	5.1	6 \ 29	549	53 \ 53	996	52 \ 52	8.25
RRB	0 \ 80^	ND	8 \ 81	2.6	3 \ 3	2.7	2 \ 4	21.0	1 \ 3	13.8	0 \ 3	5.2	1 \ 4	5.5	0 \ 3	ND	51 \ 51	1190	50 \ 50	8.06
Seasonal Wetlands	0 \ 8	ND	0 \ 8	ND	0 \ 0	---	1 \ 1	8.0	0 \ 0	---	0 \ 0	---	1 \ 1	5.0	0 \ 0	---	8 \ 8	4800	8 \ 8	7.97
River Channel Surface Water Monitoring Locations																				
C-BNS	0 \ 16	ND	0 \ 16	ND	3 \ 3	2.6	0 \ 3	ND	0 \ 3	ND	0 \ 3	5.2	0 \ 3	ND	0 \ 3	ND	16 \ 16	955	16 \ 16	8.20
C-CON	0 \ 103	ND	0 \ 103	ND	6 \ 6	2.6	0 \ 6	ND	0 \ 6	ND	0 \ 6	5.2	0 \ 6	ND	0 \ 6	ND	75 \ 75	996	75 \ 75	8.23
C-I-3	0 \ 103	ND	0 \ 103	ND	6 \ 6	2.5	0 \ 6	ND	0 \ 6	ND	0 \ 6	5.2	0 \ 6	ND	3 \ 9	346	75 \ 75	975	75 \ 75	8.26
C-MAR	0 \ 66	ND	0 \ 66	ND	5 \ 5	2.9	5 \ 5	19.8	1 \ 5	16.2	0 \ 5	5.2	0 \ 5	ND	1 \ 7	483	49 \ 49	1150	49 \ 49	7.92
C-NR1	0 \ 103	ND	0 \ 103	ND	6 \ 6	2.5	0 \ 6	ND	0 \ 6	ND	0 \ 6	5.2	0 \ 6	ND	0 \ 6	ND	75 \ 75	991	75 \ 75	8.31
C-NR3	0 \ 103	ND	0 \ 103	ND	6 \ 6	2.5	0 \ 6	ND	1 \ 6	12.3	0 \ 6	5.2	0 \ 6	ND	0 \ 6	ND	75 \ 75	992	75 \ 75	8.30
C-NR4	0 \ 103	ND	0 \ 103	ND	6 \ 6	2.3	0 \ 6	ND	1 \ 6	12.5	0 \ 6	5.2	0 \ 6	ND	2 \ 6	1150	75 \ 75	988	75 \ 75	8.30
C-R22	1 \ 74	0.11	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 \ 35	ND	0 \ 35	ND	6 \ 6	2.6	0 \ 6	ND	0 \ 6	ND	0 \ 6	5.2	0 \ 6	ND	0 \ 6	ND	35 \ 35	959	35 \ 35	8.28
C-R27	0 \ 98	ND	0 \ 98	ND	6 \ 6	2.7	0 \ 6	ND	0 \ 6	ND	0 \ 6	5.2	0 \ 6	ND	3 \ 9	345	71 \ 71	976	71 \ 71	8.26
C-TAZ	0 \ 100	ND	0 \ 103	ND	6 \ 6	2.5	0 \ 6	ND	0 \ 6	ND	0 \ 6	5.2	0 \ 6	ND	4 \ 9	406	75 \ 75	979	75 \ 75	8.28
Other Surface Water Monitoring Locations																				
SW2	0 \ 14	ND	0 \ 14	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	14 \ 14	984	14 \ 14	7.79
SW1	1 \ 22	0.11	0 \ 22	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	20 \ 20	1010	20 \ 20	7.79

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.

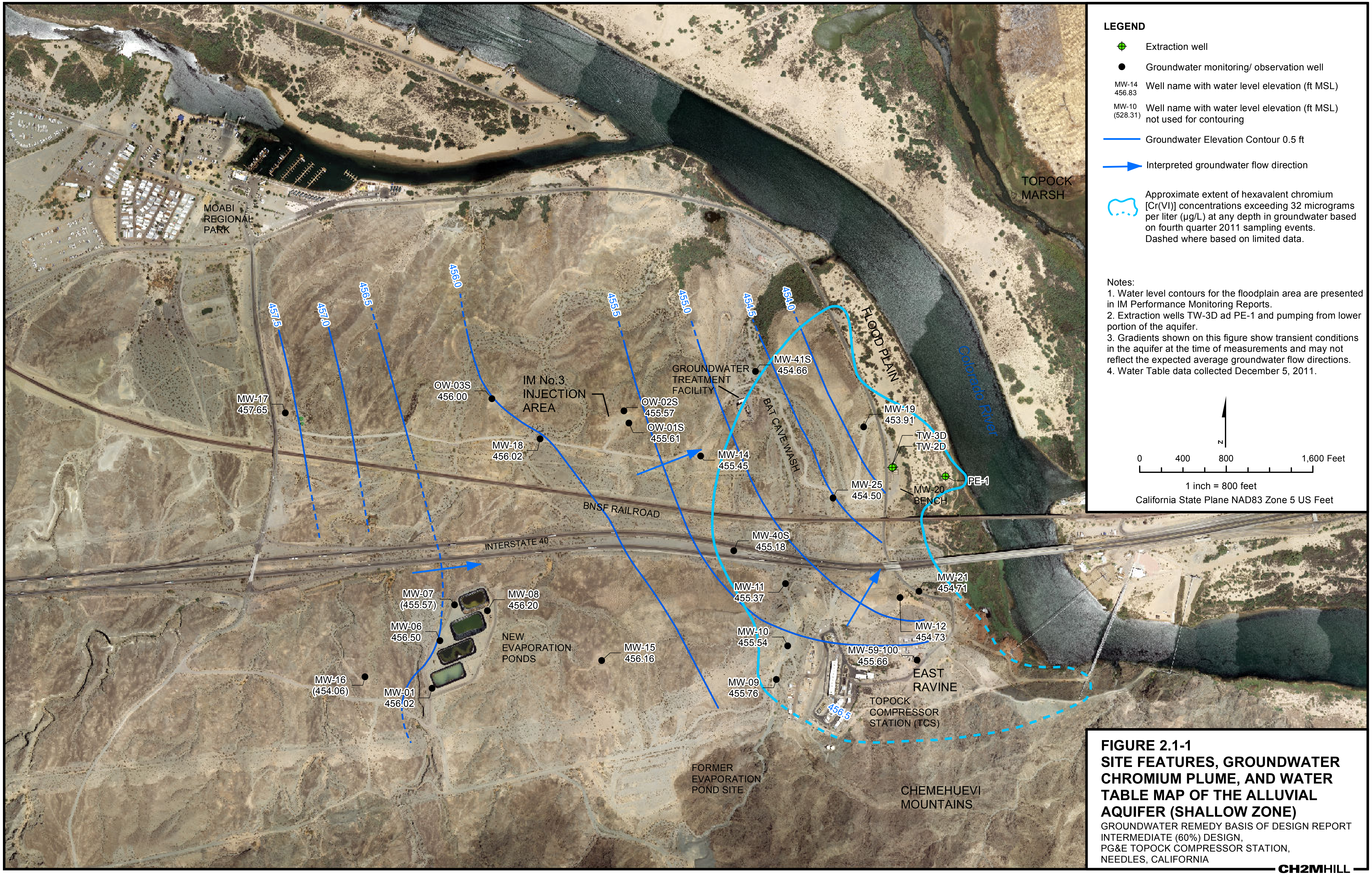

FIGURE 2.1-1
SITE FEATURES, GROUNDWATER CHROMIUM PLUME, AND WATER TABLE MAP OF THE ALLUVIAL AQUIFER (SHALLOW ZONE)
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

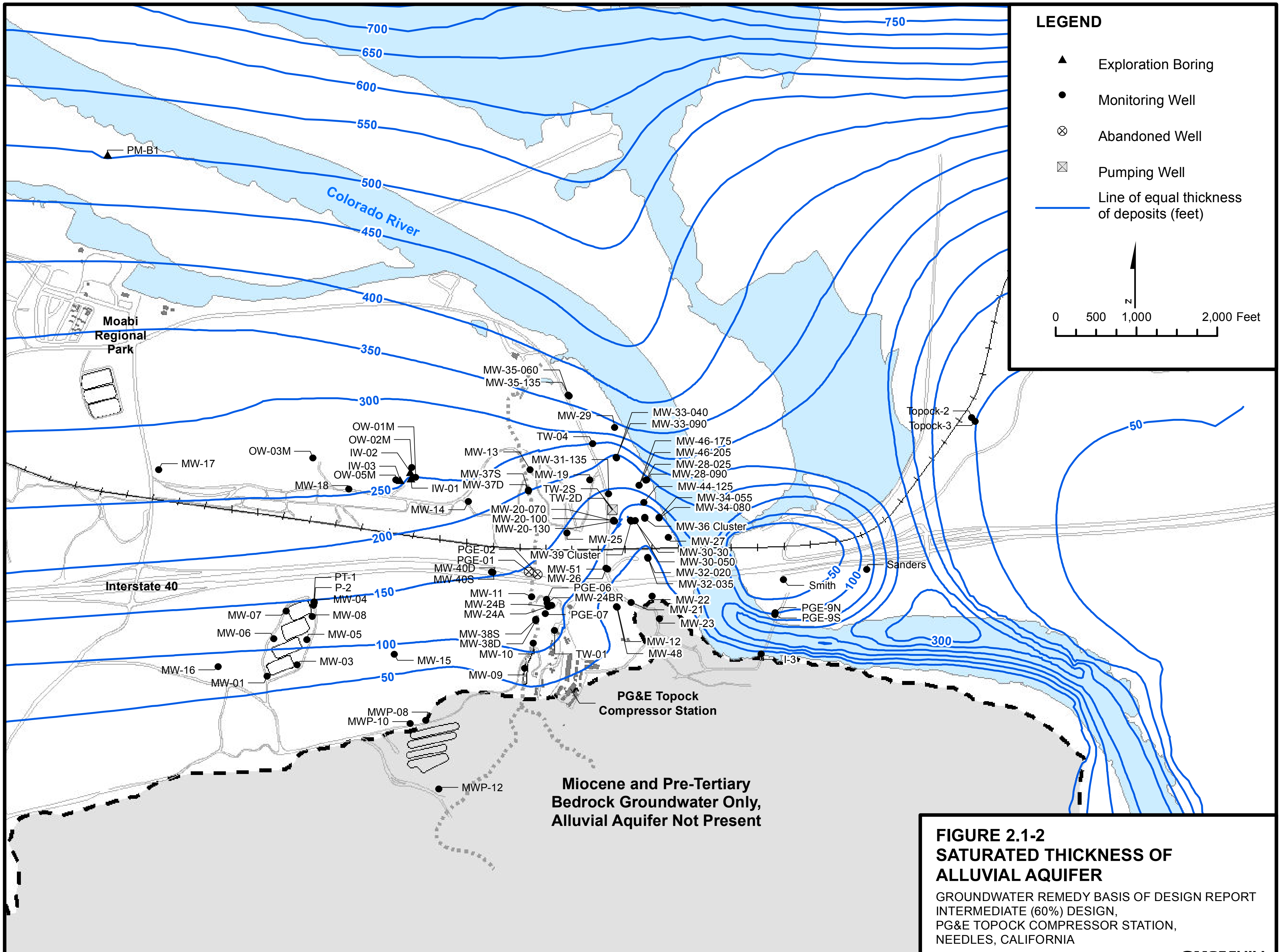

FIGURE 2.1-2
SATURATED THICKNESS OF ALLUVIAL AQUIFER

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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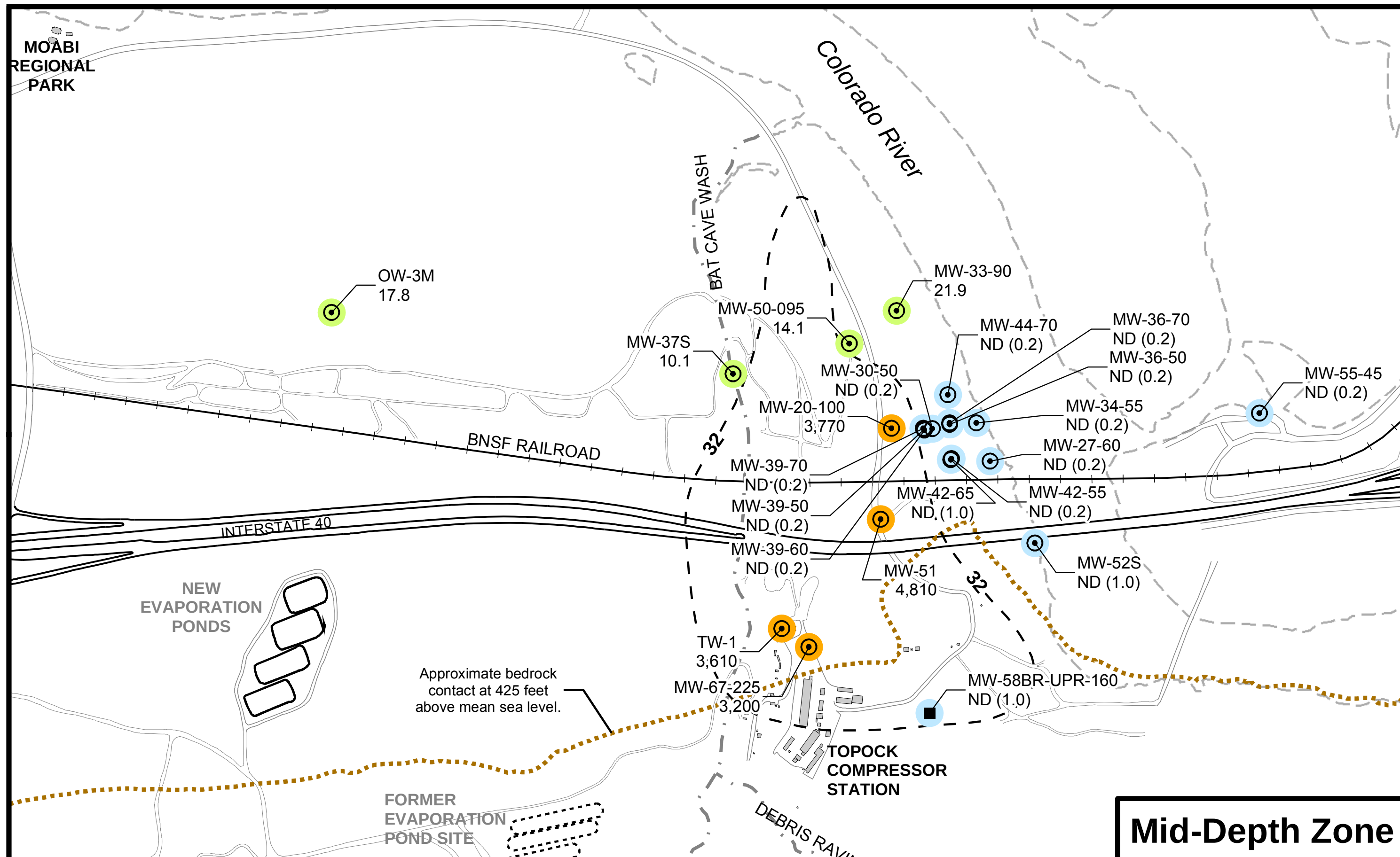
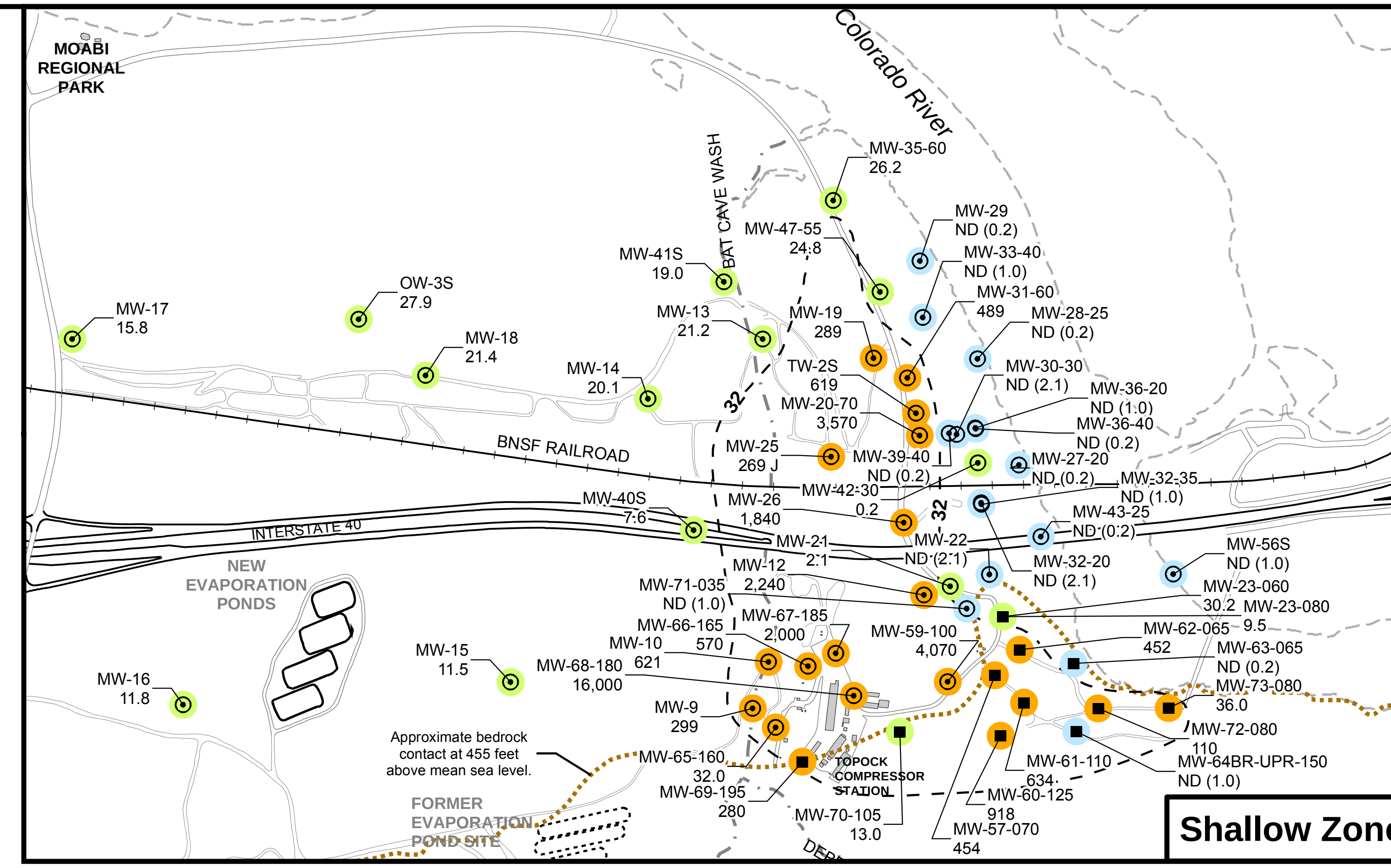
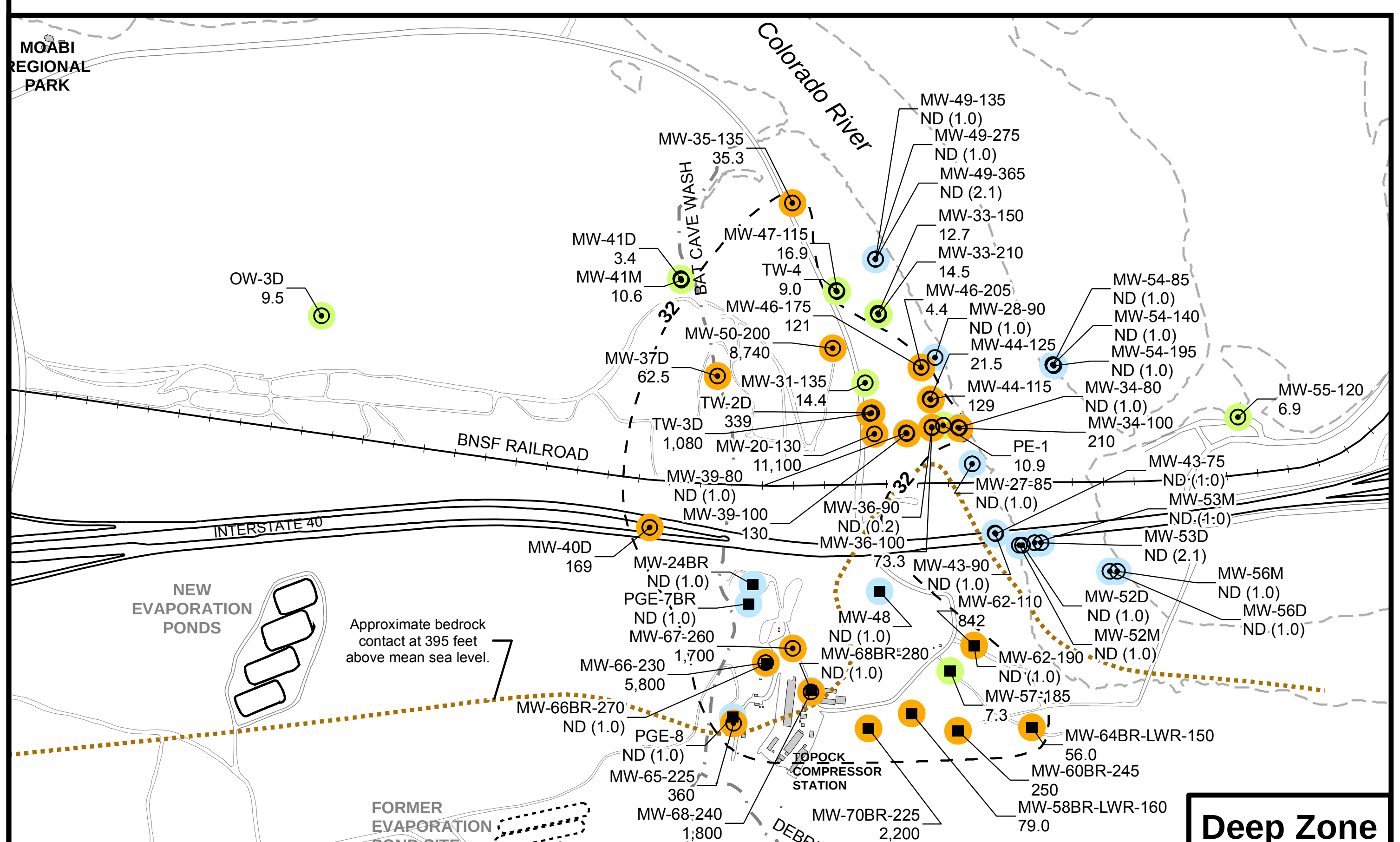






LEGEND

Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

Groundwater Well completed in Bedrock

Hexavalent Chromium Concentration

MW-17 ← Well ID
5.8 ← Concentration, micrograms per liter (µg/L)
ND (0.2) ← Cr(VI) not detected at listed reporting limit.

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

ND (Concentration not detected at listed reporting limit)

Reporting limit ≤ Concentration ≤ 32 µg/L

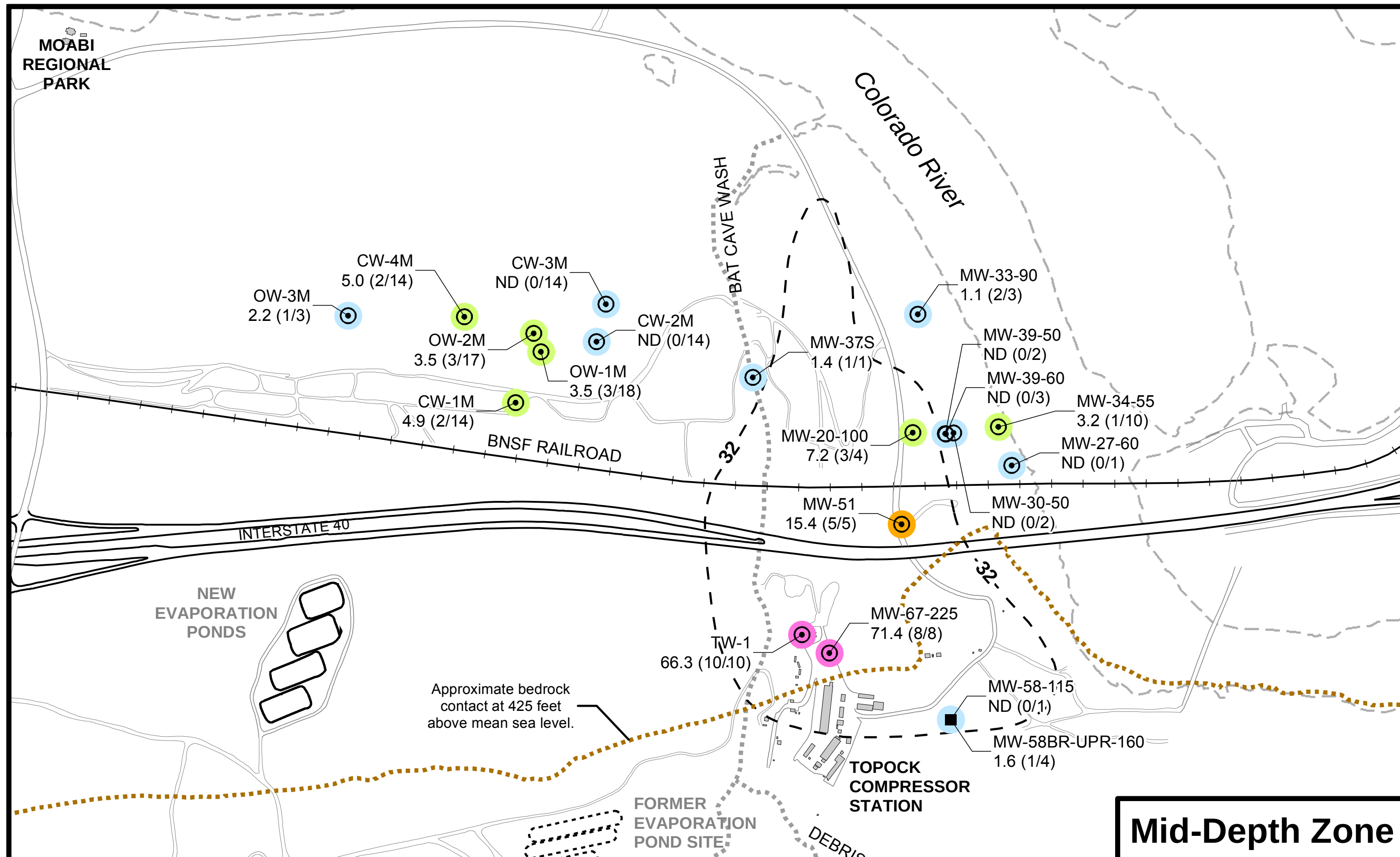
Concentration > 32 µg/L

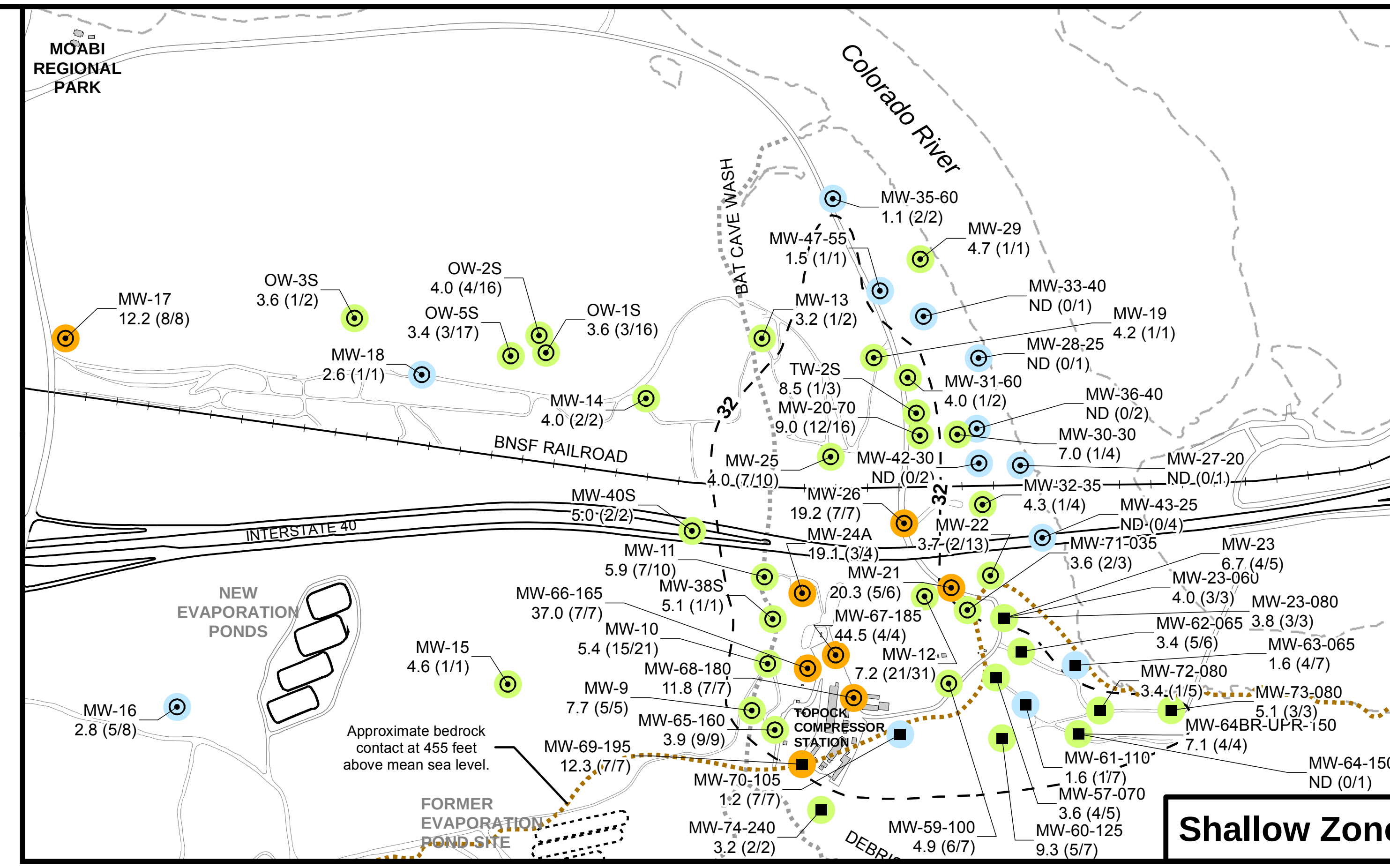
Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.

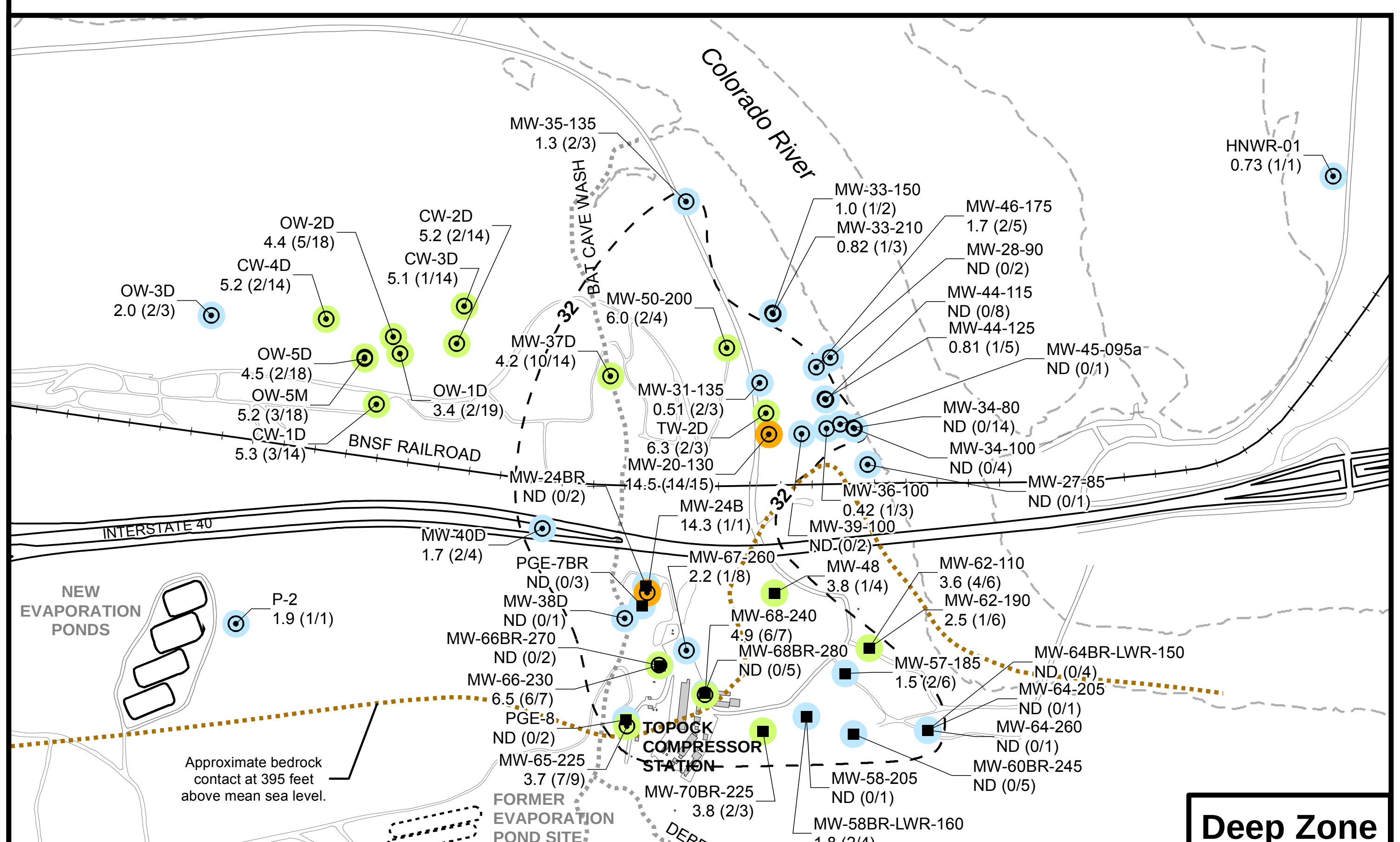
FIGURE 2.2-1
CR(VI) SAMPLING RESULTS, FOURTH QUARTER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_2-1_METALSDIST_CR6_RFI_RI60.MXD MSCHROCK 6/1/2012 5:29:24 PM







LEGEND

- Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)
- Groundwater Well completed in Bedrock

Dissolved Selenium Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L) 1997 - 2011 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

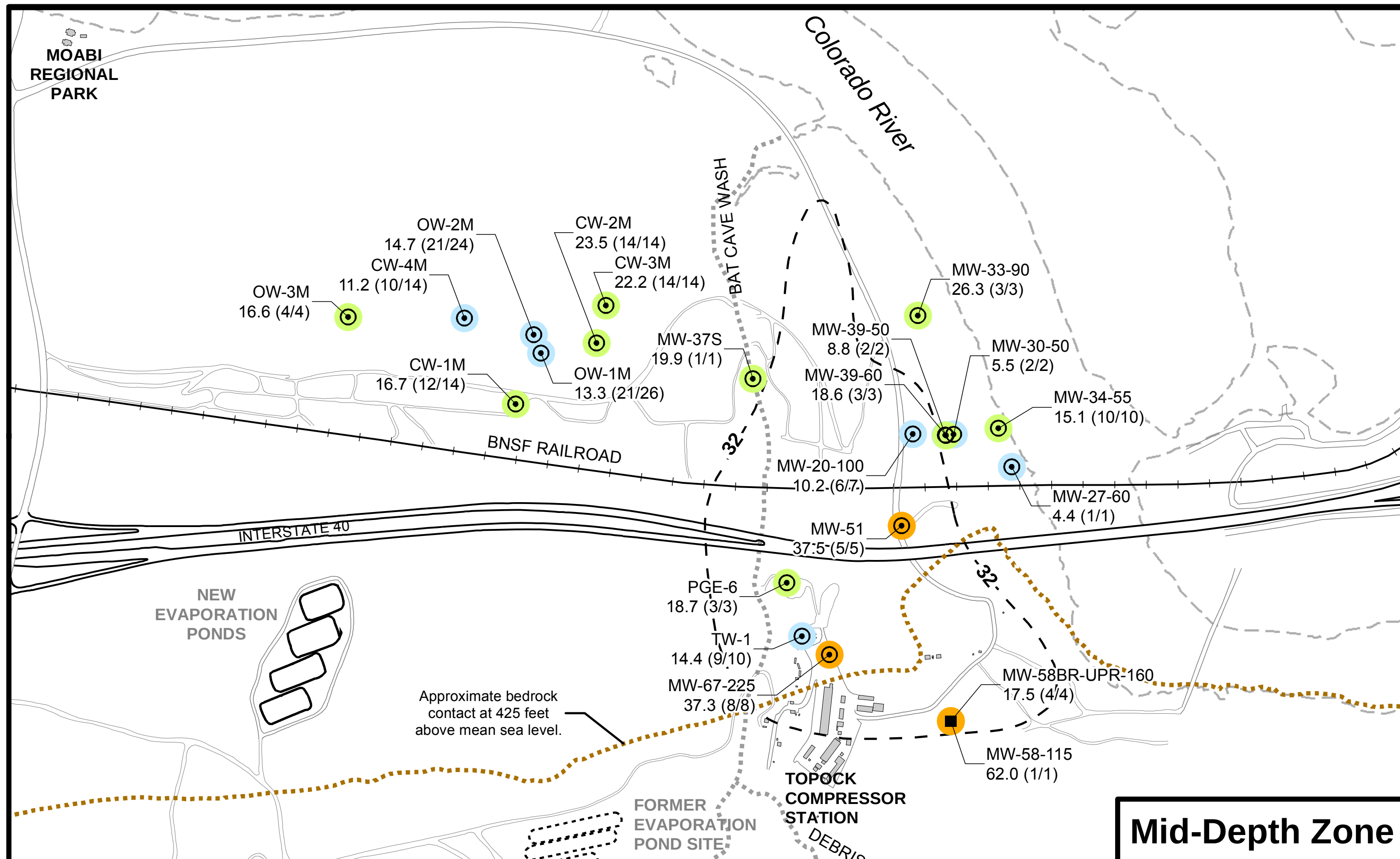
- ≤ 3.0 µg/L
- 3.0 - 10.3 µg/L
- 10.4 - 50.0 µg/L
- > 50.0 µg/L

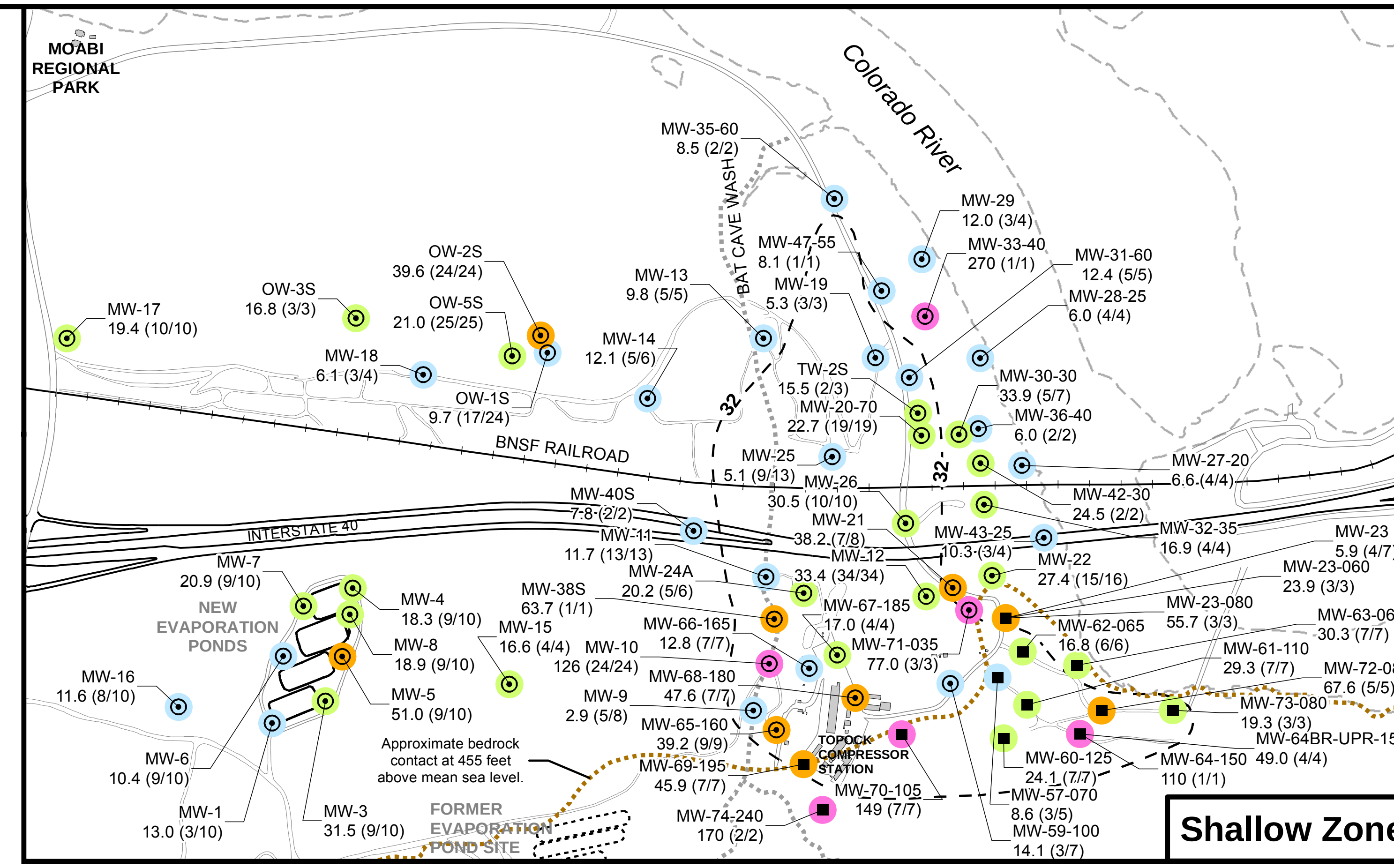
Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Selenium Background Study Upper Tolerance Limit (UTL) = 10.3 µg/L
3. Selenium applicable or relevant and appropriate requirement (ARAR) = 50.0 µg/L
4. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

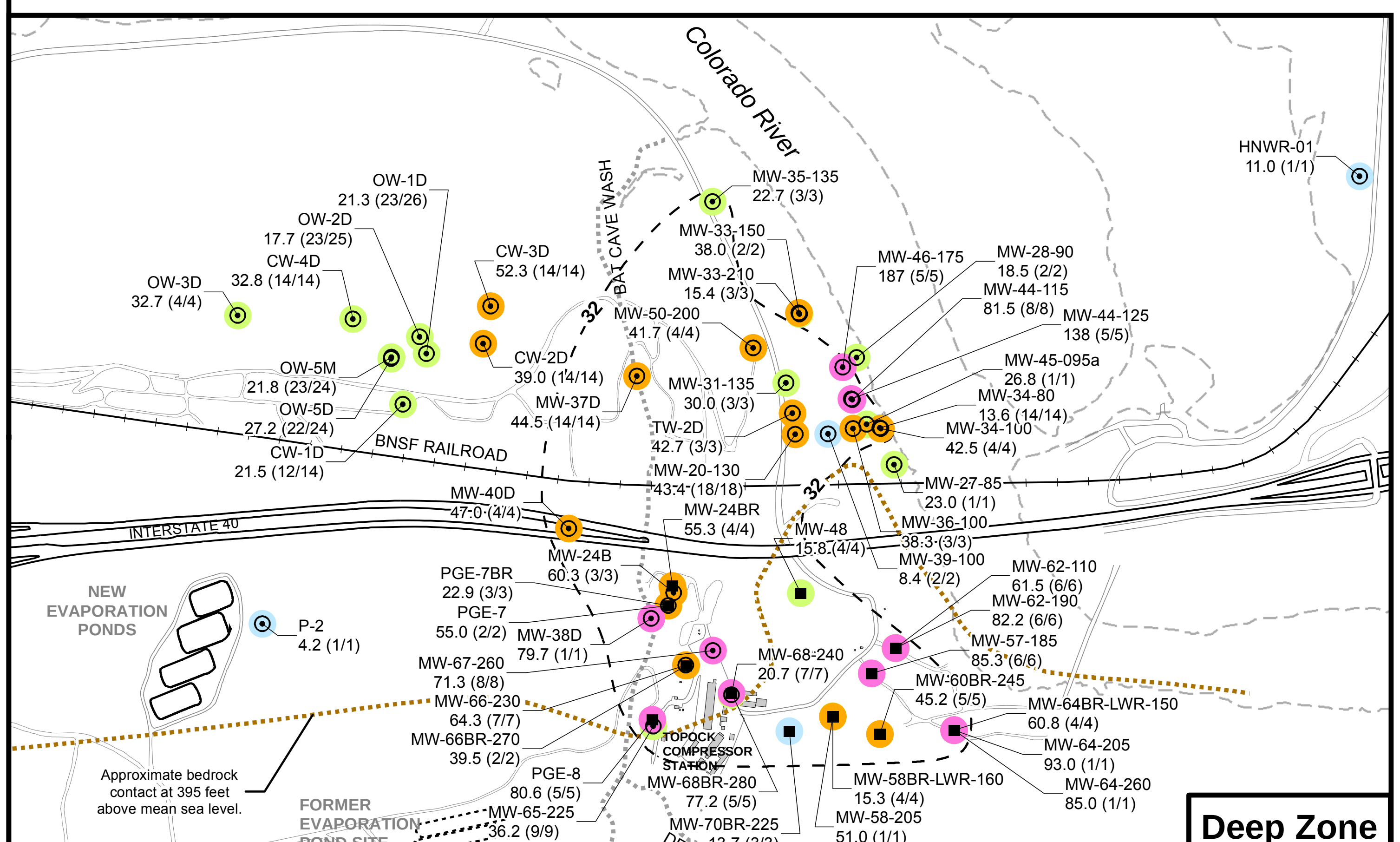
FIGURE 2.3-1
SELENIUM CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_3-1_METALSDIST_SED_RFI_RI60.MXD MSCHROCK 6/1/2012 5:38:36 PM







LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Groundwater Well completed in Bedrock

Dissolved Molybdenum Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L) 1997 - 2011 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

- ≤ 15.0 µg/L
- 15.0 - 36.3 µg/L
- 36.4 - 70.0 µg/L
- > 70.0 µg/L

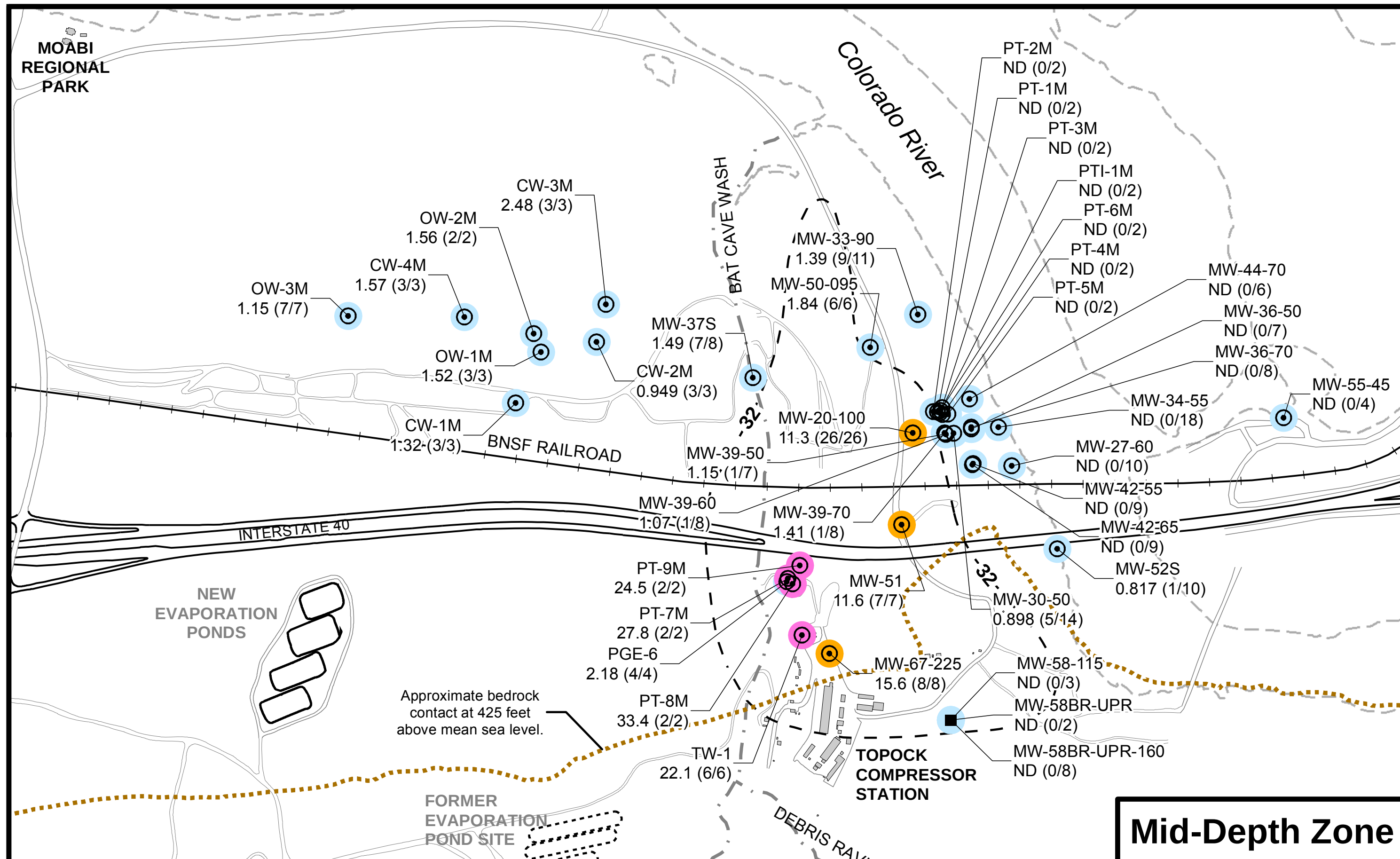
Notes:

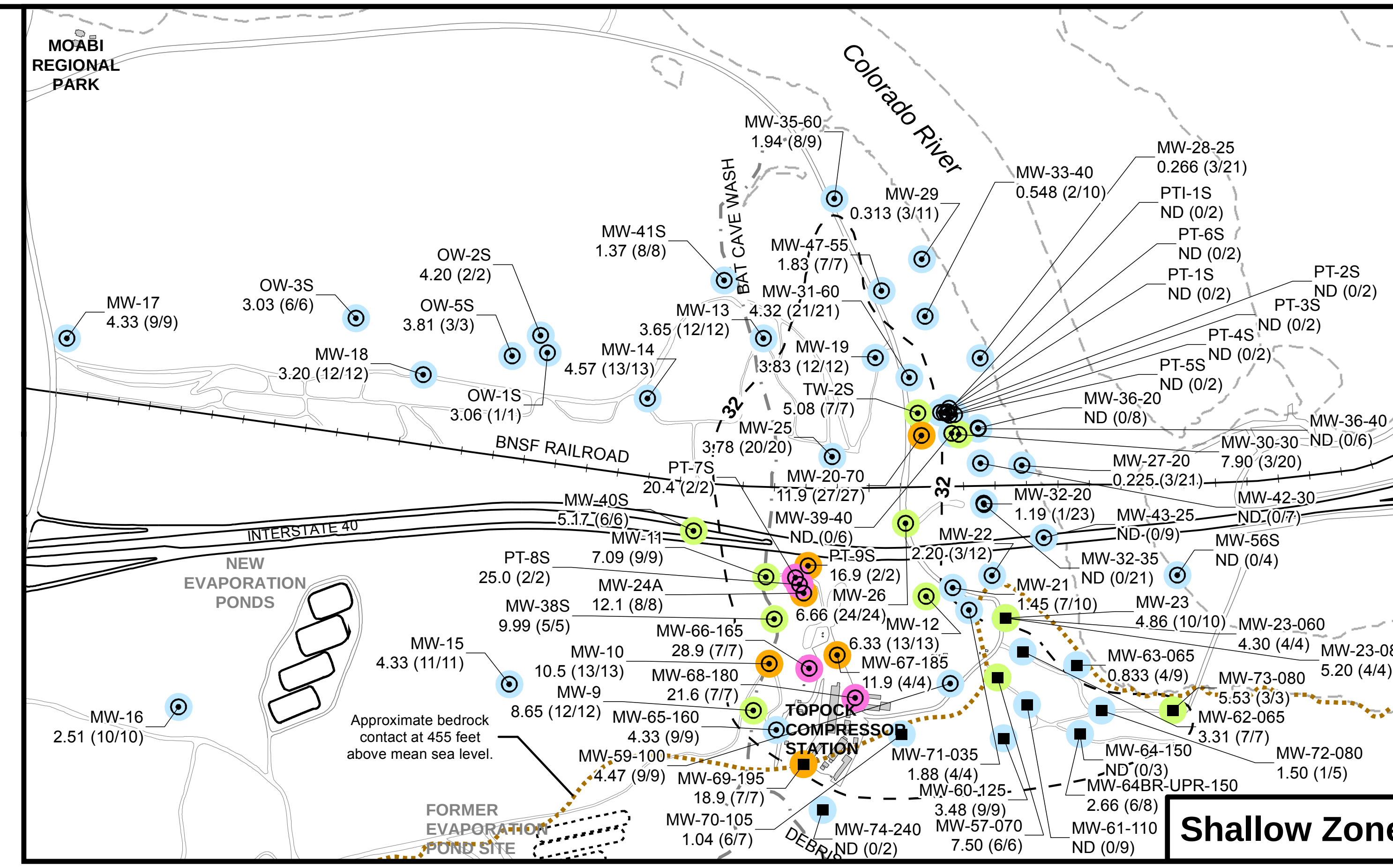
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Molybdenum Background Study Upper Tolerance Limit (UTL) = 36.3 µg/L
3. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

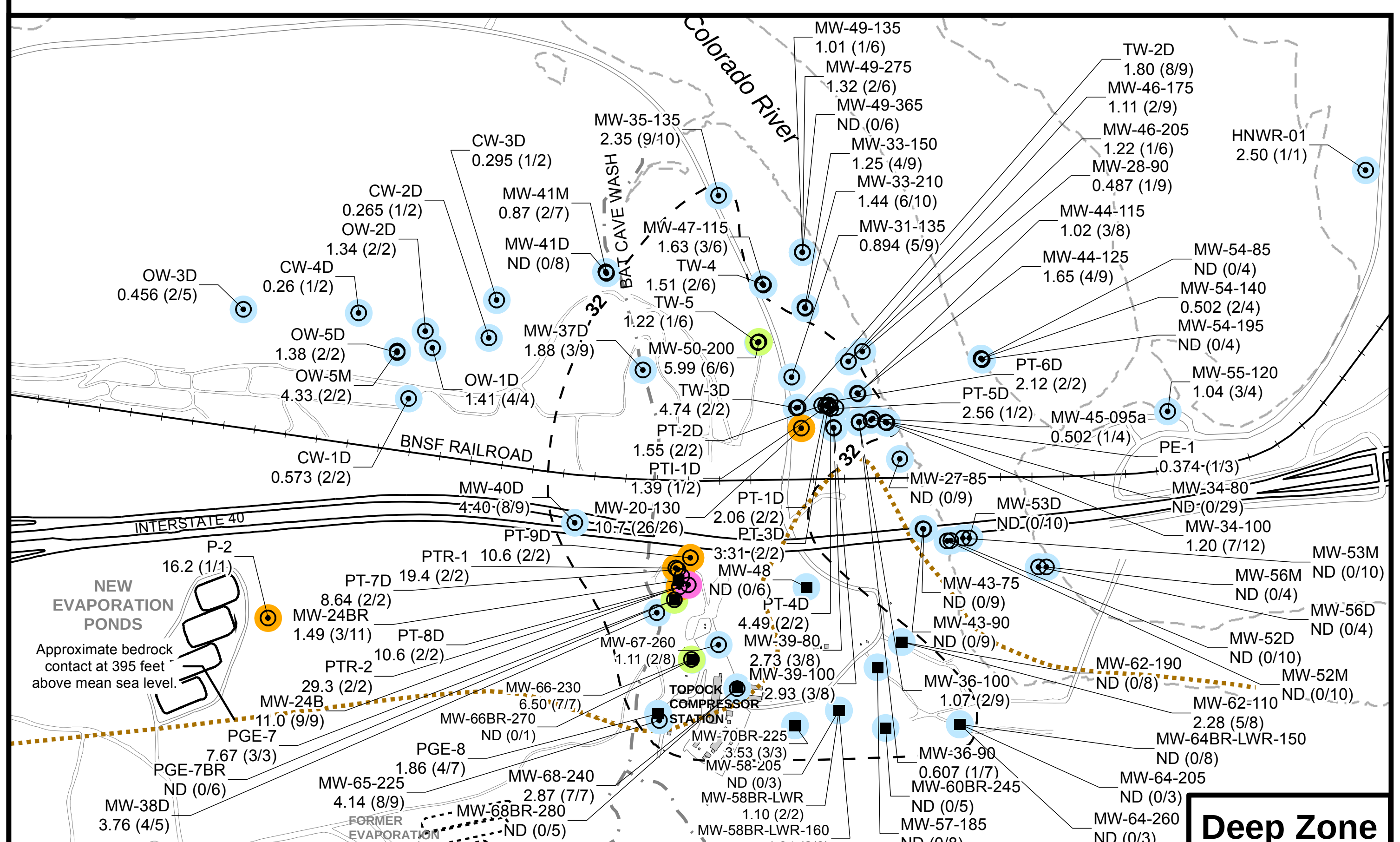
FIGURE 2.3-2
MOLYBDENUM CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_3-2_METALSDIST_MOD_RFI_RI60.MXD MSCHROCK 6/1/2012 1:23:39 AM







LEGEND

- Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)
- Groundwater Well completed in Bedrock

Nitrate Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, milligrams per liter (mg/L) (expressed as Nitrogen) 1997 - 2011 groundwater sampling

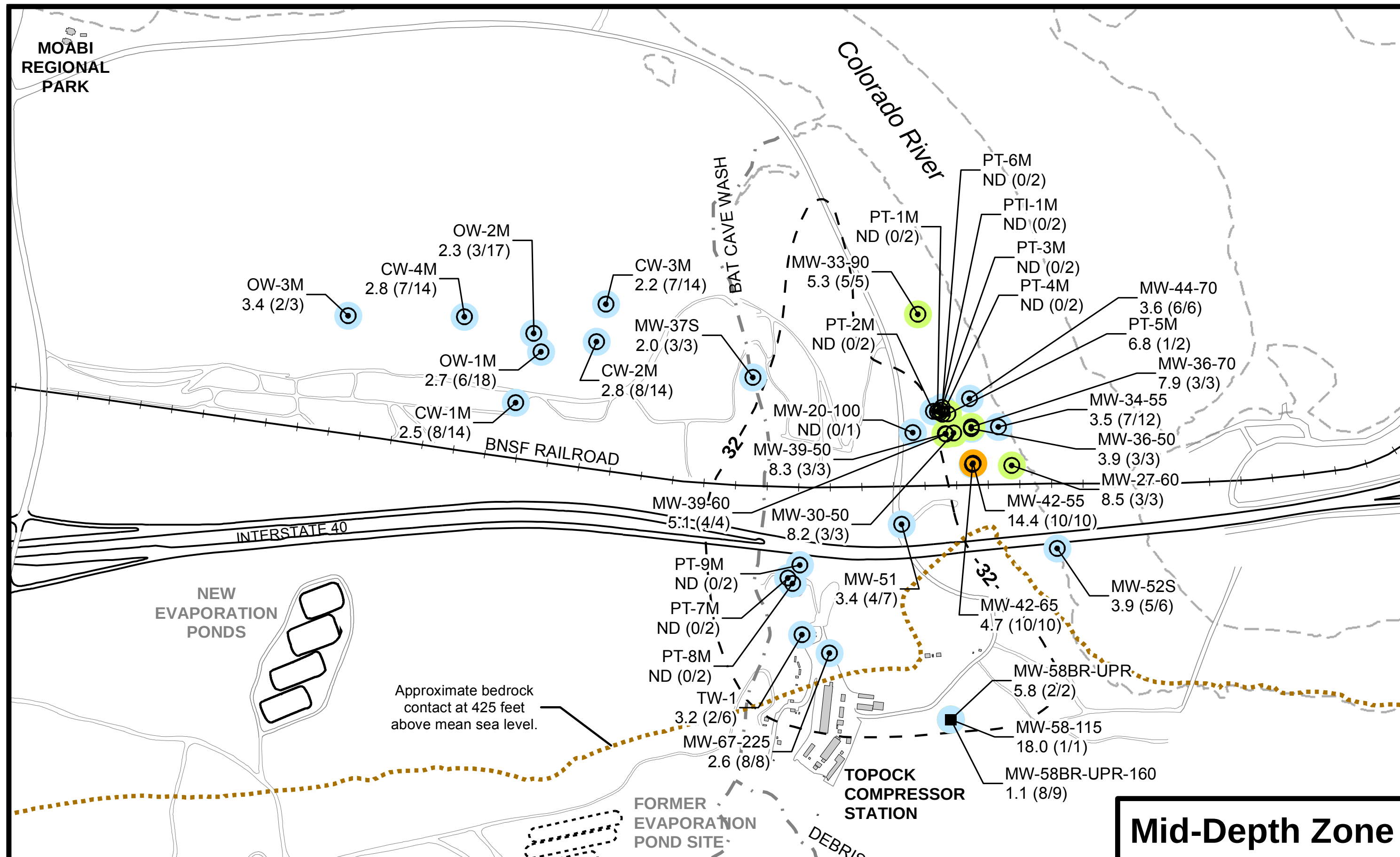
- ≤ 5.03 mg/L
- 5.03 - 10.0 mg/L
- 10.1 - 19.9 mg/L
- > 19.9 mg/L

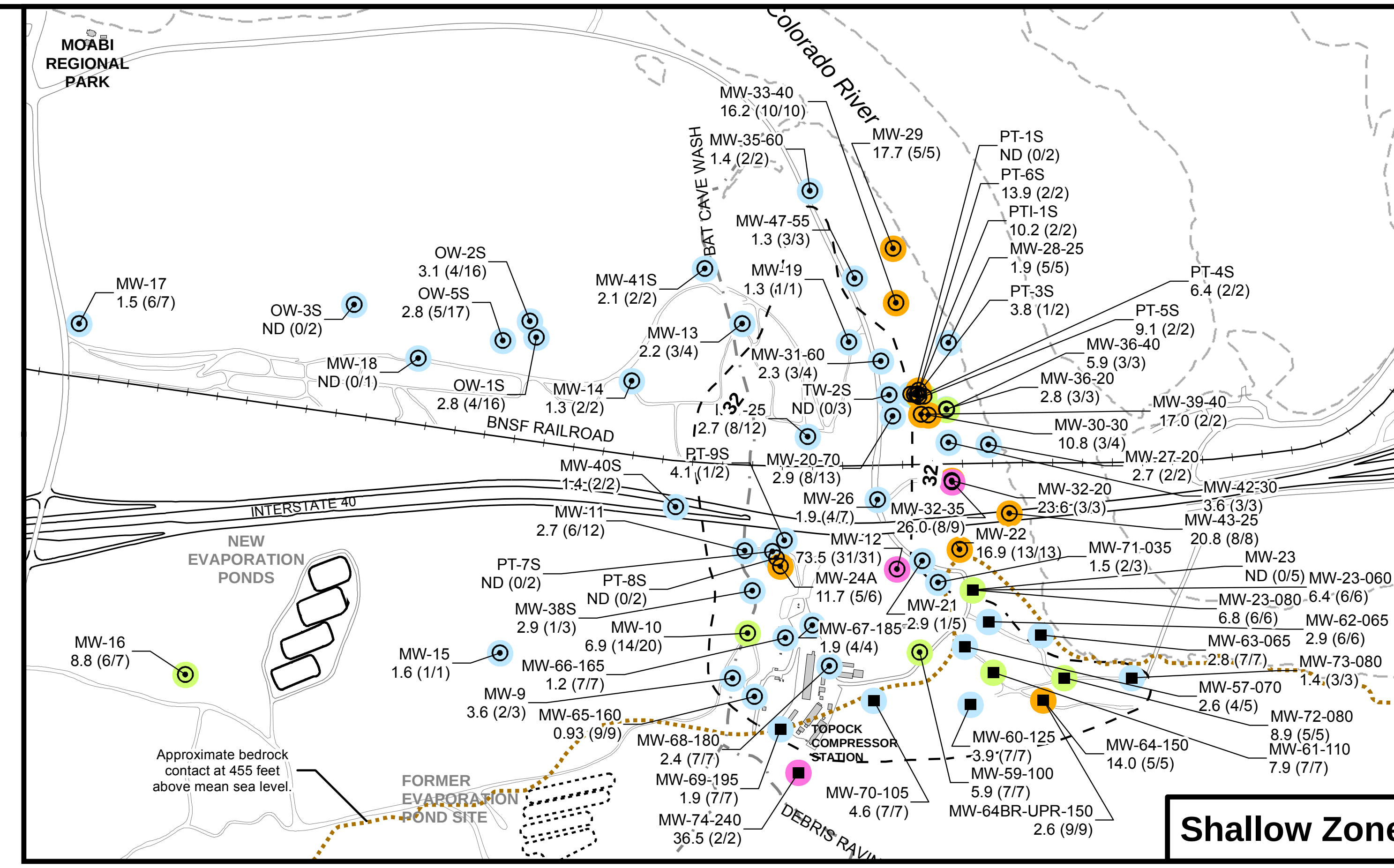
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

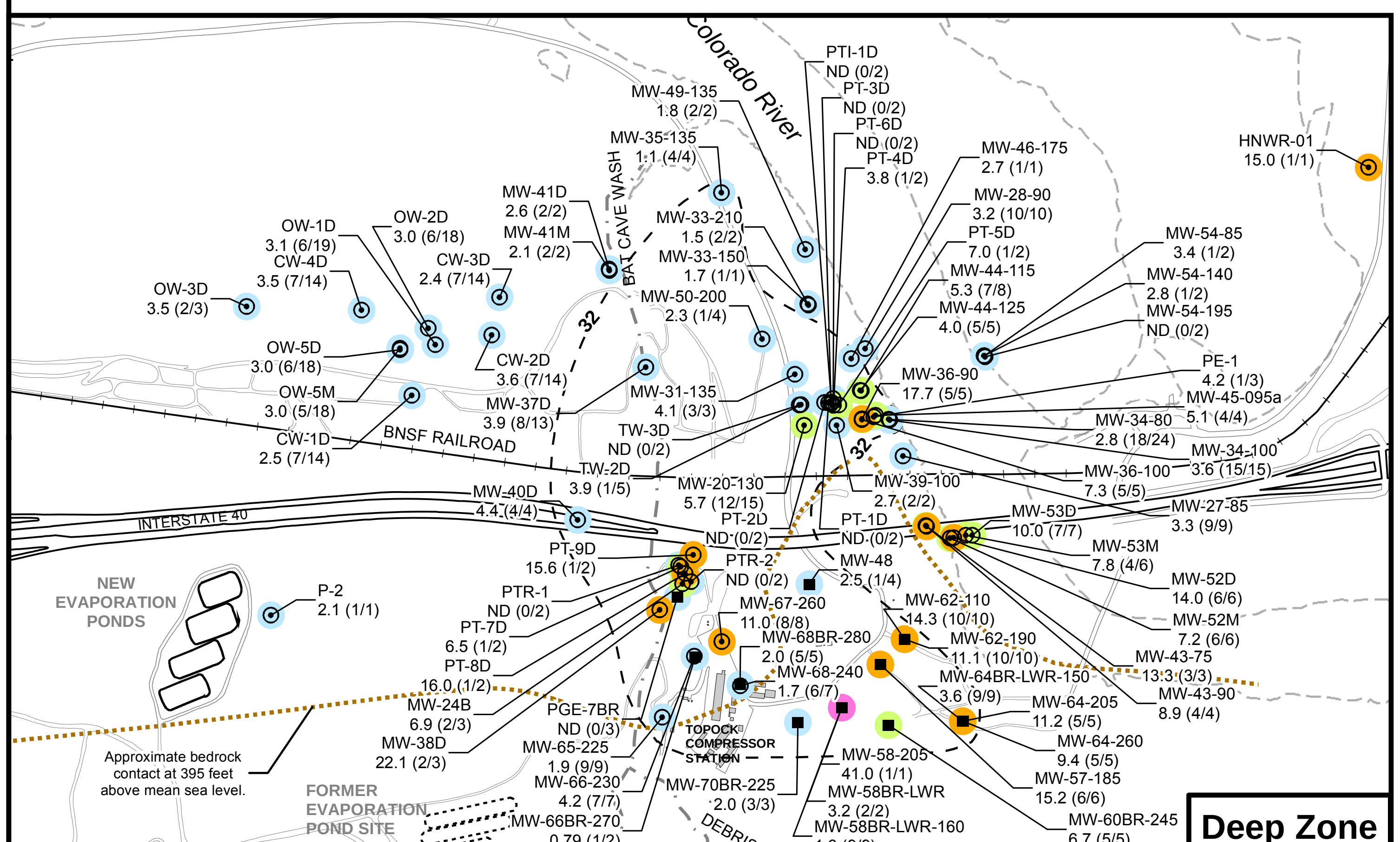
Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Nitrate Background Study Upper Tolerance Limit (UTL) = 5.03 mg/L
3. Nitrate applicable or relevant and appropriate requirement (ARAR) = 10.0 mg/L
4. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

FIGURE 2.3-3
NITRATE CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA







LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Groundwater Well completed in Bedrock

Dissolved Arsenic Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

↑ Average concentration, micrograms per liter (µg/L) 1997 - 2011 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

≤ 5.0 µg/L (or not detected [ND])

5.0 - 10.0 µg/L

10.1 - 24.3 µg/L

> 24.3 µg/L

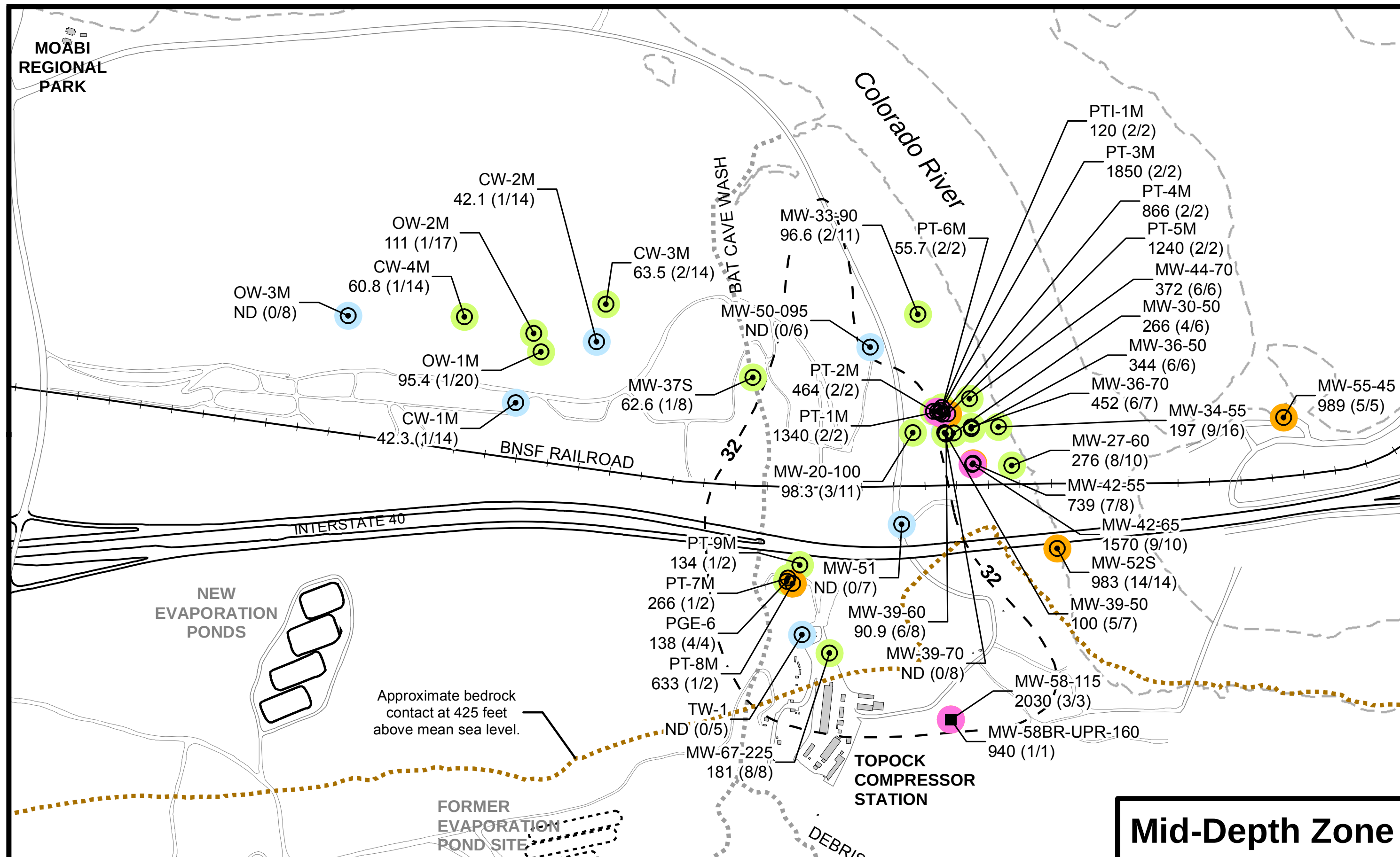
Notes:

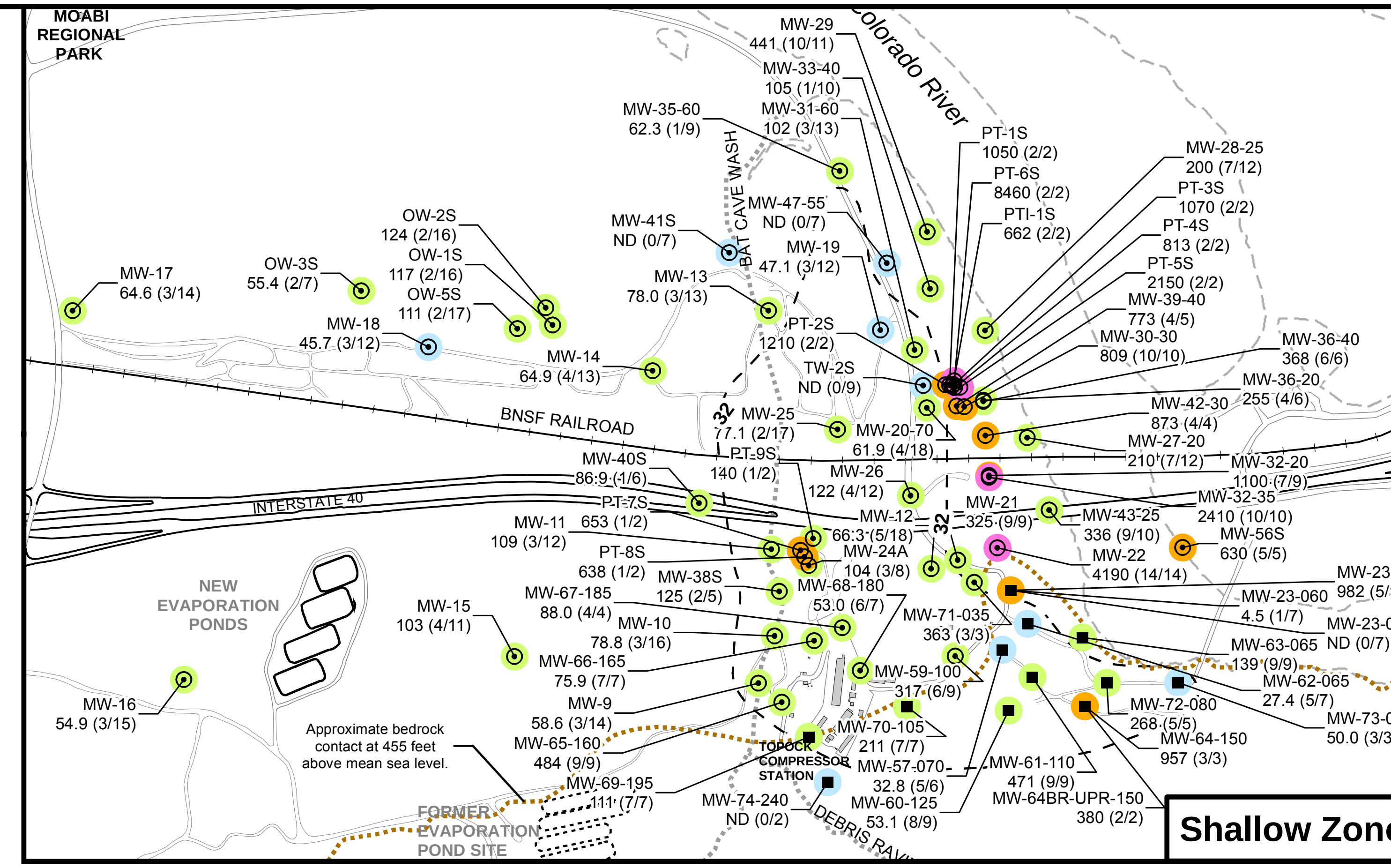
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Arsenic Background Study Upper Tolerance Limit (UTL) = 24.3 µg/L
3. Arsenic applicable or relevant and appropriate requirement (ARAR) = 10.0 µg/L
4. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

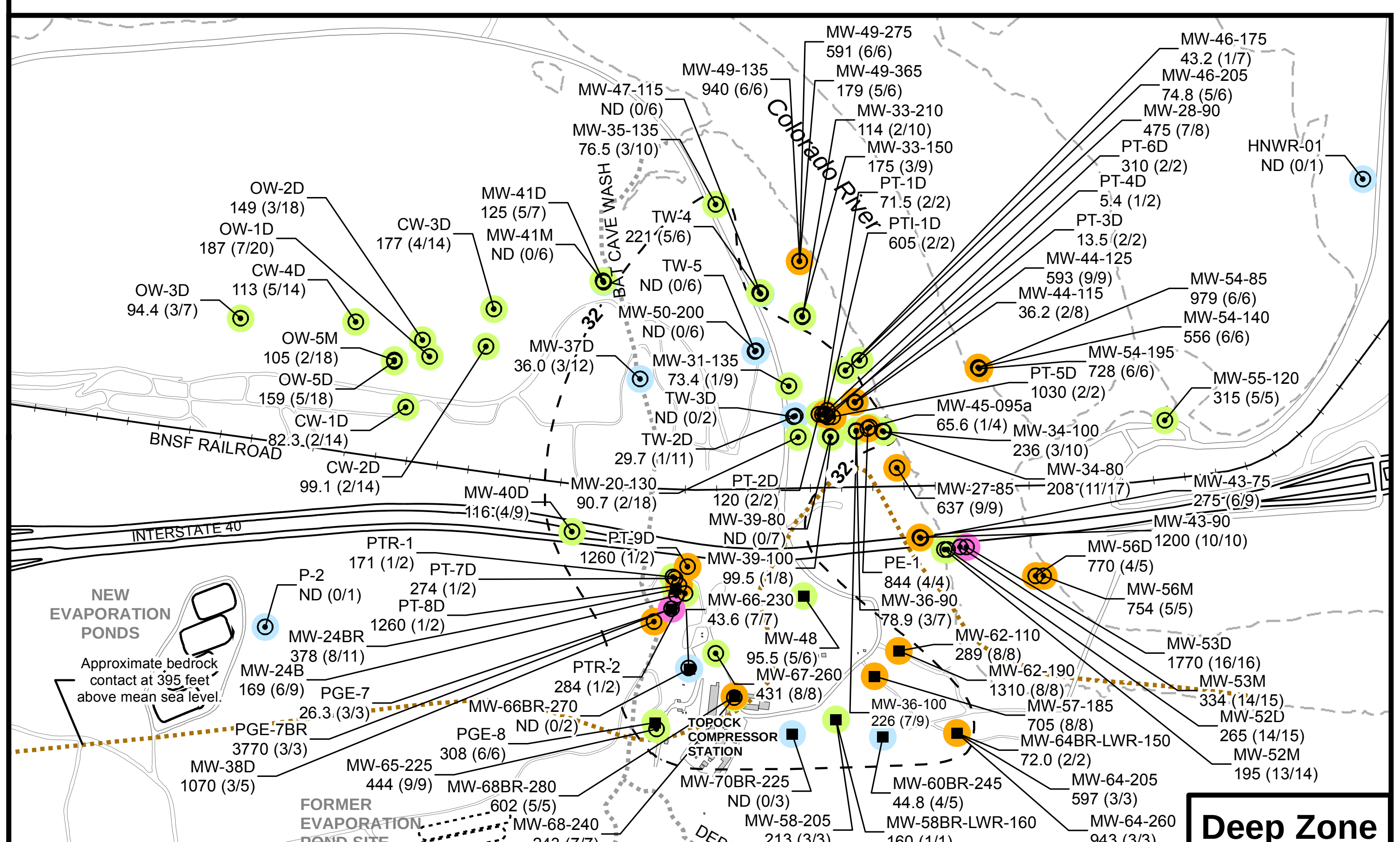
FIGURE 2.3-4
ARSENIC CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_3-4_METALSDIST_ASD_RFI_RI60.MXD MSCHROCK 6/1/2012 2:22:29 AM







LEGEND

- Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)
- Groundwater Well completed in Bedrock

Dissolved Manganese Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L) 1997 - 2011 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

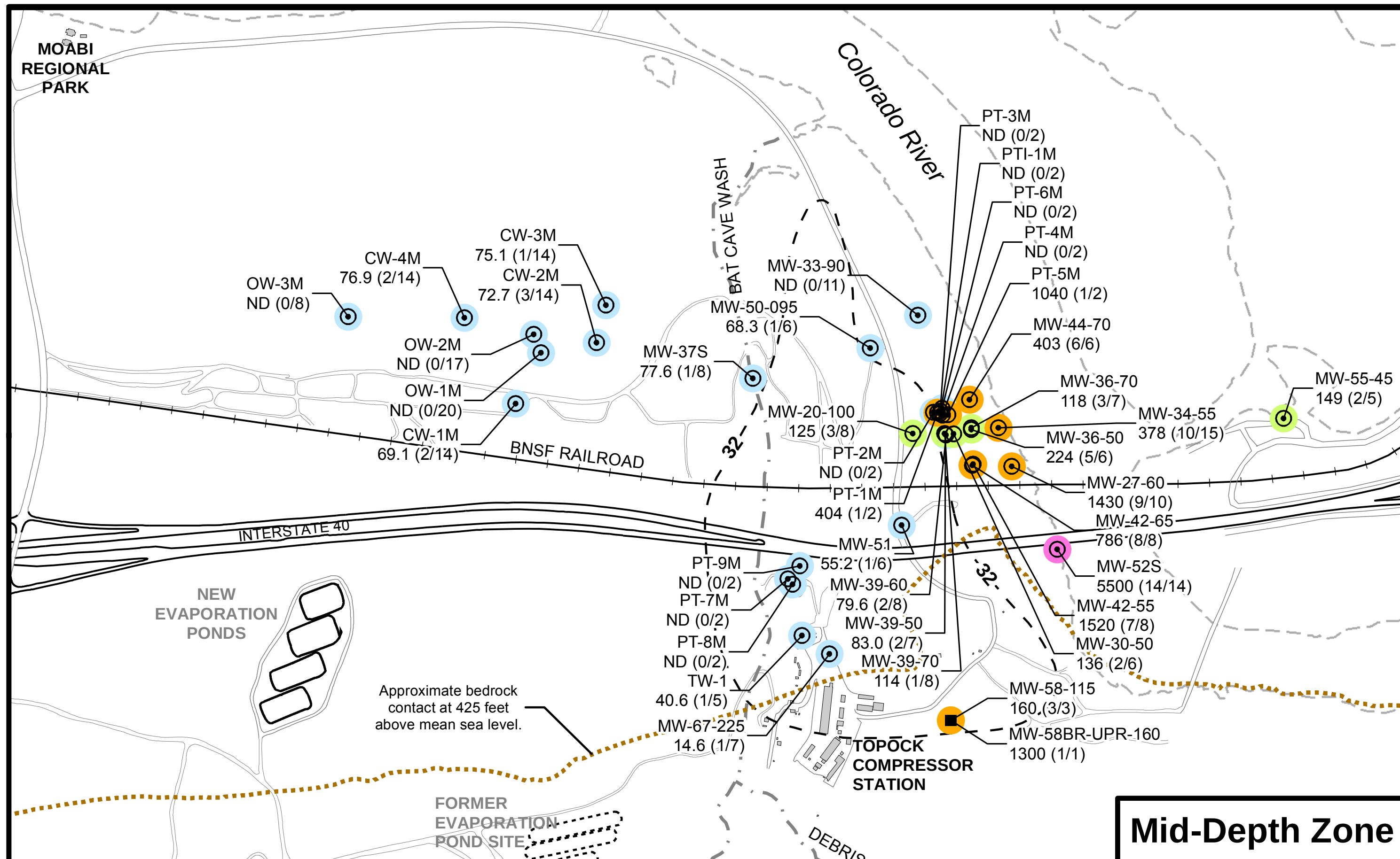
- ≤ 50.0 µg/L (or not detected [ND])
- 50.0 - 500 µg/L
- 500 - 1,320 µg/L
- > 1,320 µg/L

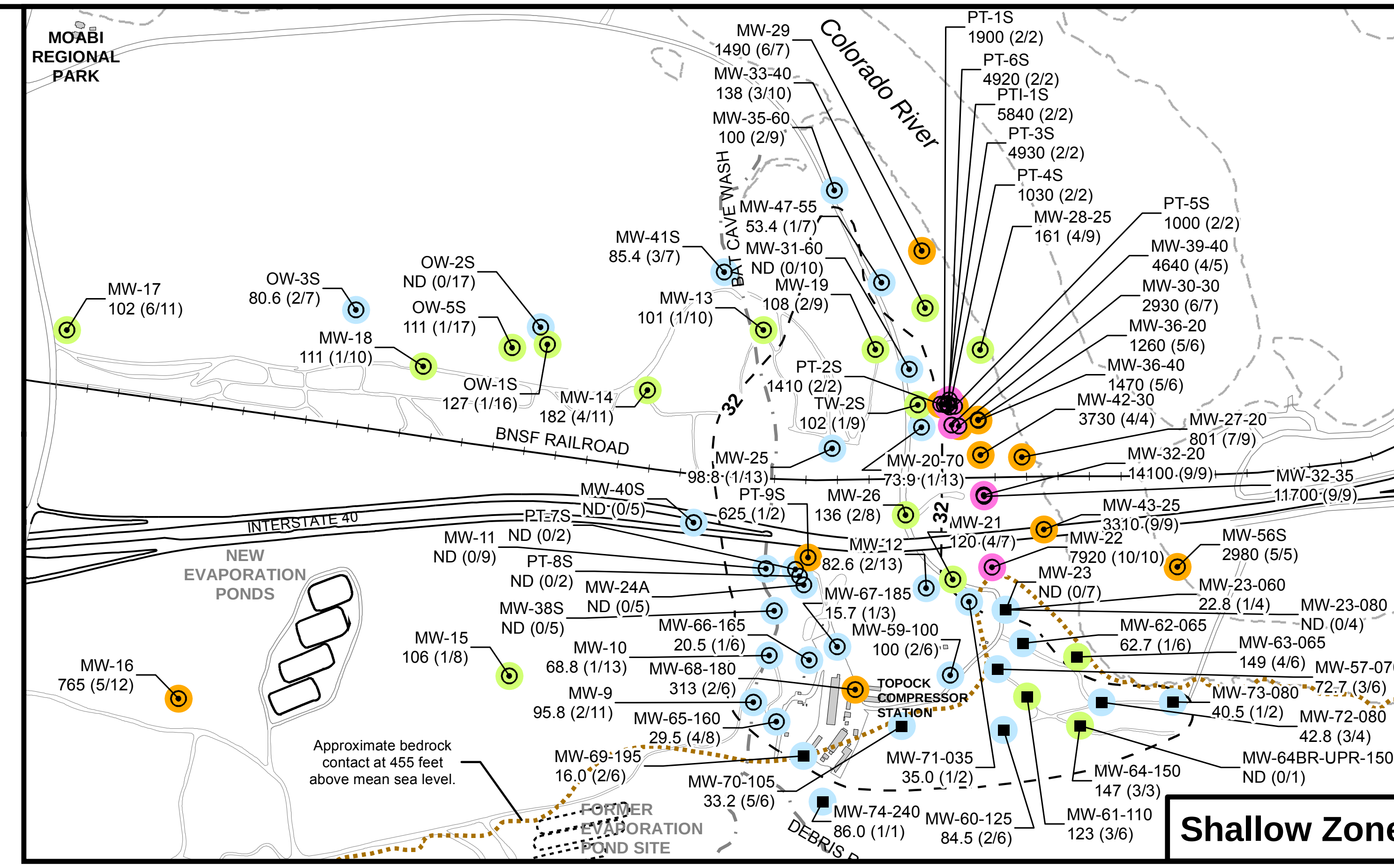
Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Manganese Background Study Upper Tolerance Limit (UTL) = 1,320 µg/L
3. Manganese applicable or relevant and appropriate requirement (ARAR) = 50.0 µg/L
4. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

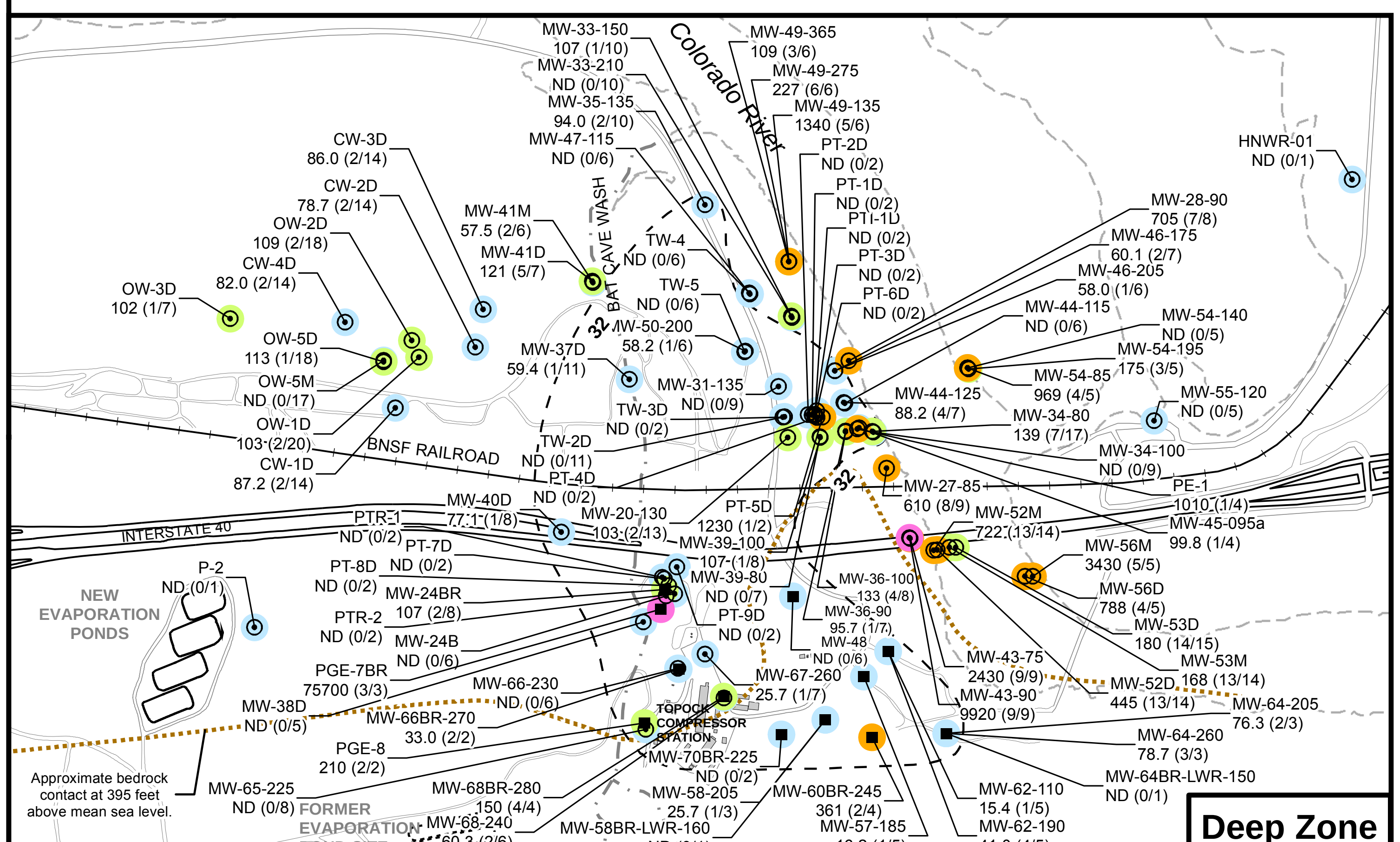
FIGURE 2.3-5
MANGANESE CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_3-5_METALSDIST_MN_RFI_RI60.MXD MSCHROCK 6/1/2012 2:46:52 AM







LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Groundwater Well completed in Bedrock

Dissolved Iron Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, micrograms per liter (µg/L) 1997 - 2011 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

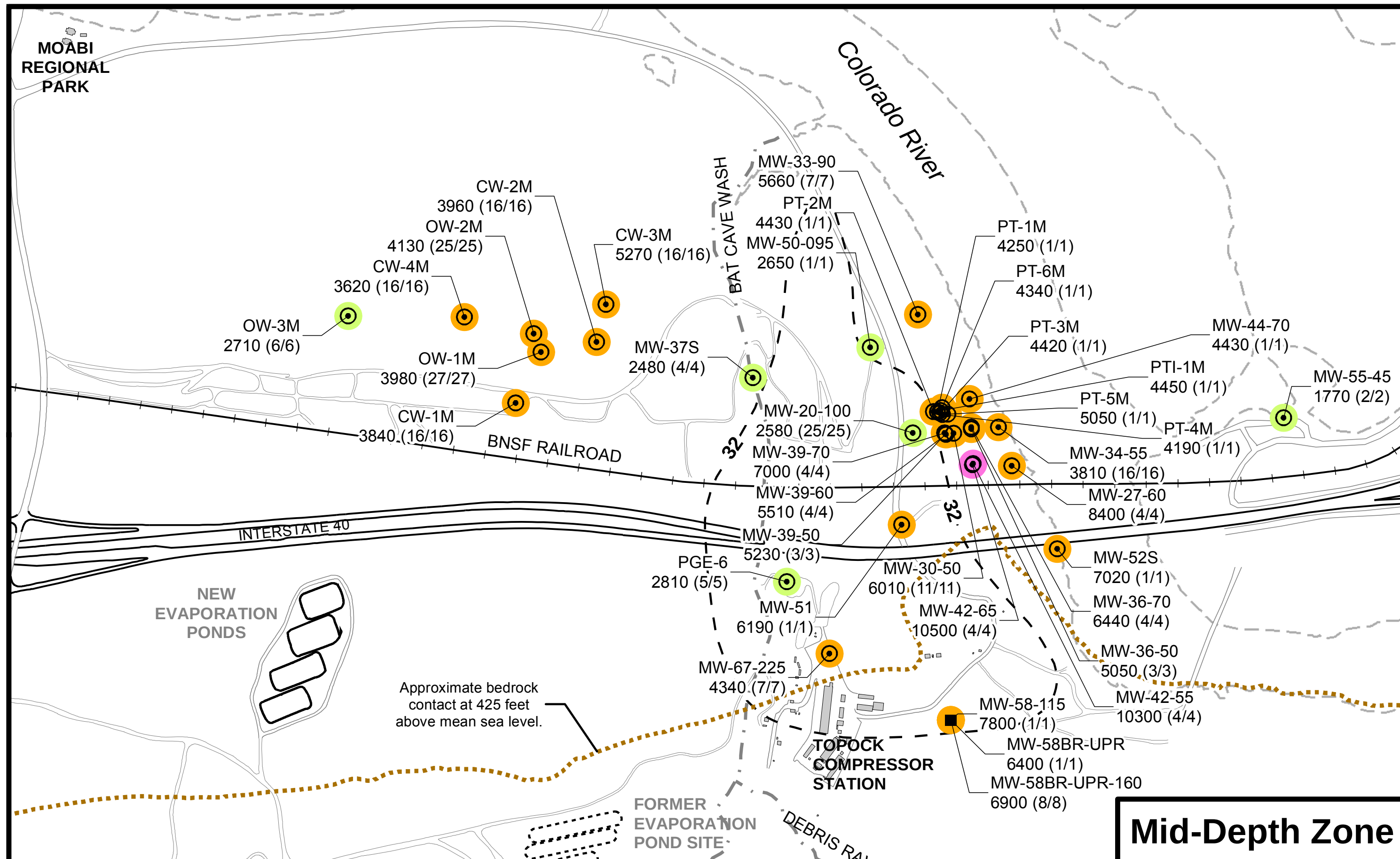
- ≤ 100 µg/L
- 100 - 300 µg/L
- 300 - 3,930 µg/L
- > 3,930 µg/L

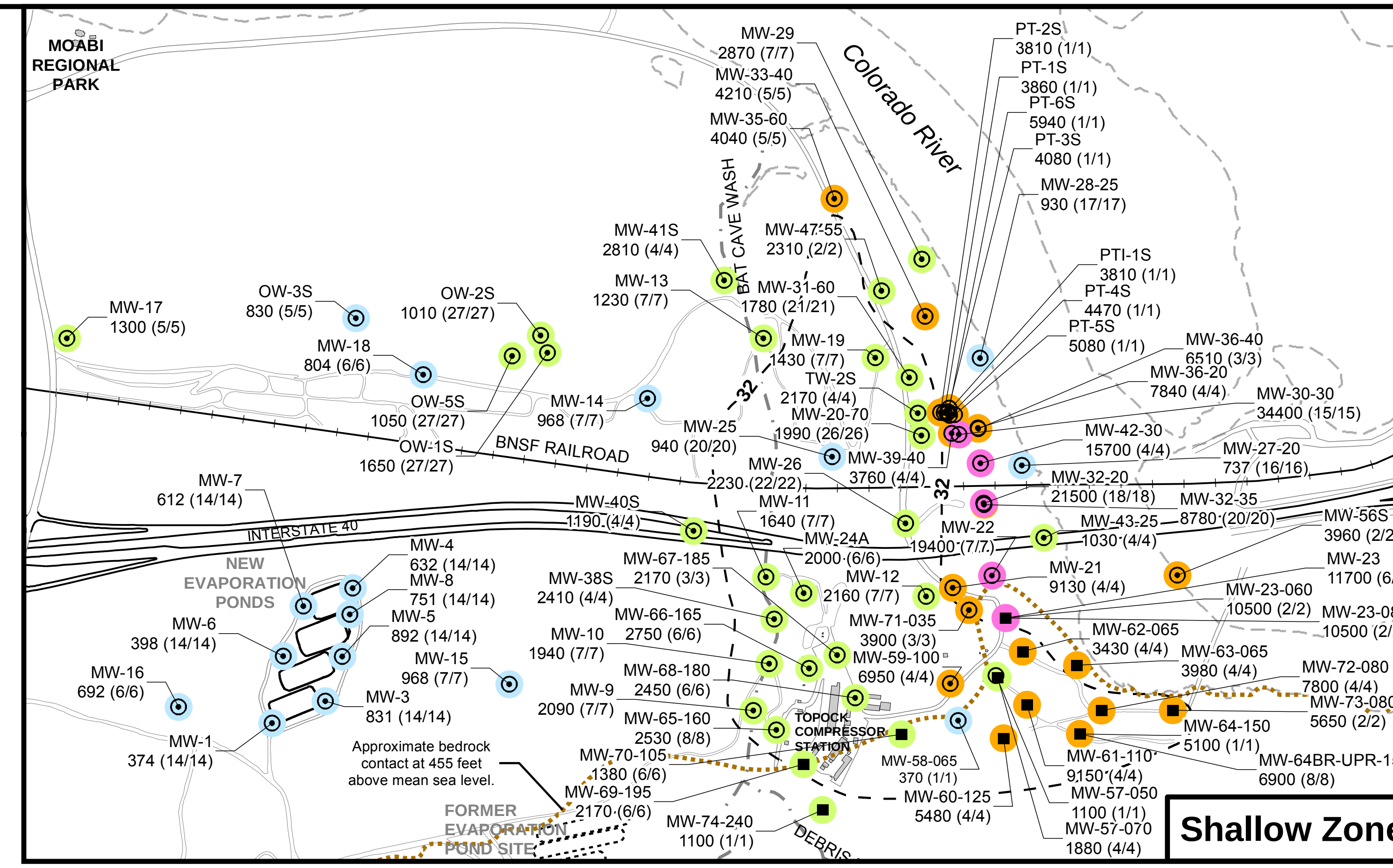
Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Iron Background Study Upper Tolerance Limit (UTL) = 3,930 µg/L
3. Iron applicable or relevant and appropriate requirement (ARAR) = 300 µg/L
4. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

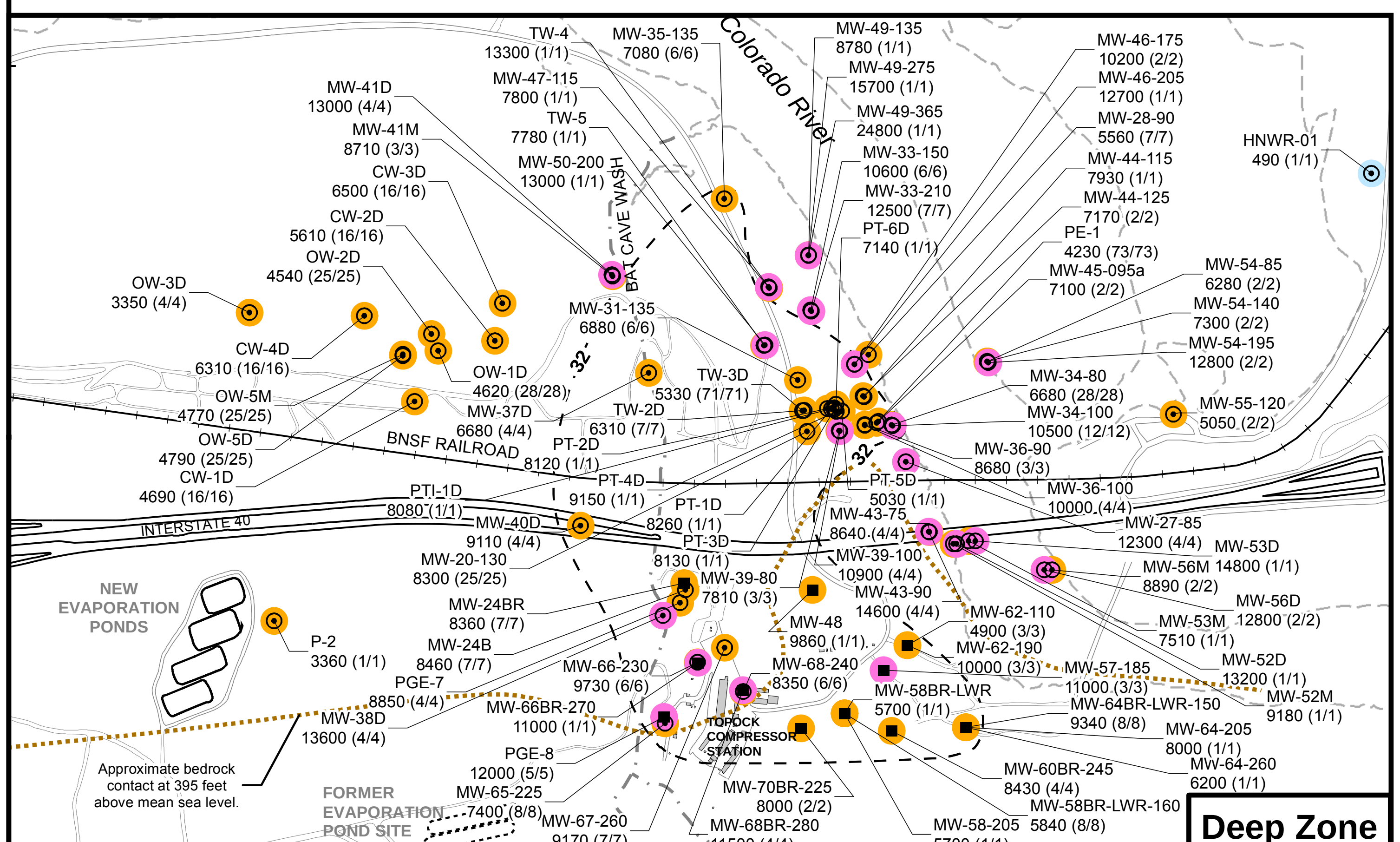
FIGURE 2.3-6
IRON CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_3-6_METALSDIST_FE_RFI_RI60.MXD MSCHROCK 6/1/2012 3:13:23 AM







LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Groundwater Well completed in Bedrock

Total Dissolved Solids (TDS) Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, milligrams per liter (mg/L) 1997 - 2011 groundwater sampling

≤ 1,000 mg/L

1,000 - 3,000 mg/L

3,000 - 10,000 mg/L

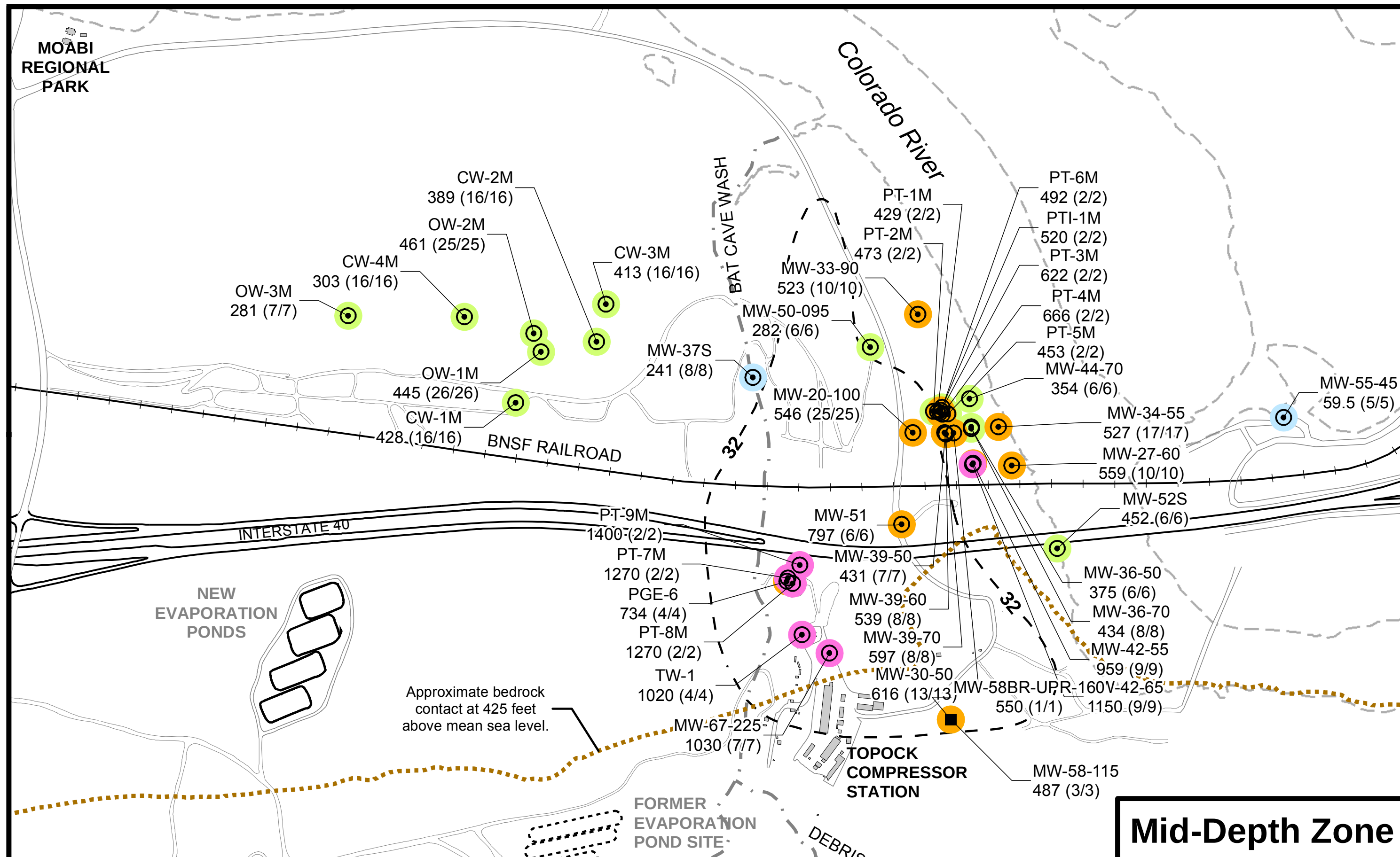
> 10,000 mg/L

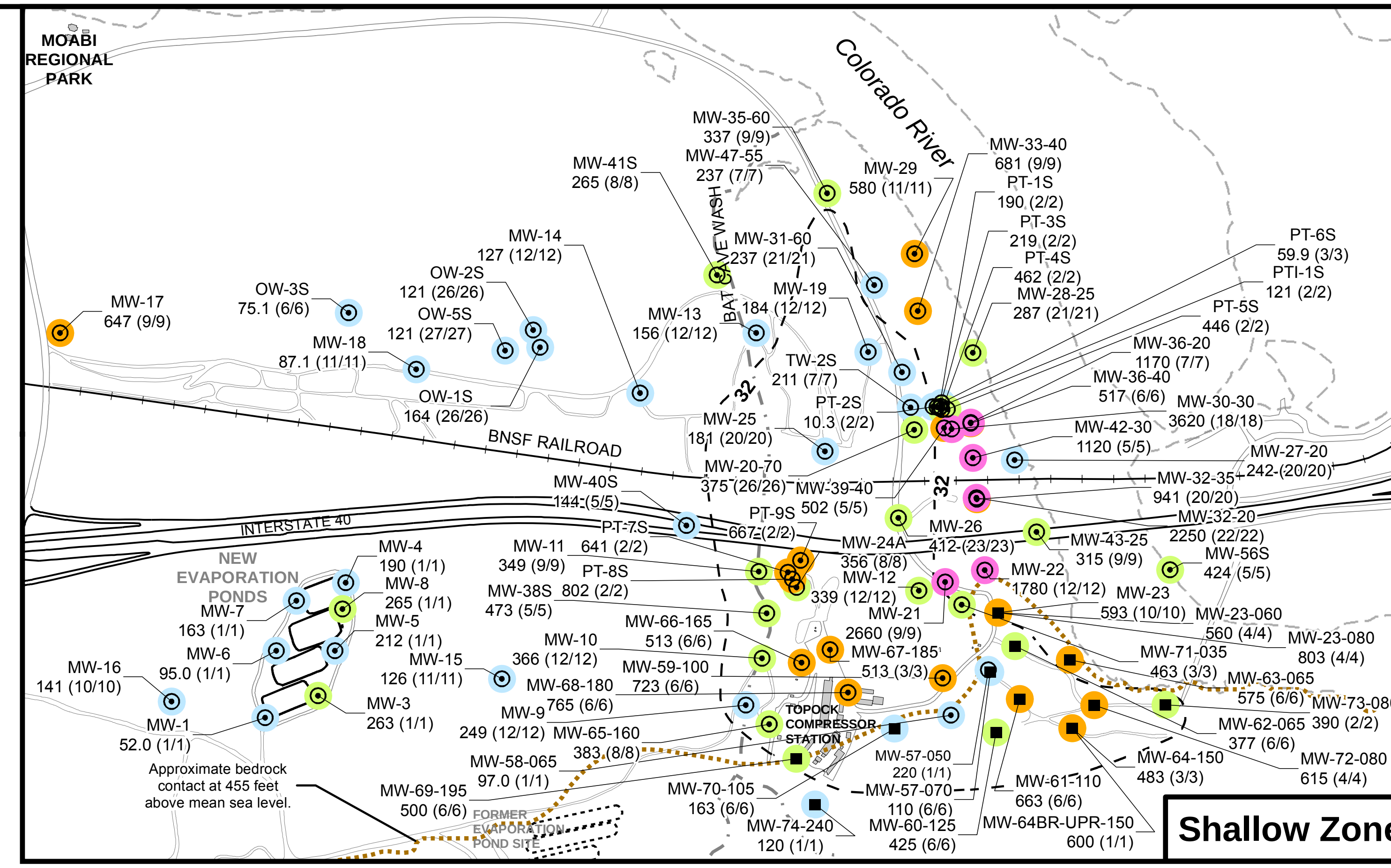
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 μg/L, Fourth Quarter 2011

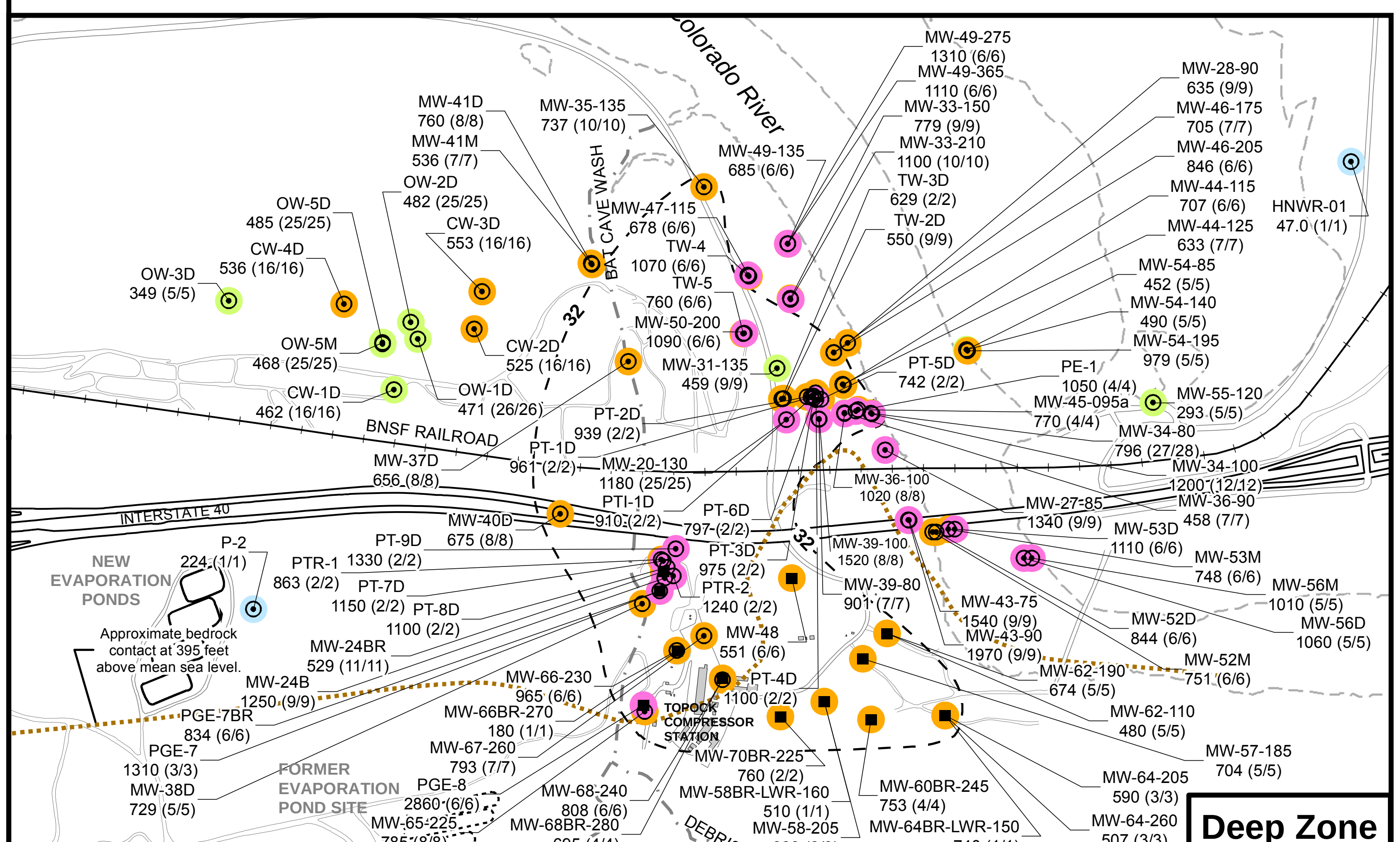
Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. TDS applicable or relevant and appropriate requirement (ARAR) = 1,000 mg/L
3. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

FIGURE 2.3-7
TDS CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA







LEGEND

⊙ Groundwater Well completed in Alluvial Aquifer (Shallow, Mid-depth or Deep Zones)

■ Groundwater Well completed in Bedrock

Sulfate Average Concentrations

MW-17 ← Well ID

5.8 (8/16) ← (No. of detections / No. of samples)

Average concentration, milligrams per liter (mg/L) 1997 - 2011 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 μg/L, Fourth Quarter 2011

- ≤ 250 mg/L
- 250 - 500 mg/L
- 500 - 1,000 mg/L
- > 1,000 mg/L

Notes:
1. Includes data through February 2012 for the East Ravine-Topock Compressor Station wells.
2. Sulfate applicable or relevant and appropriate requirement (ARAR) = 500 mg/L
3. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

FIGURE 2.3-8
SULFATE CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2011

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO G:\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2012\RFI_RI\FIG2_3-8_METALSDIST_SO4_RFI_RI60.MXD MSCHROCK 6/1/2012 4:03:38 AM

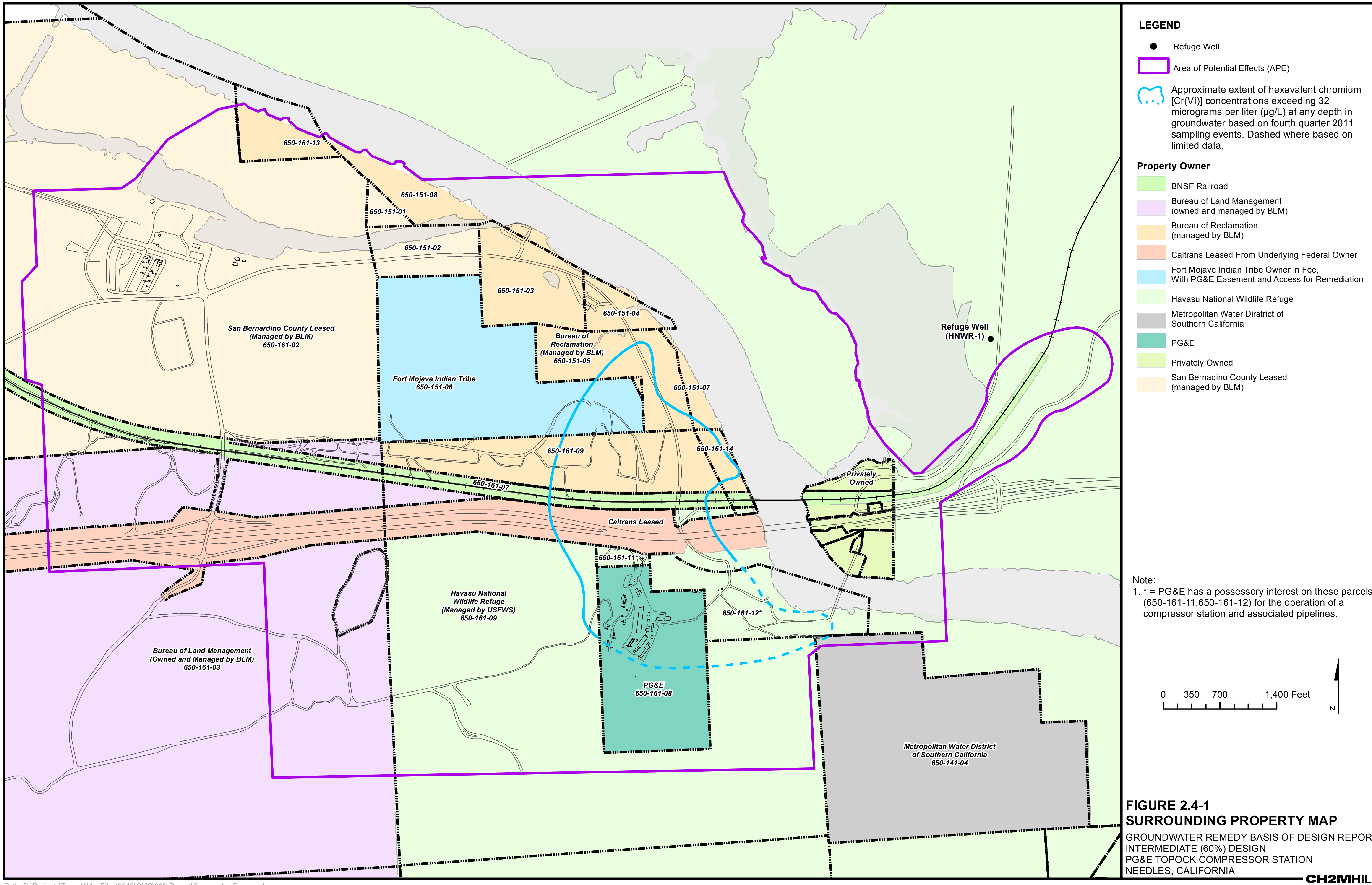
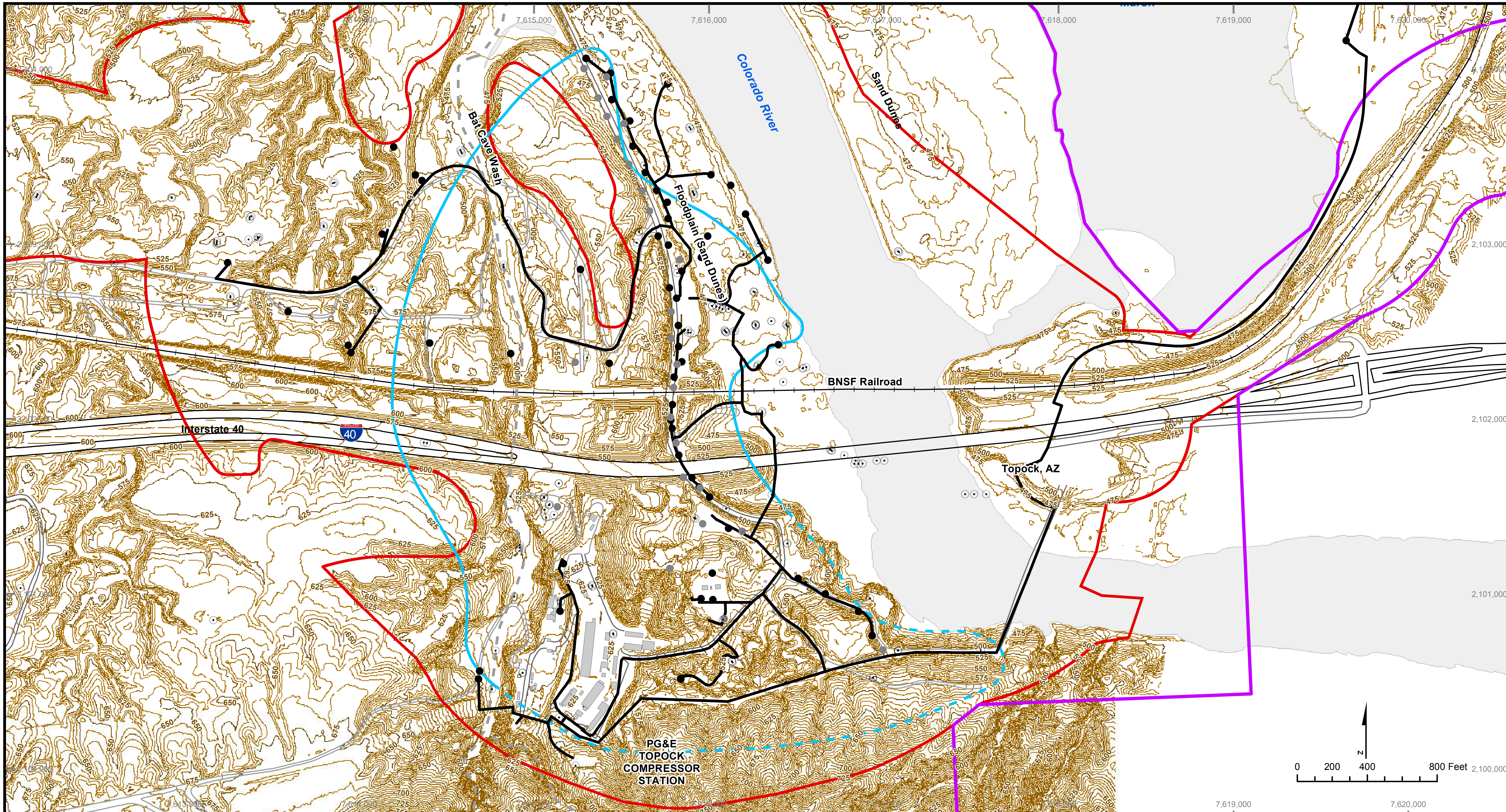


FIGURE 2.4-1
SURROUNDING PROPERTY MAP
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA



LEGEND

- Area of Potential Effects (APE)
- EIR Project Area
- Topographic Contour 25-foot Interval
- Topographic Contour 5-foot Interval
- Existing Monitoring Well
- Future Provisional Wells
- Remediation Wells
- Pipeline For Remedy
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Notes:
Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures

Sources:
Topographic data fromToponex Inc. flyover (2011).

California State Plane, NAD 83, Zone 5, US Feet Contour interval is 10 feet, with indexes at 50 feet.

FIGURE 2.4-2
SITE TOPOGRAPHY
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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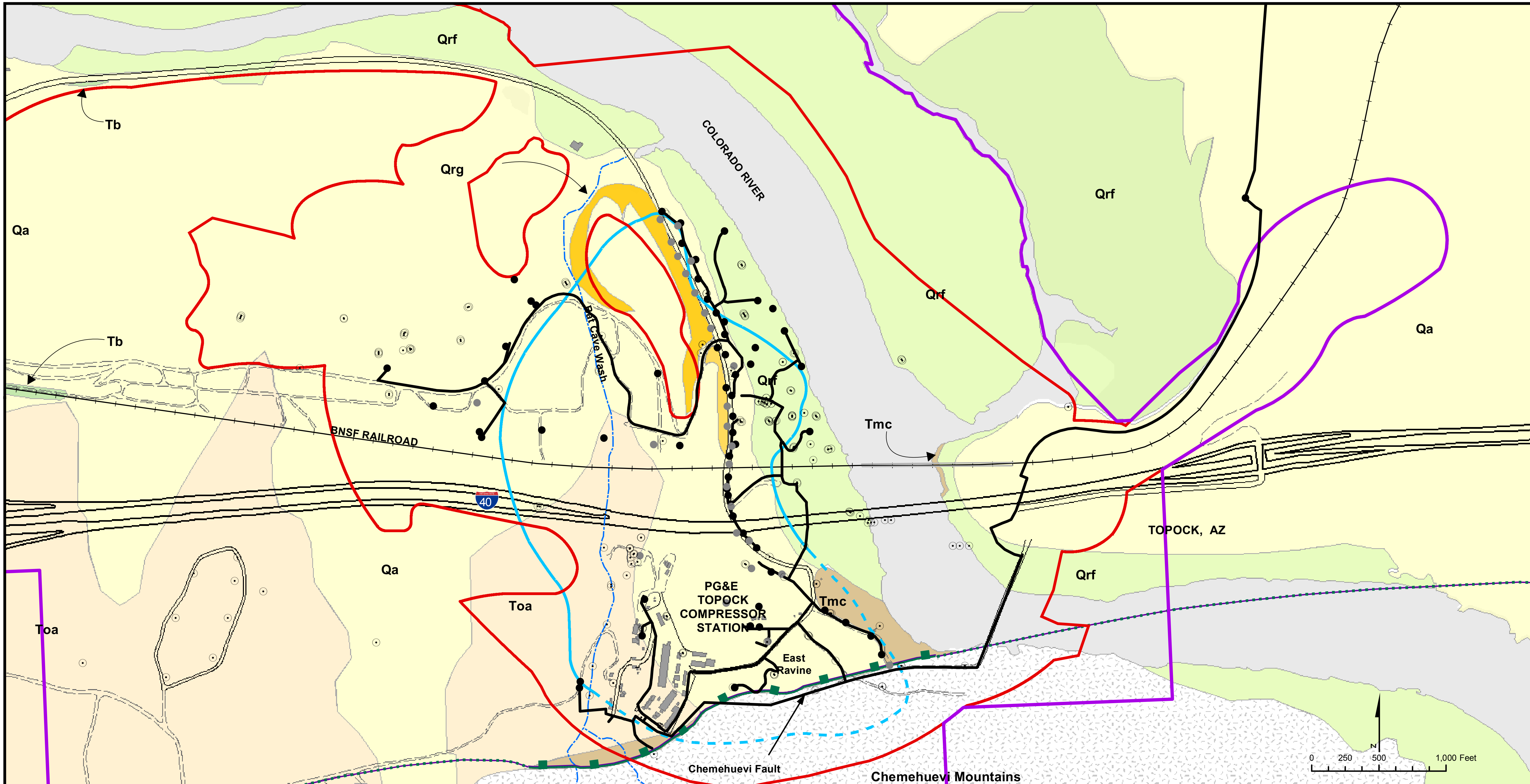

LEGEND

- Qrf = Quaternary Colorado River and recent Floodplain Deposits
- Qrg = Quaternary River Gravels
- Qa = Quaternary Alluvium and surficial deposits, undifferentiated
- Tb = Bouse Formation
- Toa = Tertiary Alluvium (Fanglomerate of Metzer and Loeltz)
- Tmc = Miocene Conglomerate (Bedrock)
- pTbr = Pre-Tertiary Bedrock (Metadiorite, Gneiss, Granitic Rocks)
- Existing Monitoring Well
- Future Provisional Wells
- Remediation Wells
- Pipeline For Remedy
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on second quarter 2011 sampling events. Dashed where based on limited data.
- Area of Potential Effects (APE)
- EIR Project Area

Notes:

1. Generalized surface geologic map compiled from Metzger and Loeltz (1973), John (1987), Howard and others (1997), and PG&E technical reports.
2. This geologic map east of the Compressor Station was updated with mapping from the 2009 East Ravine investigation (CH2M HILL,2009).
3. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

FIGURE 2.4-3
GEOLOGIC MAP
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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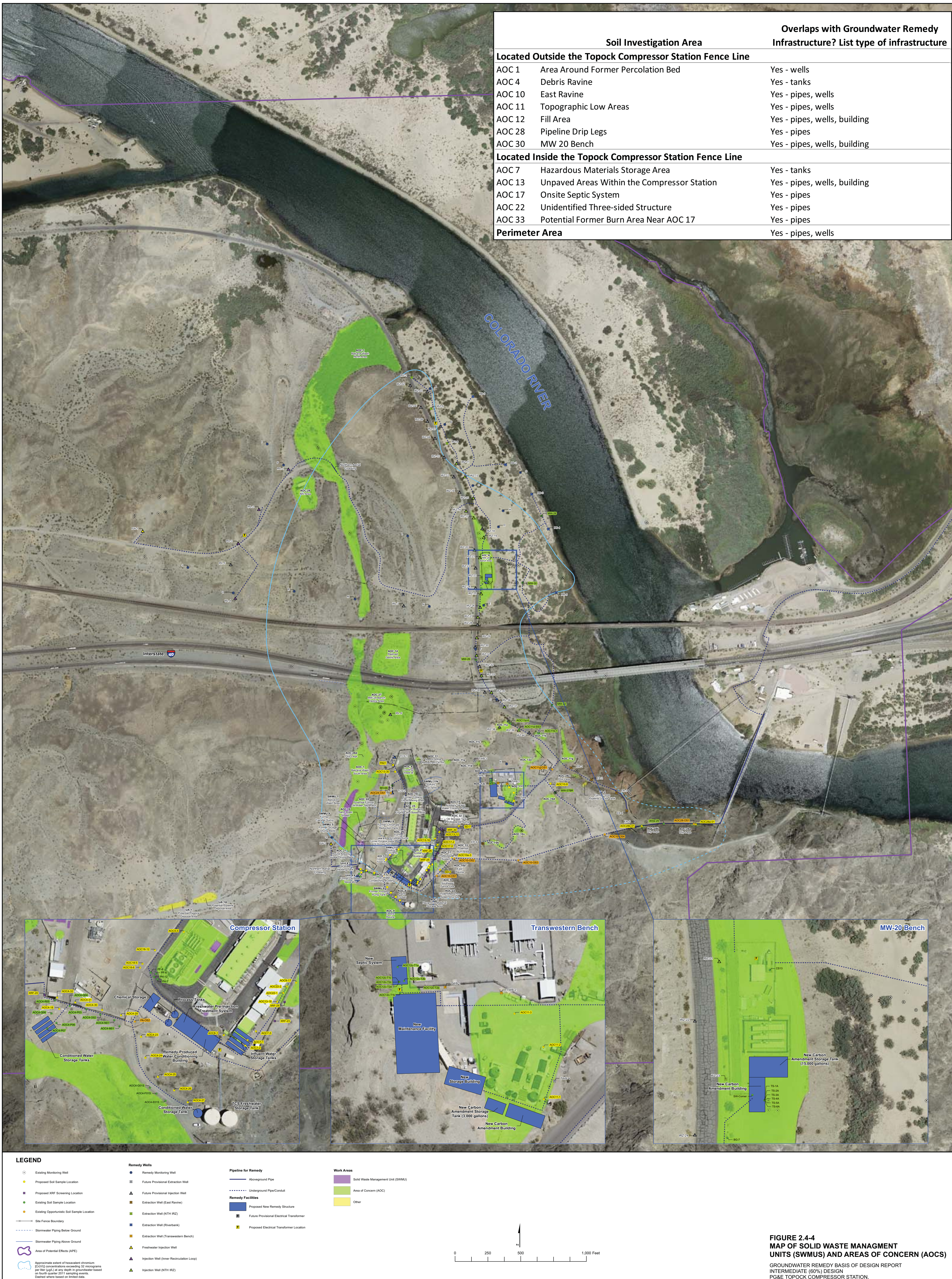
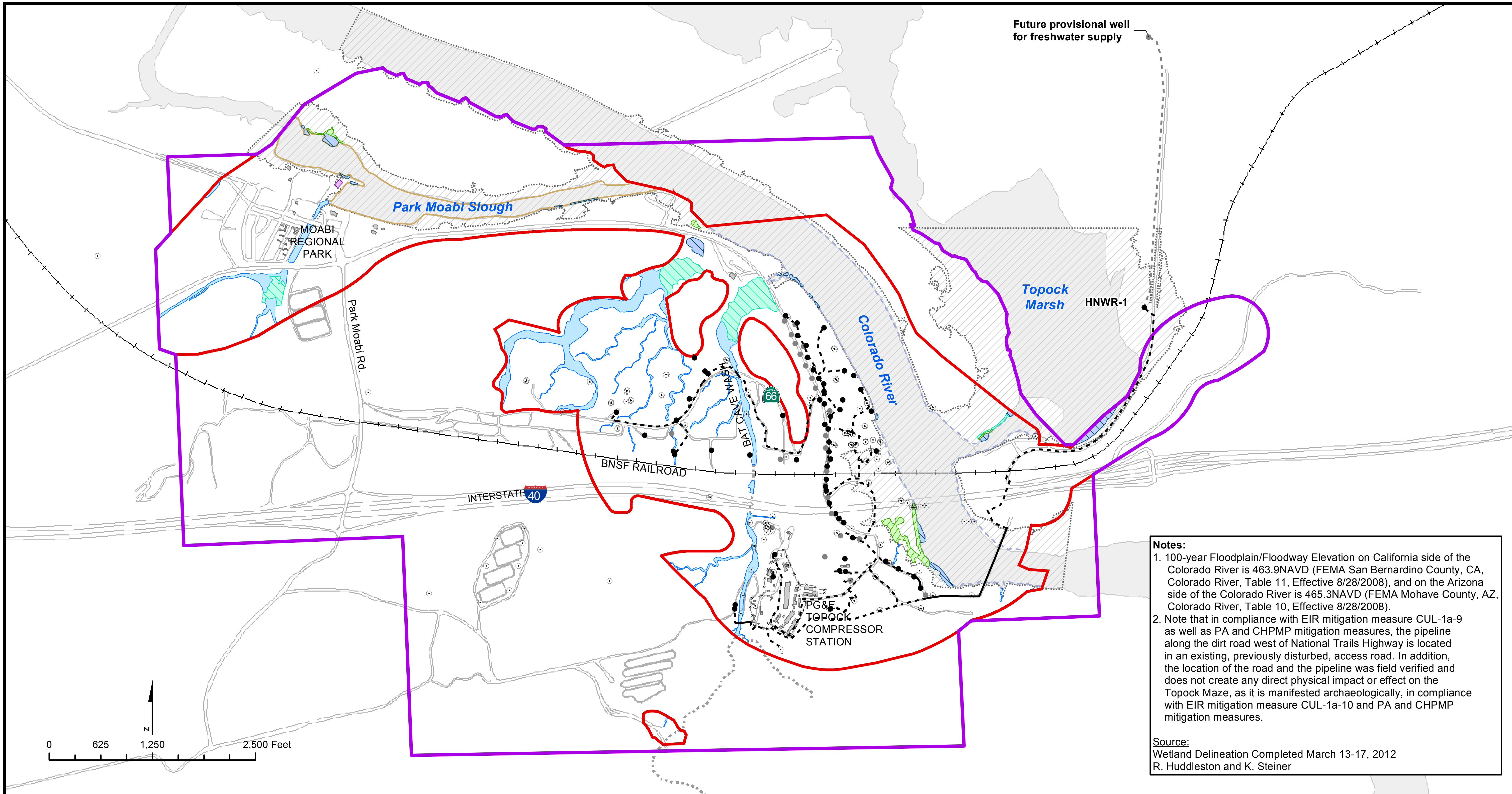


Soil Investigation Area		Overlaps with Groundwater Remedy Infrastructure? List type of infrastructure
Located Outside the Topock Compressor Station Fence Line		
AOC 1	Area Around Former Percolation Bed	Yes - wells
AOC 4	Debris Ravine	Yes - tanks
AOC 10	East Ravine	Yes - pipes, wells
AOC 11	Topographic Low Areas	Yes - pipes, wells
AOC 12	Fill Area	Yes - pipes, wells, building
AOC 28	Pipeline Drip Legs	Yes - pipes
AOC 30	MW 20 Bench	Yes - pipes, wells, building
Located Inside the Topock Compressor Station Fence Line		
AOC 7	Hazardous Materials Storage Area	Yes - tanks
AOC 13	Unpaved Areas Within the Compressor Station	Yes - pipes, wells, building
AOC 17	Onsite Septic System	Yes - pipes
AOC 22	Unidentified Three-sided Structure	Yes - pipes
AOC 33	Potential Former Burn Area Near AOC 17	Yes - pipes
Perimeter Area		Yes - pipes, wells

FIGURE 2.4-4
MAP OF SOLID WASTE MANAGMENT UNITS (SWMUS) AND AREAS OF CONCERN (AOCS)
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL



Notes:

1. 100-year Floodplain/Floodway Elevation on California side of the Colorado River is 463.9NAVD (FEMA San Bernardino County, CA, Colorado River, Table 11, Effective 8/28/2008), and on the Arizona side of the Colorado River is 465.3NAVD (FEMA Mohave County, AZ, Colorado River, Table 10, Effective 8/28/2008).
2. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

Source:
Wetland Delineation Completed March 13-17, 2012
R. Huddleston and K. Steiner

LEGEND

- Future Provisional Wells
- Proposed Remedy/Monitoring Wells
- Above Ground Pipeline/Conduit Alignment
- Underground Pipeline/Conduit Alignment
- Future Provisional/Contingent Water Pipe
- Existing Monitoring Well
- EIR Project Area
- Area of Potential Effect (APE)
- Compressor Station Fence Line
- Palustrine Scrub-Shrub Temporarily Flooded
- Palustrine Unconsolidated Bottom Permanently Flooded Excavated
- Palustrine, Emergent, Permanently Flooded
- Palustrine, Emergent, Seasonally Flooded
- Riverine Intermittent Stream Bed Cobble-Gravel Temporarily Flooded
- Riverine Lower Perennial Unconsolidated Bottom Sand Excavated
- Riverine Lower Perennial Unconsolidated Bottom Sand
- 100yr. Floodplain

FIGURE 2.4-5
JURISDICTIONAL WATERS AND WETLANDS IN PROJECT AREA, 2012

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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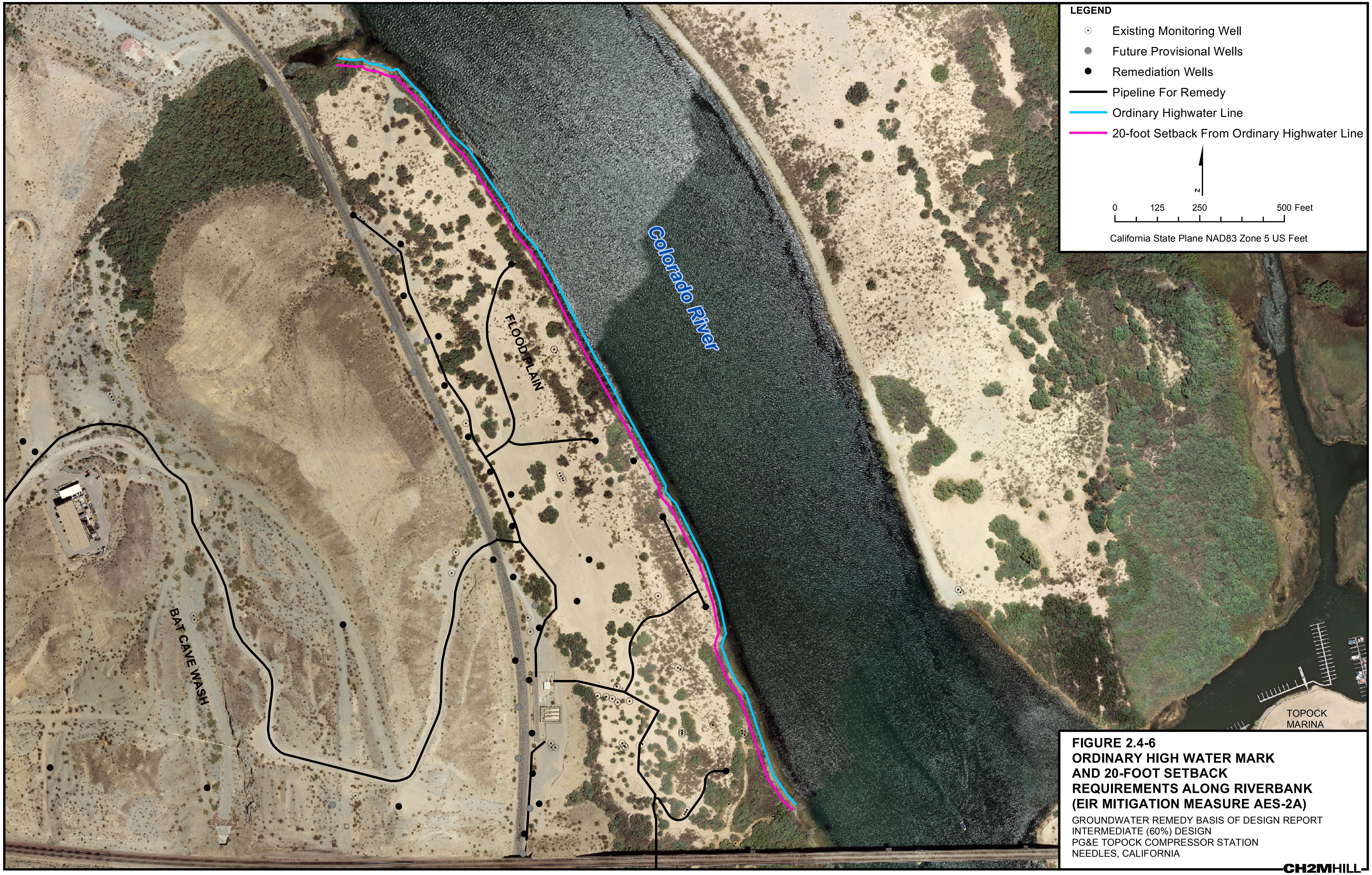

FIGURE 2.4-6
ORDINARY HIGH WATER MARK AND 20-FOOT SETBACK REQUIREMENTS ALONG RIVERBANK (EIR MITIGATION MEASURE AES-2A)

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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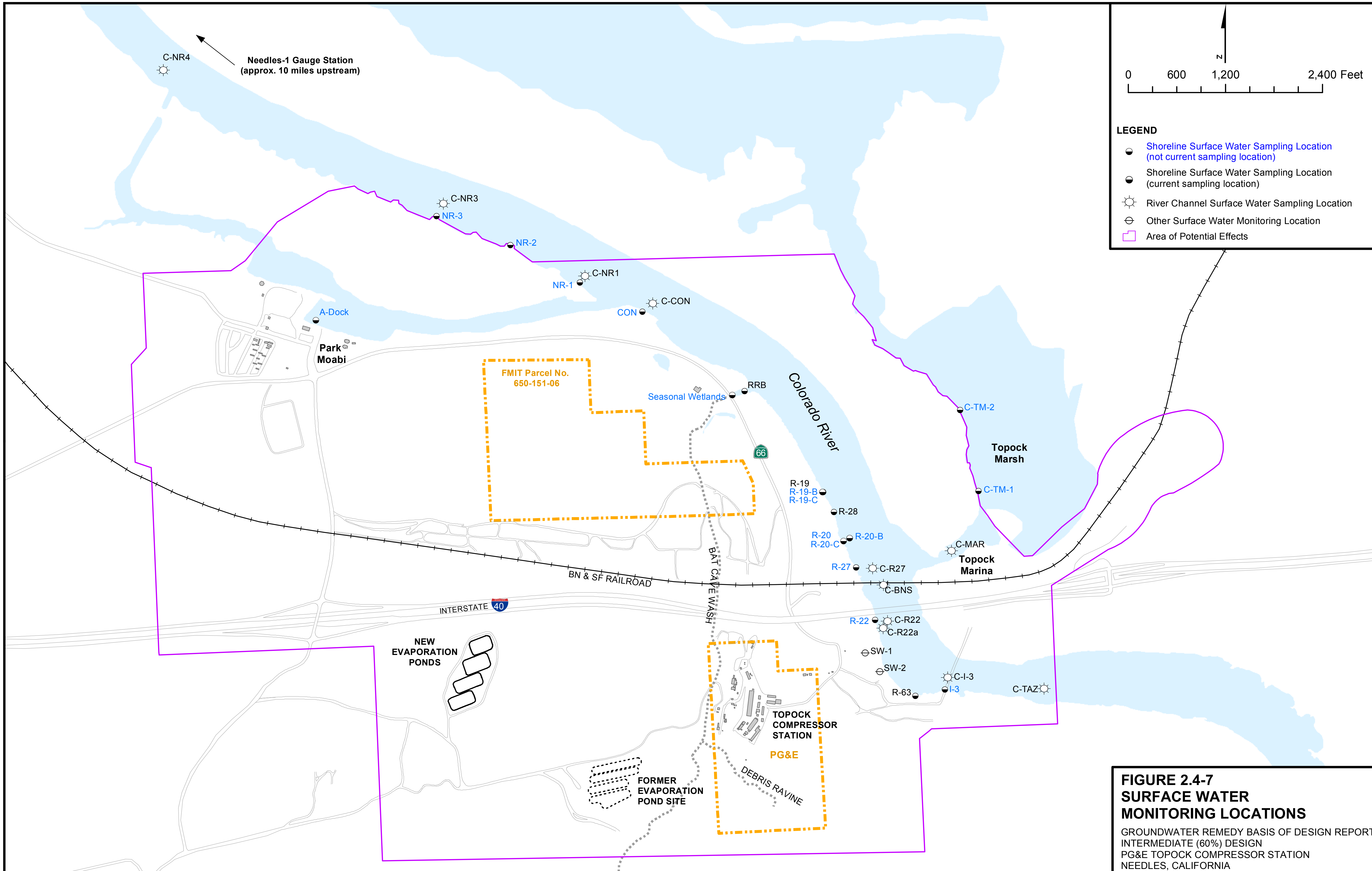

FIGURE 2.4-7
SURFACE WATER MONITORING LOCATIONS

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

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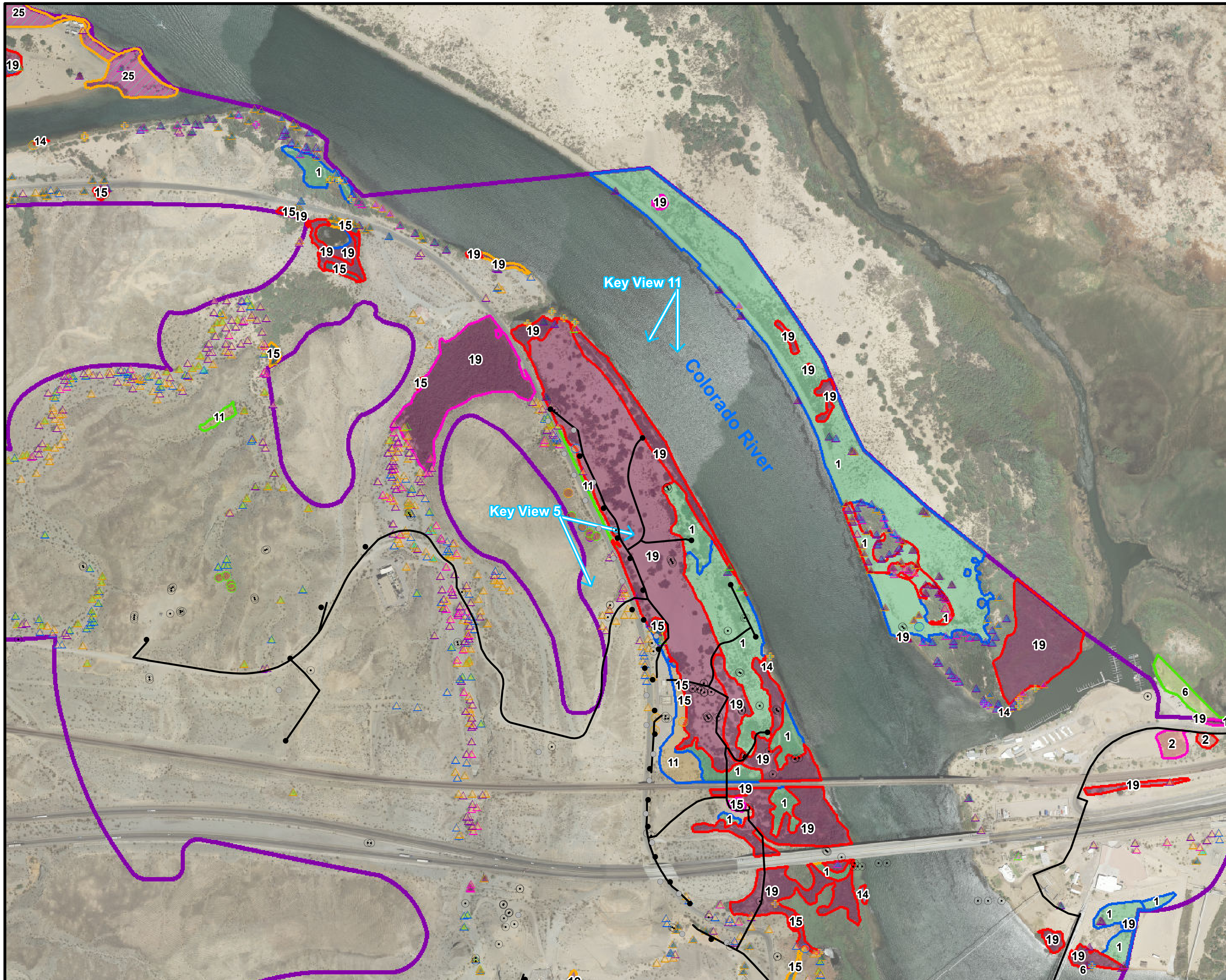

LEGEND

- Existing Monitoring Wells
- Future Provisional Wells
- Remedy Wells
- Pipeline for Remedy
- EIR Project Area
- KeyView
- Herb
- Tree
- Shrub

Height Designations

Very Tall features are outlined in PINK

Tall features are outlined in RED

Medium features are outlined in ORANGE

Short features are outlined in BLUE

Features with multiple height classes are outlined in GREEN

Notes:

1. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.
2. See following page for complete Mature Plant Legend.

N

0 500 1,000 Feet

FIGURE 2.4-8 MATURE PLANTS FROM KEY VIEWS 5 AND 11 WITHIN THE EIR PROJECT AREA IN COMPLIANCE WITH MITIGATION MEASURES AES-1 AND AES-2

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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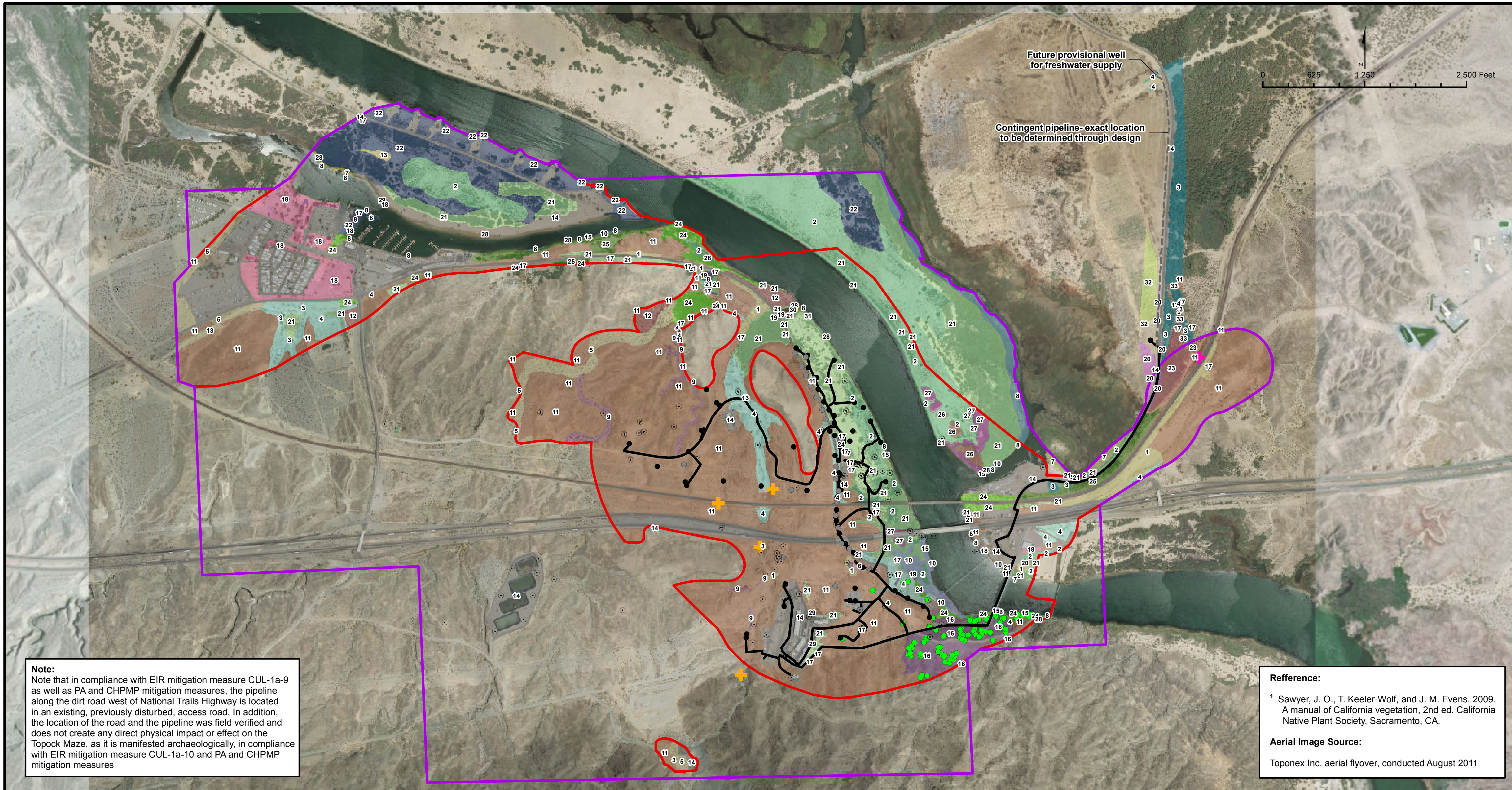

Note:
Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures

Refference:

[1] Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. A manual of California vegetation, 2nd ed. California Native Plant Society, Sacramento, CA.

Aerial Image Source:

Toponex Inc. aerial flyover, conducted August 2011

LEGEND

- Existing Monitoring Well
- Future Provisional Wells
- Remediation Wells
- Pipeline For Remedy
- Area of Potential Effects (APE)
- EIR Project Area

California Rare Plant Ranked Species (CNPS, 2011)

- Mousetail suncup (*Chylismia arenaria*)
- Spiny-haired blazing-star (*Mentzelia tricuspis*)*
- Hillside palo verde

* Considered a special-status plant in California, but identified in Arizona.

Vegetation Area Types

- Restoration Area
- Allscale Scrub (MCV2[1]: Allscale scrub) [1]
- Arrow Weed (MCV2: Arrow weed thickets)[2]
- Athel Tamarisk (MCV2: Tamarisk thickets)[3]
- Blue Paloverde (MCV2: Blue palo verde-Ironwood woodland)[4]
- Blue Paloverde/Catclaw Acacia (MCV2: Blue palo verde-Ironwood woodland)[5]
- Blue Paloverde/Honey Mesquite (MCV2: Blue palo verde woodland)[6]
- Broad-leaved Cattail (MCV2: Cattail marshes)[7]
- California Bullrush (MCV2: California bulrush marsh)[8]
- Catclaw Acacia (MCV2: Catclaw acacia thorn scrub)[9]
- Common Reed (MCV2: Common reed marshes)[10]
- Creosote bush scrub (MCV2:Creosote bush scrub)[11]
- Creosote Bush/Cattle Saltbush (MCV2: Allscale scrub)[12]
- Desert Smoke Tree (MCV2: Blue palo verde-Ironwood woodland)[13]
- Developed/Disturbed[14]
- Giant Reed (MCV2:Giant reed breaks)[15]
- Hillside Paloverde (MCV2: Foothill palo verde desert scrub)[16]
- Honey Mesquite (MCV2: Mesquite bosque)[17]
- Landscaped[18]
- Open Water [19]
- Quailbush Scrub (MCV2: Quailbush scrub)[20]
- Salt Cedar (MCV2: Tamarisk thickets)[21]
- Salt Cedar/Arrow Weed (MCV2: Tamarisk/Arrow weed thickets)[22]
- Salt Cedar/Athel Tamarisk (MCV2: Tamarisk thickets)[23]
- Salt Cedar/Honey Mesquite (MCV2: Tamarisk thickets/Mesquite bosque)[24]
- Salt Cedar/Honey Mesquite/Blue Paloverde (MCV2: Tamarisk thickets/Mesquite bosque/Blue palo verde-Ironwood woodland)[25]
- Salt Cedar/Screwbean Mesquite (MCV2: Tamarisk thickets/ Screwbean mesquite bosque)[26]
- Screwbean Mesquite (MCV2: Screwbean mesquite bosque)[27]
- Wetland [28]

FIGURE 2.4-9
VEGETATION COMMUNITIES IN EIR PROJECT AREA IN COMPLIANCE WITH MITIGATION MEASURES BIO-2A, BIO-2B, AND BIO-2C
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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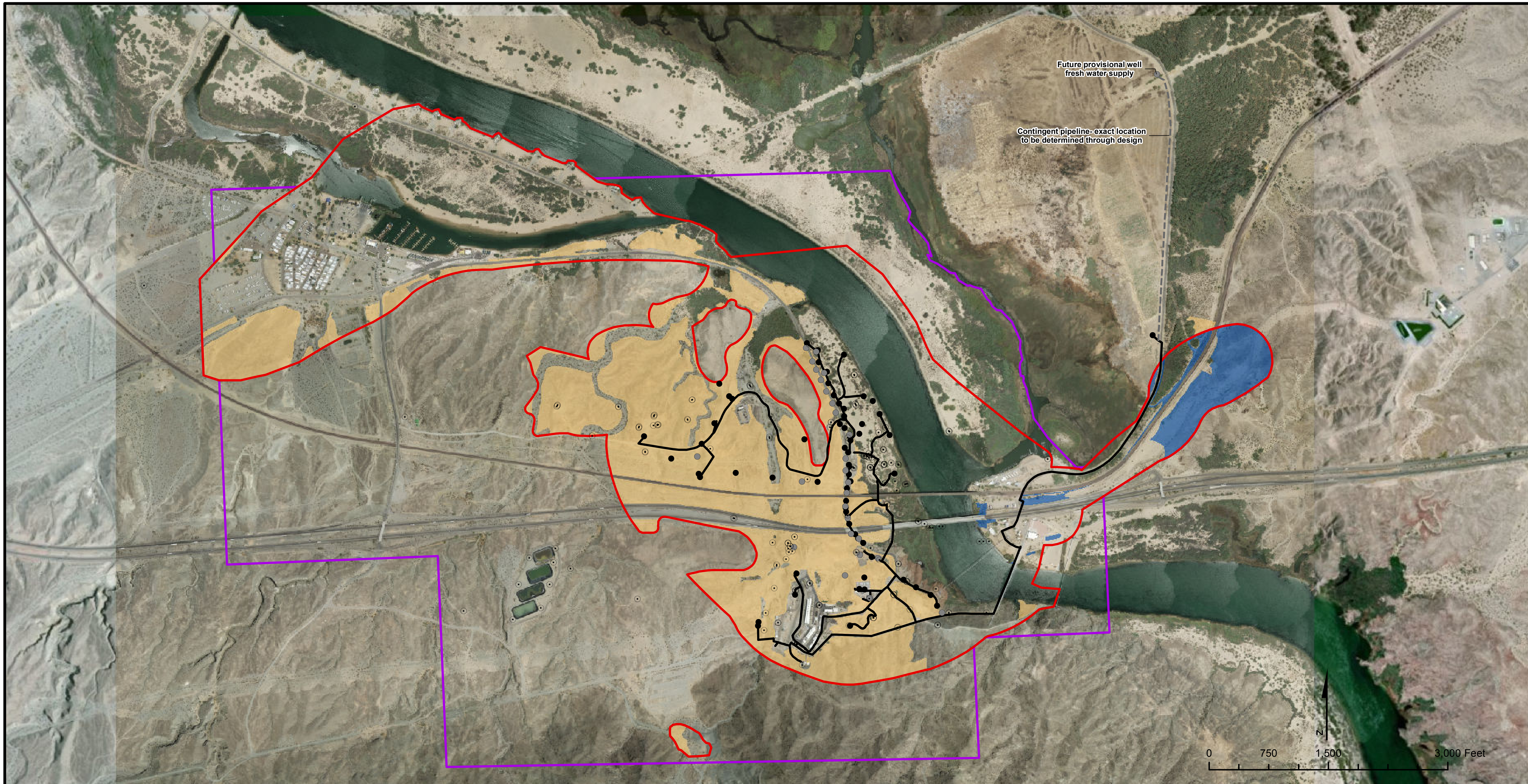


LEGEND

- EIR Project Area
- Area of Potential Effects (APE)
- Existing Monitoring Well
- Future Provisional Wells
- Remediation Wells
- Pipeline For Remedy

Habitat Areas

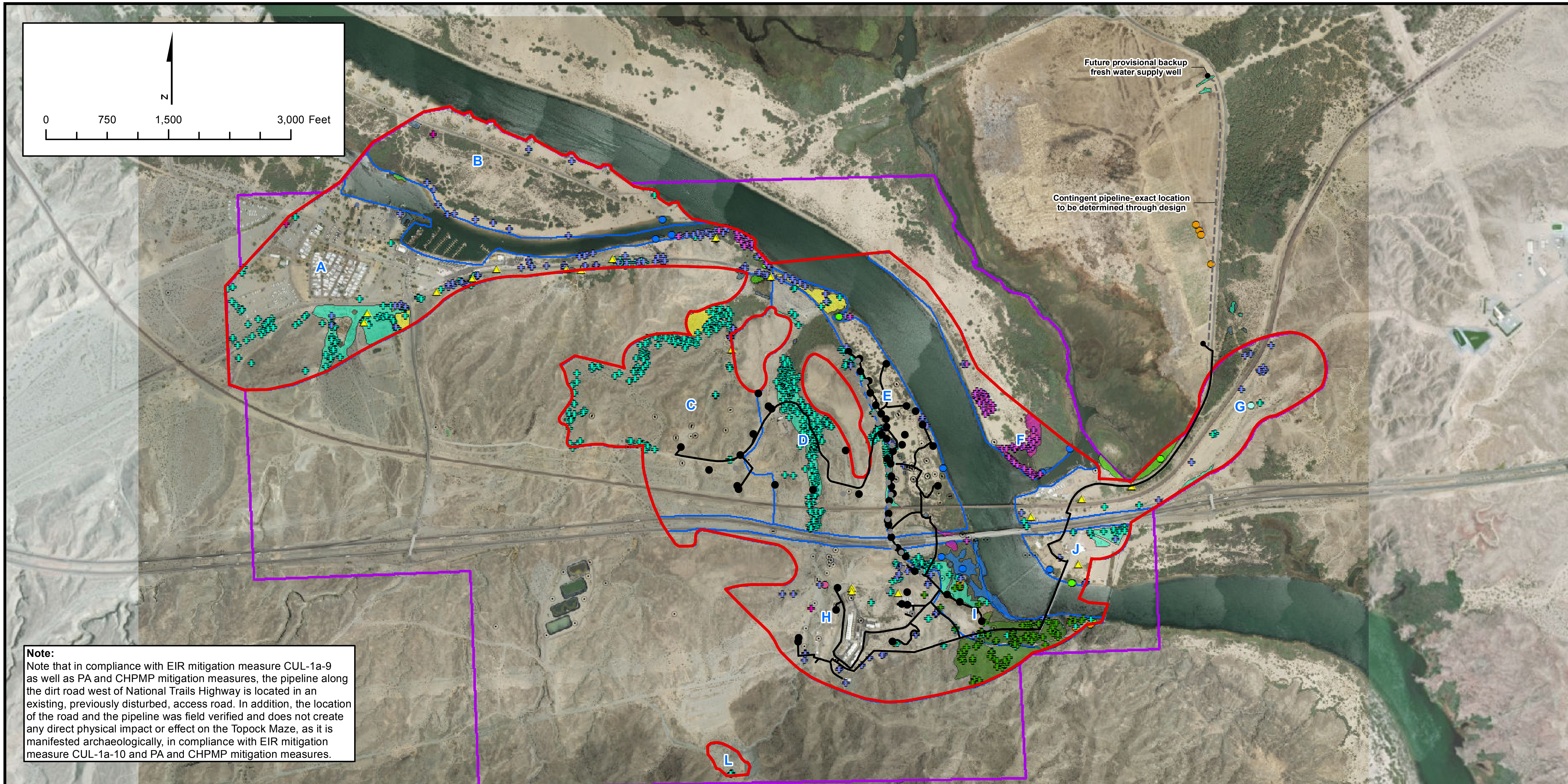
- Agassiz's Desert Tortoise
- Morafkai's Desert Tortoise

Note:
Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

FIGURE 2.4-10
HABITATS OF DESERT TORTOISE SPECIES, IN COMPLIANCE WITH MITIGATION MEASURES BIO-2B

Groundwater Remedy Basis of Design Report
Intermediate (60%) Design
PG&E Topock Compressor Station,
Needles, California

CH2MHILL



Note:
Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

LEGEND

- Existing Monitoring Well
- Future Provisional Wells
- Remediation Wells
- Pipeline For Remedy
- EIR Project Area
- Area of Potential Effects (APE)
- Survey Segment

Shrubs

Common Name	Scientific Name	Survey Segment
Cattle Saltbush	*Atriplex polycarpa*	A, B, C, D, G, H, I, J
Big Saltbush	*Atriplex lentiformis*	A, G, I, J

Source:
Appendix PLA of the Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project (January 2011)

Herbs

Common Name	Scientific Name	Survey Segment
Broad-leaved Cattail	*Typha latifolia*	A, C, E, G, I, J
Common Reed	*Phragmites australis*	A, B, E, F, G, I, J
Desert Tobacco	*Nicotiana obtusifolia*	H, I, L
Desert Lily	*Hesperocallis undulata*	G
Chia	*Salvia columbariae*	D,H
Golden suncup	*Chylismia brevipes*	A,C

Trees

Common Name	Scientific Name	Survey Segment
Blue Palo Verde	*Parkinsonia florida*	A, C, E, G, I, J
Goodding's Willow	*Salix*	A, B, E, F, G, I, J
Hillside Palo Verde	*Parkinsonia microphylla*	H, I, L
Screw Bean Mesquite	*Prosopis pubescens*	A, E, F
Honey Mesquite	*Prosopis glandulosa*	A, C, E, G, H, I, J

FIGURE 2.4-11
INDIGENOUS PLANTS OF TRADITIONAL CULTURAL SIGNIFICANCE WITHIN THE EIR PROJECT AREA IN COMPLIANCE WITH MITIGATION MEASURE CUL-1A-5
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

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SECTION 3

Design Basis and Assumptions

This section presents the design basis and assumptions for the remedy, along with the uncertainties at this intermediate (60%) 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, Development of Groundwater Flow, Geochemical, and Solute Transport Models. In addition, design basis and assumptions for the in-situ remediation system, freshwater supply and pre-injection treatment, 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 remedy components 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 draft specifications is provided in Appendix E. Figure 3.0-1 shows the overall system layout.

3.1 Summary of Modeling

The groundwater flow and solute transport model for the site consists of the groundwater flow submodel (developed in MODFLOW, a publicly available groundwater flow simulation program developed by the U.S. Geological Survey [USGS] [McDonald and Harbaugh 1988]) and the solute transport model (developed using the modular three-dimensional transport model MT3DMS[2]). Additional modeling efforts completed since the 30% design submittal included geochemical modeling simulations. Details regarding the development of these modeling study components are provided in Sections 3.1.1 through 3.1.3, as well as Appendix B.

3.1.1 Groundwater Flow Submodel Development

The groundwater flow submodel for the site is based on the original regional groundwater flow model ("the regional flow model"), a finite element flow model developed using MicroFEM (Hemker 2011) and calibrated in 2005 (CH2M HILL 2005). Details of the calibration are available in the Groundwater Model Update Report, dated July 29, 2005 (CH2M HILL 2005). In general, the regional flow model was calibrated against: (1) long-term average groundwater levels; (2) average monthly floodplain levels responding to fluctuating river levels; (3) short-term responses to pump testing events; and (4) plume development over time. In addition, the auto-calibration program PEST was employed to refine the calibration and to reduce the effects of uncertainty in each calibration target. This calibration procedure yielded a highly variable distribution of hydraulic conductivities to better reflect the local-scale geologic heterogeneities that characterize the natural system.

Some modifications were made to the 2005 regional flow model prior to the CMS/FS to incorporate findings from investigations conducted in the East Ravine area (see Appendix E in CH2M HILL 2009d), and to support the design of the selected remedy, the regional flow model was further updated with lithologic and hydraulic data that had become available since the original calibration.

The groundwater flow submodel was extracted from the updated regional flow model and converted to MODFLOW in order to improve the model resolution and facilitate the use of MT3DMS for the solute transport modeling (the MT3DMS code uses the flows computed by MODFLOW in its transport calculations). The submodel domain, which includes approximately 1.3 square miles of the full regional flow model domain, was selected to incorporate the extent of the hexavalent chromium plume, the portion of the Colorado River adjacent to the site, and all elements of the proposed remediation system. Additional details regarding the submodel domain, discretization, and hydraulic properties are provided in Appendix B. In general, the groundwater flow submodel

[2] See Section 3.1.2 for a discussion of the MT3DMS model.

honors the hydraulic conductivity distribution and boundary conditions (i.e., simulated groundwater heads and fluxes) established by the original regional model.

3.1.2 Solute Transport Model Development

The solute transport model was developed using the modular three-dimensional transport code referred to as MT3DMS. Originally known as MT3D, this modeling software 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 named 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 (i.e., advection-diffusion formulation, which accounts for the mass exchange between mobile and immobile portions of the aquifer) 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 from the introduction of carbon to the aquifer.

The specific input values (solute transport parameters) utilized in the solute transport model along with the rationale for their selection are provided in Appendix B. In general, these values were developed based on the available literature and/or site-specific data obtained from previous investigations, in-situ pilot testing, and experience operating IM-3 at the site. In addition, a sensitivity analysis was conducted in which various parameters (e.g., Cr[VI] partition coefficient, manganese generation/attenuation rate, and arsenic generation/attenuation rate) were adjusted until a reasonable qualitative and quantitative fit to the observed data was obtained.

3.1.3 Geochemical Model Development

Geochemical modeling (batch and one-dimensional transport simulations incorporating the biogeochemical reactions governing solute behavior in the aquifer) was performed to evaluate the anticipated behavior of reactive species during remedy implementation, including total organic carbon (TOC), Cr(VI), and byproducts as a function of groundwater geochemistry and aquifer properties. The goals of the geochemical modeling effort were to characterize known geochemical reactions that will occur and to aid in the estimation of parameters used in the sitewide solute transport model. A detailed description of the reactions that were included in the geochemical simulations is provided in Appendix B. Another important goal of the geochemical modeling was to test the validity of the sitewide solute transport model in describing Cr(VI) reduction and byproduct dynamics. In some cases, detailed in Appendix B, the sitewide solute transport model could not explicitly take into account the geochemistry and thermodynamics of the modeled reactions. In these cases, the geochemical model was used to confirm that these geochemical processes (e.g., kinetically-limited reductive dissolution of manganese oxides) were being adequately captured by the simplified representations used in the solute transport model (e.g., empirically derived proportionality constant linking manganese generation to the concentration of organic carbon). A detailed discussion of the geochemical modeling results and their impact on the solute transport model is provided in Appendix B.

The geochemical model simulations included batch systems (i.e., well-mixed, no transport) and simplified one-dimensional transport simulations highly representative of aquifer conditions. Batch simulations were performed with the geochemical modeling software PHREEQC using the default PHREEQC thermodynamic database. Additional geochemical parameters that were not listed in the default database were collected from literature sources, including Dzombak and Morel (1990), Morel and Hering (1993), and others as indicated in Appendix B. One-dimensional reactive transport simulations were performed using PHT3D, which links the solute transport modeling software MT3DMS with PHREEQC. Although PHREEQC alone can be used for one-dimensional transport modeling, the linkage with MT3DMS provides a more robust, stable, and efficient numerical code for transport calculations. The same modified PHREEQC thermodynamic database was used in the PHT3D simulations. One-dimensional simulations included an IRZ flowpath (750 feet long, passing through an IRZ well towards the river) for comparison with the sitewide solute transport model, and a hyporheic zone flowpath (5 feet long, normal to the sediment-river water interface) to evaluate hyporheic zone dynamics and solute discharge to the river.

The specific goal of the hyporheic zone modeling effort was to place reasonable bounds on the quantity of manganese that would be expected to enter the river from the floodplain under various remedy scenarios—i.e., anticipated IRZ activity and enhanced IRZ activity (increased Mn[II] concentration relative to the anticipated IRZ activity scenario)—relative to ambient conditions. Model results indicated that increasing groundwater fluxes and river bank Mn(II) concentrations resulting from remedy operation are not anticipated to result in higher concentrations of Mn(II) being discharged to the river under reasonable, hyporheic zone-specific Mn(II) oxidation rates. A detailed discussion of the hyporheic zone model domain, parameters, execution, and results is provided in Appendix B.

3.1.4 Remediation System Design and Analysis

The following hydraulic components of the remedy were incorporated into the groundwater flow and solute transport model:

- NTH IRZ Wells (Injection and Extraction)
- River Bank Extraction Wells
- Freshwater Injection Wells
- Inner Recirculation Loop Injection Wells
- East Ravine Extraction Wells
- Transwestern Bench Extraction Wells
- TCS Injection Wells

Each of these components is discussed in more detail in Section 3.2, and Figure 3.0-1 shows the locations of the remediation wells.

Potential well locations were carefully selected by first avoiding culturally or otherwise sensitive areas to minimize impact; delineated areas were closely evaluated, and sensitive areas were avoided to the extent possible during well placement. Numerous iterations of the remedial system layout and operational strategy were then considered and simulated in order to arrive at an optimized remedial approach and to account for uncertainties in the model predictions. Parameters that were adjusted between model runs included well locations, well extraction or injection rates, well cycling patterns (i.e., duration of active operation versus shutdown), carbon substrate amendment injection concentrations, and reinjection destinations; optimization criteria included the following:

- Reduce the anticipated remedial time frame for effective capture and treatment of the Cr(VI) plume;
- Minimize the necessary remediation infrastructure (i.e., total number of new well locations) or “footprint” of the remedial system; and
- Minimize the impact of potential byproducts (i.e., arsenic and manganese).

A more detailed description of the model optimization process is provided in Appendix B along with a discussion of the simulation results and sensitivity analysis.

To facilitate visualization and understanding of how the different remedial components were modeled, cross-sections showing the well locations and depths within the simulated model structure are provided as Figures 3.1.-1 through 3.1-7. Figure 3.1-1 depicts the following selected cross-section locations:

- Cross-section A-A’ features the River Bank Extraction Wells (Figure 3.1-2)
- Cross-section B-B’ features the NTH IRZ Wells (injection and extraction wells) and the East Ravine Extraction Wells (Figure 3.1-3)
- Cross-section C-C’ features the Transwestern Bench Extraction Wells (Figure 3.1-4)
- Cross-section D-D’ features the four Inner Recirculation Loop Injection Wells (Figure 3.1-5)
- Cross-section E-E’ features the two TCS Injection Wells (Figure 3.1-6)
- Cross-section F-F’ features the two Freshwater Injection Wells (Figure 3.1-7)

The following sections present design approaches and criteria for the different remedial components.

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 the Inner Recirculation Loop 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). The River Bank Extraction Wells will also serve to capture Cr(VI) located downgradient of the NTH IRZ and to control IRZ-generated byproducts in the deeper portion of the aquifer.
- Implementation of a smaller-scale TCS Recirculation Loop, comprised of extraction wells installed in the area northeast of the Compressor Station (the Transwestern Bench Extraction Wells) and in the East Ravine area (the East Ravine Extraction Wells) and the two TCS Injection Wells at the Compressor Station (Section 3.2.3). The purpose of the TCS Recirculation Loop 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 represent a level of detail appropriate for the 60 percent design phase and will be further developed over the course of the design and implementation process. Figure 3.2-1 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:

- Four groundwater extraction wells (i.e., NTH IRZ Extraction Wells; IRZ-1, IRZ-5, IRZ-9, and IRZ-23) situated within four locations within the NTH IRZ (see Figure 3.0-1)
- 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 (IRZ-11, IRZ-13, IRZ-15, IRZ-16, IRZ-17, IRZ-19, IRZ-20, IRZ-21, IRZ-25, IRZ-27, IRZ-29, IRZ-31, IRZ-33, IRZ-35, IRZ-37, and IRZ-39) also

located within the NTH IRZ (see Figure 3.0-1), that will be used to re-inject carbon-amended water into the aquifer

- One provisional extraction well (IRZ-40) and up to 30 provisional injection wells situated within 19 locations within the NTH IRZ (see Figure 3.0-1) may also be installed and activated dependent on the monitored performance of the NTH IRZ over time; criteria for installation and activation of the provisional wells are provided in Appendix L, the Draft O&M Manual (presented under separate cover)
- Below-grade piping networks for the conveyance of extracted groundwater, carbon-amended water, fresh water, and/or water produced from routine remedy O&M activities (i.e., backwashing)
- A well maintenance system to facilitate routine maintenance of the NTH IRZ wells
- A clean-in-place (CIP) system to facilitate maintenance of the IRZ extraction, injection, and backwash pipelines

Design criteria for the NTH IRZ are summarized in Exhibit 3.2-1.

3.2.1.1 Description

Recirculation System Design

The NTH IRZ will act as a recirculating system in which all of the water extracted via the four NTH IRZ Extraction Wells will be amended with carbon substrate and injected into the NTH IRZ line via the 24 NTH IRZ Injection Wells, resulting in a net flow of 0 gpm. Various recirculation system designs were discussed in the CMS/FS and considered for the NTH IRZ, including the use of dual-screen wells with injection and extraction intervals within a single location, the use of alternating injection and extraction wells along the NTH IRZ line, and the current proposed configuration (see Figure 3.0-1). Although using dual-screen wells with both injection and extraction intervals or alternating injection and extraction wells tends to facilitate the lateral distribution of organic carbon, in practice it is difficult to operate such configurations without extracting carbon substrate or treated water, thus complicating system maintenance and potentially creating performance/operational issues such as short-circuiting or a discontinuous IRZ. A more detailed discussion of the basis for the recirculation system design is provided in Appendix B. Based on the results of groundwater flow and solute transport modeling, the current recirculation system configuration—injection wells spaced along the NTH IRZ line with extraction wells located at the ends and in minimal places along the line—will allow for adequate lateral dispersion of organic carbon while minimizing the potential for the extraction of carbon substrate or treated water.

NTH IRZ Extraction Wells

The design flow rates (Table 3.2-1) and preliminary layout of the NTH IRZ Extraction Wells, as shown on Figure 3.0-1, were determined based on the results of the groundwater flow and solute transport modeling and optimization effort. Numerous NTH IRZ well layouts and extraction/injection patterns were considered and simulated using an iterative process until the identified optimization criteria (see Section 3.1.4) were satisfied (see Appendix B for more detail). In general, the purpose of the NTH IRZ Extraction Wells is to preserve the natural west to east flow gradient, and thus encourage flow through the IRZ. The three northern NTH IRZ Extraction Wells (IRZ-1, IRZ-5, and IRZ-9) were positioned to minimize the number of NTH IRZ wells while offering hydraulic control of the northern, low concentration end of the Cr(VI) plume and minimizing the extraction of reduced water containing organic carbon or dissolved minerals. The NTH IRZ Extraction Well situated near the center of the NTH IRZ line (IRZ-23) was positioned to maintain and accentuate the eastern flow component of the groundwater, and adjustments will be made to the injection flow rates and carbon dosing in the vicinity of this well location in order to alleviate potential well fouling (see Appendix L, the Draft O&M Manual). Consideration was also given to locating the NTH IRZ Extraction Wells farther to the south to assist with the extraction component of the TCS Recirculation Loop. However, given the limited unconsolidated aquifer thickness at the southern end of the NTH IRZ (approximately 10 feet as compared to 300 feet at the northern end) and the injection volumes necessary to maintain an effective NTH IRZ, locating the NTH IRZ Extraction Wells to the north provided greater advantage in the model simulations. Each NTH IRZ Extraction Well will have a flow rate ranging from 40 to 160 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 3.2-1).

EXHIBIT 3.2-1

NATIONAL TRAILS HIGHWAY IN-SITU REACTIVE ZONE (NTH IRZ) ENGINEERING DESIGN ELEMENTS AND FEATURES

Groundwater Remedy Revised Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
NTH IRZ Extraction Wells - Number	4 wells (at 4 locations), 1 provisional well	To preserve natural west to east flow gradient and encourage flow through IRZ.
NTH IRZ Injection Wells - Number	24 (divided among 16 locations), 30 provisional (divided among 19 locations)	To develop and maintain the IRZ while minimizing necessary infrastructure.
NTH IRZ Extraction Well - Layout	Extraction wells located at the ends and in minimal places along the NTH IRZ line	To minimize potential for the extraction of reduced water containing organic carbon or dissolved minerals; provide hydraulic control of northern end of Cr(VI) plume; and maintain eastern flow component of groundwater.
NTH IRZ Injection Well - Layout	Injection wells spaced along the NTH IRZ line	To ensure adequate lateral distribution of organic carbon; prevent potential breakthrough of Cr(VI) plume; and minimize byproduct formation.
Extraction flow	300 gpm (nominal, total) 200 – 400 gpm (range, total) 40 – 160 gpm (nominal, per well)	To balance injection flow and provide hydraulic control (operated in cycles of 6 months on, 18 months off).
Injection flow	300 gpm (nominal, total) 200 – 400 gpm (range, total) 4 – 20 gpm (nominal, per well)	To develop and maintain the IRZ (operated in cycles of 6 months on, 18 months off).
Carbon substrate dosing and flow rate	100 mg/L TOC (nominal) 500 mg/L TOC (maximum) 100 gallons/day TOC (nominal) 700 gallons/day TOC (maximum)	To achieve sufficient lateral distribution of organic carbon while minimizing byproduct generation.
Carbon substrate selection	Ethanol	Ethanol was selected for initial use in the final remedy based on cost considerations and PG&E's greater experience and past successes with this carbon substrate. However, the carbon substrate may change over the life of the project.
Carbon substrate storage tank size	15,000 gallons	Aboveground tank to be located at the MW-20 Bench.
Backwash rate	Backwash injection wells (2x average injection rate per well)	Based on experience from operation of aquifer storage and recovery systems and IRZ well maintenance evaluations at the PG&E Hinkley Compressor Station (see Appendix L).

The NTH IRZ Extraction 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 unconsolidated alluvial sediments. These sediments from which extraction will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the extraction wells as shown on Table 3.2-1 are preliminary, based in part on the thickness of the saturated sediments above bedrock. Final determination of the screened intervals will be made based on information collected in the field during borehole installation. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data. A more detailed discussion of NTH IRZ Extraction Well design considerations is provided in Section 3.2.5.1 and Appendix C.

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 (see Appendix D, Drawing M-04-01). Dual screen extraction wells will be constructed with a dedicated pump for each well screen with the intervals separated using a pneumatic packer. 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 (see Appendix D, Drawings M-04-03 and M-04-04).

NTH IRZ Injection Wells

The design injection flow rates (Table 3.2-1) and layout of the NTH IRZ Injection Wells, as shown on Figure 3.0-1, were determined based on the results of the groundwater flow and solute transport modeling and optimization effort described in more detail in Appendix B. Numerous NTH IRZ well layouts and extraction/injection patterns were considered and simulated using an iterative process until the identified optimization criteria (see Section 3.1.4) were satisfied. NTH IRZ Injection Wells will be spaced at approximately 150-foot intervals except at two locations (between IRZ-16 and IRZ-17, and between IRZ-20 and IRZ-21) near the center of the NTH IRZ line where spacing will be reduced to 75 feet to prevent potential breakthrough of the Cr(VI) plume (see Figure 3.0-1). Although results of the modeling effort indicated that injection at the 16 NTH IRZ Injection Well locations/clusters resulted in effective remediation (i.e., produced an adequate reducing zone while limiting byproduct formation) while minimizing the necessary infrastructure, provisional well locations were also considered as a conservative approach to address predictive uncertainty inherent to groundwater flow and solute transport modeling. The need for installation and activation of the proposed provisional NTH IRZ Injection Wells (shown on Figure 3.0-1) will depend on operational data, monitored performance of the NTH IRZ, and the success of less intrusive system adjustments. A more detailed discussion of the monitoring data and their application is provided in Appendix L, the Draft O&M Manual. 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 4 to 20 gpm, with a maximum injection flow rate of 40 gpm (IRZ-11 and IRZ-13) as summarized in Table 3.2-1. In general, the injection flow rates vary proportionally to aquifer thickness, which ranges from over 300 feet thick at the northern end of the NTH IRZ to approximately 10 feet thick at the southern end.

The NTH IRZ Injection 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 unconsolidated alluvial sediments. These sediments within which injection will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the injection wells as shown on Table 3.2-1 are preliminary, based in part on the thickness of the saturated sediments. Final determination of the screened intervals will be made based on information collected in the field during borehole installation. A more detailed discussion of NTH IRZ Injection Well design considerations is provided in Section 3.2.5.1 and Attachment D of Appendix C.

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 (Appendix D, M-

04-05 through M-04-09). 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, and a backflush return header (Appendix D, M-04-05 through M-04-09). NTH IRZ wells configured as extraction wells will be connected to a groundwater conveyance header (Appendix D, M-04-04). 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. A process flow schematic of the carbon substrate amendment system is provided in Appendix D, G-06-01. Components of this 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 Dosing, Metering, and Control Equipment. The carbon dosing, metering, and control equipment will include valves, flow meters, chemical metering pumps (30 gallons per hour, 200 ft w.c. TDH), and ancillary equipment as shown in the piping and instrumentation diagram (Drawing I-06-01) provided in Appendix D. Extracted groundwater is dosed with carbon and flows through an in-line static mixer before being routed to the carbon-amended groundwater conveyance header. A sample port and pressure gauge located downstream of the static mixer will be used for monitoring purposes.

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.

The primary carbon substrate storage tank will be a 15,000-gallon, above-grade, horizontal saddle tank that is fully compatible with the contained media. The tank will have 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 tank will include the following, as shown in Appendix D, M-06-04:

- 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; and (4) a pipeline secondary containment leak detection system—i.e., a fluid level switch, pressure monitoring system or similar. Details are shown on Drawing M-06-04 of Appendix D.

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; see Drawing S-06-03 of Appendix D). The concrete slabs and surrounding walls will either be cast monolithically or the joints will be constructed with water stops.

Portable Tanks. The NTH IRZ Injection Well design will include manual addition ports to accommodate the potential use of portable tanks (5- to 1,000-gallon capacity) for the direct injection of dilute carbon substrate solution at the wellheads. This alternative means of reagent delivery allows for added flexibility in long-term system operation, and portable tanks can be used for specific, targeted injections on an as-needed basis. Portable tanks may be preferred over pipelines at locations where the carbon injection volume is low, injections occur with long rest periods, or long pipelines are expected to pose health and safety and/or long-term O&M challenges. Portable tanks may also be used in conjunction with substrates that are perishable (e.g., whey) and/or exhibit a long biodegradation half-life to facilitate a low volumetric dose.

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. An elevated catwalk platform will be constructed across the top of the tank to allow for operator access during operations and maintenance without the need for aerial lift equipment.

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), with a nominal target rate of 100 gpd, based on ethanol as the substrate. Injection rates will be adjusted to optimize carbon injection by allowing rest periods (i.e., pattern of 6 months on followed by 18 months off) 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. The target carbon dosage and flow rates were selected based on the results of the groundwater flow and solute transport modeling and optimization effort (see Appendix B for additional detail). Parameters including the rate, concentration, and frequency of carbon substrate injection were varied within the model in order to achieve sufficient lateral distribution of organic carbon across the spaces between injection locations while minimizing byproduct generation. For example, if the carbon substrate concentration or injection rate was too low, the model indicated bleed-through of the Cr(VI) plume past the NTH IRZ. However, the simulation of higher concentrations and/or injection rates demonstrated increased levels of byproducts.

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 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). The backwash rate was chosen based on experience gained from the operation of aquifer storage and recovery systems. The backwashing strategy is currently being evaluated on an IRZ well at the PG&E Hinkley Compressor Station site, and preliminary data indicate that backwashing effectively prolongs the injection capacity of the IRZ well. Flexibility in system operation is planned to allow for variable flows and frequency of backwashing based on system performance. Additional details regarding the backwashing rate, frequency, and performance criteria for potential in-field adjustments are provided in Appendix L, the Draft O&M Manual.

Periodically, wells will 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. Injection of liquid carbon dioxide (Aqua Gard™ process) may also be used. 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).

Details regarding the remediation well maintenance procedures are provided in Appendix L, the Draft O&M Manual.

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 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. The acid will lower the pH of the groundwater, resulting in the potential temporary dissolution of Cr(III) minerals that may have formed within the screen, filter pack, and/or aquifer within the immediate vicinity of the injection well. The dissolved Cr(III) will either be removed from the well during rehabilitation, or will re-precipitate as pH is buffered following rehabilitation. The biological dispersant is not expected to impact groundwater chemistry or the reducing environment of the IRZ during rehabilitation.

A more detailed discussion of the chemical rehabilitation process, including protocols and safety requirements, is provided in Appendix L, the Draft O&M Manual.

3.2.1.2 Design Basis

Treatment Chemistry

Chromium-impacted groundwater will be treated in-situ through geochemical precipitation/fixation. Degradable organic carbon substrate (i.e., ethanol) 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 and Upland ISPTs were used to evaluate two potential organic carbon substrates (i.e., ethanol and lactate), assess different reagent delivery methods, and gather site characterization data necessary for the full-scale reagent delivery design (i.e., mobile porosity and radius of influence to volume relationship). Brief descriptions of the ISPTs are provided below, and a detailed discussion of how the ISPT results were used in the full-scale design is included in Appendix B.

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) horizontal distribution of tracer was complicated by vertical “short-circuiting” of the recirculation wells (i.e., a significant portion of amended water traveled vertically from the injection well screen to the extraction well screen).

Organic Carbon Substrate Selection

The ISPTs evaluated two different organic carbon substrates with similar degradation rates, ethanol and lactate, and as discussed above, both reagents were demonstrably effective in remediating Cr(VI). Ethanol was selected for use in the ongoing design and for initial use in the final remedy based on cost considerations and PG&E’s greater experience and past successes with this carbon substrate (e.g., at the PG&E Hinkley Compressor Station site). However, carbon substrate selection may change over the lifetime of the project as substrate costing varies. In addition, alternative substrates (e.g., emulsified vegetable oil, with a slower biodegradation rate) could be useful for certain situations that arise over the life of the project (e.g., during the late operational stages when a low dosage, slow release reservoir of carbon is preferred). Appendix L, the Draft O&M Manual, presents the process monitoring plan for evaluating carbon distribution and determining when a different carbon substrate may be needed to achieve sufficient distribution over the course of the project. To the extent possible, flexibility is being incorporated into the design to allow for changes in the carbon substrate. Modifications to system equipment, including pumps and flow meters, may be required to switch from ethanol to carbon substrates such as lactate or emulsified vegetable oil. Whey would require more extensive modifications to the carbon substrate storage and dosing infrastructure, given its perishable nature. Switching between carbon substrates would also require some system preparation activities, for example, cleaning of the storage tanks and reagent lines.

More comprehensive engineering criteria, including chemical reaction equations for the various substrates, 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. Appendix L, the Draft O&M Manual, provides further detail regarding the performance criteria that will trigger modifications to the operational approach and the protocol for implementing such modifications. Contingency measures in the event of various modes of remedy failure (including contaminant breakthrough) are also summarized as part of Appendix L.

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; (2) facilitate the cleanup of the Colorado River floodplain; and (3) provide secondary protection for the Colorado River by controlling the migration of potential byproducts generated by the NTH IRZ in the deeper portion of the aquifer. The Inner Recirculation Loop will consist of the following system components:

- Five River Bank Extraction Wells (RB-1 through RB-5) installed along the Colorado River (see Figure 3.0-1)
- Four Inner Recirculation Loop Injection Wells (IRL-1 through IRL-4) installed near the western margin of the groundwater plume north of I-40 (see Figure 3.0-1)
- Three provisional Inner Recirculation Loop Injection Wells (IRL-5 through IRL-7; see Figure 3.0-1) may also be installed and activated dependent on the monitored performance of the remedy over time; criteria for installation and activation of the provisional wells are provided in Appendix L, the Draft O&M Manual
- 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, fresh water, and/or water produced from routine remedy O&M activities (i.e., backwashing)
- A well maintenance system to facilitate routine maintenance of the injection wells

Design criteria for the Inner Recirculation Loop are summarized in Exhibit 3.2-2.

3.2.2.1 Description

River Bank Extraction Wells

It is anticipated that three to five of the River Bank Extraction Wells (shown on Figure 3.0-1) will be operated at any given time based on the need to control potential migration of Cr(VI) located downgradient of the NTH IRZ, control byproduct migration in the deeper portion of the aquifer, and enhance hydraulic gradients to accelerate the remediation timeframe, while simultaneously minimizing the effects of the river bank extraction on development and maintenance of the NTH IRZ and/or maintenance of the natural reducing rind located along the Colorado River. Monitoring wells will be used to monitor the effectiveness of the NTH IRZ, and to help determine the ideal pattern of River Bank Extraction Well operations to maintain an appropriate balance of these operational goals. Appendix L, the Draft O&M Manual, provides further detail regarding the process monitoring data that may trigger modifications to the operation of the River Bank Extraction Wells.

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 3.2-2). The nominal extraction flow rate will range from approximately 25 to 50 gpm per well at approximately 350 ft w.c. TDH.

EXHIBIT 3.2-2

INNER RECIRCULATION LOOP ENGINEERING DESIGN ELEMENTS AND FEATURES

Groundwater Remedy Revised Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
River Bank Extraction Wells – Number/Layout	5 wells (at 5 locations), along the Colorado River	To induce groundwater flow through the NTH IRZ, capture Cr(VI) located downgradient of the NTH IRZ, and control IRZ-generated byproducts in the deeper portion of the aquifer.
Inner Recirculation Loop Injection Wells – Number/Layout	4 wells (at 4 locations), 3 provisional wells (at 3 locations), near the western margin (upgradient) of the groundwater plume north of I-40	To induce groundwater flow through the NTH IRZ.
River Bank Extraction Wells flow	150 gpm (nominal, total) 150 – 500 gpm (range, total) 25 – 50 gpm (nominal, per well)	
Inner Recirculation Loop Injection Wells flow	450 gpm (nominal, total) 150 – 900 gpm (range, total) 75 – 200 gpm (nominal, per well)	Includes 300 gpm of freshwater for the nominal flow and up to 900 gpm of freshwater for the maximum flow, as needed.
Carbon substrate dosing	0 – 50 mg/L TOC	The minimum of 0 mg/L TOC is applicable when Cr(VI) concentrations in the extracted groundwater do not exceed the cleanup level (i.e., treatment is not required). Low concentrations of organic carbon will be added should Cr(VI) treatment be required. The maximum of 50 mg/L TOC was established to allow for: (1) additional consumption of TOC for cell growth; (2) promotion of reducing conditions in the subsurface; and (3) accommodation of uncertainties in field implementation.
Carbon substrate selection	Ethanol	Ethanol was selected for initial use in the final remedy based on cost considerations and PG&E's greater experience and past successes with this carbon substrate. However, the carbon substrate may change over the life of the project.
Carbon substrate storage tank size	15,000 gallons	Aboveground tank to be located at the MW-20 Bench.
Backwash rate	Backwash injection wells (2x average injection rate per well)	Based on experience from operation of aquifer storage and recovery systems and IRZ well maintenance evaluations at the PG&E Hinkley Compressor Station (see Appendix L).

The River Bank Extraction Wells will be constructed using up to 12-inch nominal diameter well casing with two screened intervals. The lower screened interval will target the deeper portion of the unconsolidated alluvial sediments and the upper screen will be installed near the top of the aquifer. A packer will be installed in the well to separate the upper and lower screened intervals. The purpose of the upper screen is to allow for additional shallow groundwater capture should the monitoring data indicate that this is needed. The sediments from which extraction will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the extraction wells as shown on Table 3.2-2 are preliminary, based in part on the thickness of the saturated sediments. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the River Bank extraction wells. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data. appropriate screened intervals for the extraction wells. Note that the lower screen of the River Bank Extraction Wells are proposed to be screened beneath the reducing rind to minimize negative hydraulic impacts to this natural reductive zone, and to minimize the potential for well fouling caused by the high dissolved mineral content of the naturally-reduced groundwater of the rind.

An electric motor-operated, submersible pump(s) (Grundfos or similar) will be installed in each River Bank 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 (see Appendix D, M-05-01). 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 (see Appendix D, M-05-03 and M-05-04).

Inner Recirculation Loop Injection Wells

Water injected via the Inner Recirculation Loop Injection Wells (see Figure 3.0-1) will include: (1) groundwater captured by the River Bank Extraction Wells and amended with carbon, as necessary, using the carbon substrate dosing facilities located at the MW-20 Bench; and (2) fresh water from the freshwater supply system (see Section 3.3). The current layout of the Groundwater Flow and Solute Transport Model has the two northern Inner Recirculation Loop Injection Wells (IRL-1 and IRL-2) receiving water from the River Bank Extraction Wells (without carbon amendment), while fresh water is injected at the two southern wells (IRL-3 and IRL-4). However, the final layout of the Inner Recirculation Loop will be flexible enough to accommodate either injection water source (i.e., extracted water from the River Bank Extraction Wells or fresh water from the freshwater supply system) to minimize potential byproduct impacts. 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 0 and 50 mg/L of TOC. Low concentrations of organic carbon are planned for the Inner Recirculation Loop Injection Wells in the event that levels of Cr(VI) in the extracted floodplain groundwater are high enough to require treatment (i.e., exceed the cleanup level of 32 µg/L). The minimum of 0 mg/L TOC is applicable when concentrations of Cr(VI) in the extracted groundwater do not exceed the cleanup level, and thus in-situ treatment is not required. Based on the modeling results, the maximum anticipated concentration of Cr(VI) is 13 parts per billion (ppb), below the background concentration of 32 ppb, indicating that treatment of the extracted groundwater is not likely to be required. Should Cr(VI) treatment be required, low concentrations of organic carbon will be added. Once the reducing zone has been established, a low concentration of organic carbon will be required to consume the dissolved oxygen, nitrate, and Cr(VI), and to promote iron reduction for potential abiotic reduction of Cr(VI). For reference, approximately 3.4 mg/L of TOC from ethanol would be required to reduce 8 mg/L of oxygen, 2 mg/L of nitrate as nitrogen, and 13 ppb of Cr(VI). The upper end of the range, 50 mg/L TOC, was established above this concentration to allow for: (1) additional consumption of TOC for cell growth; (2) promotion of reducing conditions in the subsurface; and (3) accommodation of uncertainties in field implementation.

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 (see Table 3.2-2).

Inner Recirculation Loop Injection Wells will be constructed using up to 12-inch nominal diameter well casing with one or two discrete screened intervals These sediments within which injection will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the injection wells as shown on Table 3.2-2 are preliminary, based in part on the thickness of the saturated sediments. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the injection wells. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data. In-well components may include 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 (see Appendix D, M-05-02).

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 (see Appendix D, M-05-05 and M-05-06). Additional injection well vault components will be as described as in Section 3.2.1.1.

Each Inner Recirculation Loop Injection Well will be connected to a carbon-amended groundwater conveyance header, a spare header, and 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 Inner Recirculation Loop 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). The backwash rate was chosen based on experience gained from the operation of aquifer storage and recovery systems. The backwashing strategy is currently being evaluated on an IRZ well at the PG&E Hinkley Compressor Station site, and preliminary data indicate that backwashing effectively prolongs the injection capacity of the IRZ well. Flexibility in system operation is planned to allow for variable flows and frequency of backwashing based on system performance. Additional details regarding the backwashing rate, frequency, and performance criteria for potential in-field adjustments are provided in Appendix L, the Draft O&M Manual.

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.

Details regarding the remediation well maintenance procedures are provided in Appendix L, the Draft O&M Manual.

3.2.2.2 Design Basis

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

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. Appendix L, the Draft O&M Manual, provides further detail regarding the performance criteria that will trigger modifications to the operational approach and the protocol for implementing such modifications. Contingency measures in the event of various modes of remedy failure (including contaminant breakthrough) are also summarized as part of Appendix L.

3.2.3 TCS Recirculation Loop

The TCS Recirculation Loop will be established using extraction wells installed in the area northeast of the TCS (i.e., the two Transwestern Bench Extraction Wells, TWB-1 and TWB-2, and two provisional wells, TWB-3 and TWB-4; see Figure 3.0-1) and in the East Ravine area (i.e., the five East Ravine Extraction Wells, ER-1 through ER-4 and ER-6, and provisional well, ER-5; see Figure 3.0-1) to capture impacted groundwater from the alluvial deposits located downgradient of the TCS and from shallow bedrock in the East Ravine, respectively. Criteria for installation and activation of the provisional wells are provided in Appendix L, the Draft O&M Manual.

Extracted groundwater will be (1) conveyed to a second carbon storage and amendment facility to be located at the Transwestern Bench; (2) dosed with carbon; and (3) injected at two TCS Injection Wells (see Figure 3.0-1).

Design criteria for the TCS Recirculation Loop are summarized in Exhibit 3.2-3.

3.2.3.1 Description

Transwestern Bench Extraction Wells

It is anticipated that the two Transwestern Bench 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 (the "Embayment Area"). These wells will be operated at any given time for a total extraction flow rate ranging from 2 to 30 gpm, with an anticipated combined nominal rate of approximately 22 gpm (see Table 3.2-3). The expected nominal extraction flow rates per well will be 13 gpm (TWB-1) and 9 gpm (TWB-2) at approximately 320 ft w.c. TDH.

The proposed layout and operational strategy for the Transwestern Bench Extraction Wells were determined based on the groundwater flow and solute transport modeling, additional site walks to identify access issues, and the optimization effort detailed in Appendix B. Results of this effort indicated that two extraction wells in the Embayment Area operating at a total flow rate of 22 gpm were sufficient to hydraulically contain groundwater in the vicinity. However, characterization of the Embayment Area is primarily defined by data collected from MW-59. Installation of the two proposed Transwestern Bench Extraction Wells is expected to assist in refining understanding of the hydrogeology of the Embayment Area, and if the aquifer conditions are different than anticipated, the number of extraction wells may be adjusted (e.g., the provisional wells may be installed) to achieve the desired hydraulic control. Decision criteria for increasing or decreasing the number of extraction wells are provided in Appendix L, the Draft O&M Manual.

The Transwestern Bench Extraction 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 unconsolidated alluvial sediments. These sediments from which extraction will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs in other areas of the site. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the injection wells as shown on Table 3.2-3 are preliminary, based in part on the thickness of the saturated sediments. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the extraction wells. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data.

EXHIBIT 3.2-3

TCS RECIRCULATION LOOP ENGINEERING DESIGN ELEMENTS AND FEATURES

Groundwater Remedy Revised Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
Transwestern Bench Extraction Wells – Number/Layout	2 wells (at 2 locations), 2 provisional wells (at 2 locations), in the area northeast of the TCS (the "Embayment Area")	To assist in refining understanding of the hydrogeology of the Embayment Area and to accelerate capture and treatment of Cr(VI) impacted groundwater immediately downgradient of the TCS.
East Ravine Extraction Wells – Number/Layout	5 wells (at 5 locations), 1 provisional well, downgradient of the TCS in the southeast portion of the plume that exists in the bedrock	To extract Cr(VI) impacted groundwater located in the bedrock.
TCS Injection Wells – Number/Layout	2 wells (at 2 locations), in the immediate vicinity of the TCS	To treat Cr(VI) impacted groundwater in the immediate vicinity and accelerate groundwater flow toward the Transwestern Bench Extraction Wells and the NTH IRZ.
Extraction flow	27 gpm (nominal, total) – includes 22 gpm from Transwestern Bench Extraction Wells and 5 gpm from East Ravine Extraction Wells 10 – 75 gpm (range, total)	To provide hydraulic capture of Cr(VI) impacted groundwater in the Embayment Area and East Ravine bedrock.
Injection flow	27 gpm (nominal, total) 10 – 75 gpm (range, total)	To directly treat Cr(VI) under the TCS and allow for adequate dispersion of the injectate away from the point of injection; maximum flow includes up to 75 gpm of freshwater
Carbon substrate dosing	100 mg/L TOC (nominal)	To achieve sufficient lateral distribution of organic carbon while minimizing byproduct generation. During the 18 month NTH IRZ off cycle, carbon substrate dosing will be reduced to 5 mg/L (to treat Cr[VI] concentrations in the extracted groundwater).
Carbon substrate selection	Ethanol	Ethanol was selected for initial use in the final remedy based on cost considerations and PG&E's greater experience and past successes with this carbon substrate. However, the carbon substrate may change over the life of the project.
Carbon substrate storage tank size	3,000 gallons	Aboveground tank to be located at the Transwestern Bench.
Backwash rate	Backwash injection wells (2x average injection rate per well)	Based on experience from operation of aquifer storage and recovery systems and IRZ well maintenance evaluations at the PG&E Hinkley Compressor Station (see Appendix L).

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 (see Appendix D, M-03-01). 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 (see Appendix D, M-03-03 and M-03-04). Each well will be connected to a groundwater conveyance header that will be routed to the carbon substrate amendment system located at the Transwestern Bench.

East Ravine Extraction Wells

Initial estimates, presented in the 2009 CMS/FS, held that approximately 15 wells, pumping a combined total of up to 10 gpm, would be required to provide hydraulic capture of the area of Cr(VI) in the East Ravine bedrock. However, this design has since been revised to five extraction wells operating at a total nominal flow rate of 5 gpm (maximum of 9 gpm) based on data obtained from the more recent East Ravine groundwater investigations (see Section 2.1.2).

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 5 gpm (i.e., approximately 0.5 gpm per well for ER-1 through ER-4 and 3 gpm for ER-6; see Table 3.2-3). A provisional well location (ER-5) was also considered as a conservative approach to address predictive uncertainty inherent to groundwater flow and solute transport modeling. The need for installation and activation of the proposed provisional East Ravine Extraction Well will depend on operational data, process monitoring data, and the success of less intrusive system adjustments. Detailed decision criteria for increasing the number of East Ravine Extraction Wells are provided in Appendix L, the Draft O&M Manual.

The East Ravine Extraction 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 bedrock. Another potential construction methodology for the East Ravine Wells would be to drill through any unconsolidated deposits and the weathered portion of the bedrock and set an up to 12-inch diameter carrier casing. Below the carrier casing depth drilling would proceed to the target depth and the well would consist of an open bedrock borehole beneath the casing. No well screen would be installed for this construction methodology. The geologic environment in the East Ravine area is largely undifferentiated with the exception of the distinction between conglomerate and metadiorite rocks. Within each of these types of bedrock, there are no individual hydrostratigraphic units, and groundwater flow within the bedrock is primarily through fractures and faults. Therefore, the screened intervals of the extraction wells as shown on Table 3.2-3 are preliminary, based in part on the thickness of the anticipated saturated rocks. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the extraction wells. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data. 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 (see Appendix D, M-03-01). 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 (see Appendix D, M-03-03 and M-03-04). 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 13.5 gpm of carbon-amended groundwater for a combined nominal flow rate of 27 gpm (see Table 3.2-3), and injections will be timed to allow for adequate dispersion of the injectate away from the well. Results of the modeling effort indicate that the potential for westward flow from the TCS Injection Wells, and the resulting westward expansion of the plume, is sufficiently mitigated by the natural eastward flow gradient and the injection of fresh water at FW-2, located outside of the plume footprint (see Section 3.3 for a discussion of the freshwater supply system), at a nominal rate of 50 gpm (i.e., more than double the combined nominal injection flow rate of 24 gpm). In addition, contingency measures in the event of various modes of remedy failure are summarized as part of Appendix L.

TCS Injection Wells will be constructed using up to 12-inch nominal diameter well casing with one or two discrete screened intervals of the unconsolidated alluvial sediments. These sediments within which injection will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the injection wells as shown on Table 3.2-3 are preliminary, based in part on the anticipated thickness of the saturated sediments. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the injection wells. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data.

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) (see Appendix D, M-03-02). The wellhead connections and/or control/monitoring devices will be contained within a below-grade concrete vault (see Appendix D, M-03-05 and M-03-06). 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 Bench)

A second carbon substrate amendment system that will include a 3,000-gallon aboveground storage tank (AST) will be located at the Transwestern 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 Transwestern Bench 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 (see Appendix D, M-08-04). 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 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 Transwestern Bench 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.

Details regarding the remediation well maintenance procedures are provided in Appendix L, the Draft O&M Manual.

3.2.3.2 Design Basis

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. Furthermore, although the borehole drilled at MW-70BR-225 during the second phase of investigation yielded enough groundwater to sustain pumping for hydraulic testing, the drawdown measured in the observation wells was negligible. Results of the second phase are summarized in Section 2.1.2 detailed in a technical memorandum entitled *Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation, Pacific Gas and Electronic Company, Topock Compressor Station, Needles, California*. The Addendum was submitted to agencies on November 12, 2012 and results were discussed at the January 17, 2013 TWG meeting. Comments were received from DTSC and DOI on February 15, 2013. The Addendum is currently being revised to incorporate comments. Ultimately, data from both investigation phases were consistent with the regional hydrogeology, in that there was no evidence to indicate any sizable potential for development of groundwater in the bedrock formation, although locally, small yields could be developed from fractures (Metzger and Loeltz 1973). The latest East Ravine data have been considered in the 60% design, and groundwater extraction is still considered the most viable option for this area. .

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 Transwestern Bench 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

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. Appendix L, the Draft O&M Manual, provides further detail regarding the performance criteria that will trigger modifications to the operational approach and the protocol for implementing such modifications. Contingency measures in the event of various modes of remedy failure (including contaminant breakthrough) are also summarized as part of Appendix L.

3.2.4 Clean-In-Place System

Design criteria for the CIP system are summarized in Exhibit 3.2-4.

EXHIBIT 3.2-4

CLEAN-IN-PLACE SYSTEM ENGINEERING DESIGN ELEMENTS AND FEATURES

Groundwater Remedy Revised Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
Velocity	3 – 10 feet per second	
Volume	10,000 – 40,000 gallons per event, including maintenance solution and freshwater	Based on the length of the NTH IRZ carbon-amended water and extracted groundwater forcemains.
Maintenance reagent	To be determined	Reagents to be considered include those categories of water treatment chemicals approved for use in drinking water systems; ultimate selection of an effective reagent(s) will require bench-scale testing of actual scale deposits, and the reagent(s) will be compatible with the high-density polyethylene conveyance piping.
Frequency	Approximately once per year	Clean-in-place (CIP) events will be scheduled to coincide with the regular NTH IRZ system shutdown periods; the frequency of the CIP events will depend on the level of fouling and may be as infrequent as once every five years.

3.2.4.1 Description

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. CIP events will be scheduled to coincide with the regular system shutdown periods at an expected frequency of once every year; however, depending on the level of fouling, CIP events may be required as infrequently as once every five years. 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 reagents used will be those categories of water treatment chemicals approved for use in drinking water systems. Ultimate selection of an effective reagent(s) will require bench-scale testing of actual scale deposits. 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). During each CIP event, the carbon-amended water injection system will be shut off, groundwater extraction will cease, and clean water will be used to flush the lines. Each conveyance forcemain valve will be positioned to isolate the wells and create a loop with the associated spare conveyance header. This loop will originate and terminate with the CIP tank (frac tank). Fresh water will be added to the CIP tank along with the appropriate quantities of amendments (per the recommended recipe as determined based on the bench-scale testing of scale deposit samples). The CIP system will operate by recirculating the amended water in a loop. Upon completion, fresh water will be added to flush the lines. Following completion of the CIP event, the valves will be positioned to facilitate normal operation.

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. The volume of spent solution is expected to be roughly 10,000 to 40,000 gallons per event.

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 high-density polyethylene (HDPE) conveyance piping.

3.2.4.2 Design Basis

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

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 Inner Recirculation Loop Injection Wells), or within areas with lower saturated thickness (i.e., Transwestern Bench extraction wells northeast of Compressor Station, East Ravine extraction wells, southernmost NTH IRZ injection wells), one well will be employed. Dual-screened wells will be employed if the saturated thickness exceeds 40 to 100 feet and two screens are therefore necessary to ensure targeted distribution of substrate in each zone. A well cluster will be employed if more than two well screens are necessary to provide full coverage of the target contaminated zone at locations where the vertical aquifer thickness is more than 110 feet. The purpose of the multiple wells per location is to ensure adequate discrete control of the injection fluid into the formation and not to promote recirculation within the well cluster.

- **Screened interval.** The sediments within which sediments injection and extraction will occur are undifferentiated. The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. This is likely because of the nature of the deposits themselves and the depositional environment (alluvial fan/debris flow deposition). Therefore, the screened intervals of the wells as shown on Tables 3.2-1 through 3.2-3 are preliminary, based in part on the anticipated thickness of 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 Inner Recirculation Loop Injection Wells) are available based on the results of the modeling effort. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the injection wells. Appendix C provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data. 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 remediation wells installed in the unconsolidated aquifer will be a minimum of 8 inches in diameter and up to 12 inches in diameter to accommodate the in-well infrastructures (e.g., submersible backwash pumps, pressure transducers, inflatable packers, etc.). The East Ravine Extraction Wells which will be installed in bedrock may be of open hole design without a well screen and may be of smaller diameter (potentially 4-inch diameter in the open borehole portion of the well) than the remediation wells installed in the unconsolidated aquifer.
- **Screen and filter pack sizing.** The filter pack and screen will be sized based on the particle size distribution analyses, determined by transporting the recovered earth materials through sieves .
- **Casing and screen material and type.** Casing material for the IRZ wells deeper than 150 ft will be 316L stainless steel below saturation and either 304 stainless or carbon steel above saturation to provide the required tensile strength and collapse pressure resistance for the expected installation depths. If a mix of stainless steel and carbon steel casings are used then it may be necessary to install a dielectric coupling between the two casing types to inhibit corrosion. Casing material for the IRZ wells shallower than 150 ft may be schedule 80 PVC or of similar construction as the deeper wells. 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. Further detail regarding the well casing and screen material is provided in Appendix C.
- **Well seals.** Well seals (placed between screen intervals and above the upper screen interval) will be comprised of neat cement. Filter pack sands will be installed to a minimum of 4 feet above the top of the screen, and capped by a minimum of 2 feet of fine-grained 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 through the borehole.

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, fresh water, 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 HDPE pipe in a standard construction trench. Short sections of piping will be constructed in pre-cast concrete trench systems around the MW-20 Bench carbon amendment system to facilitate normal operation and maintenance of the Bench facilities. 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. Expansion loops or joints will be located in all necessary areas in accordance with best engineering practice. All valves, instruments, control devices, pumps, and other equipment shall be installed in a manner such that they are easily accessible for O&M; and equipment and instruments with readout displays shall be oriented to allow for ease of data collection. 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;
- Provisional wells have been identified as a conservative approach to address predictive uncertainty inherent to groundwater flow and solute transport modeling. The need for installation and activation of the proposed provisional wells will depend on operational data, process monitoring data, and the success of less intrusive system adjustments. A more detailed discussion of the decision criteria for installation of the provisional wells is provided in Appendix L, the Draft O&M Manual;
- 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 fresh water from several potential sources. The primary objectives of the freshwater 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 PG&E's preferred supply of fresh water (i.e., a well or wells in Arizona, specifically HNWR-1 well without pre-treatment) that was presented in the preliminary (30%) design.

In compliance with DTSC's directive (DTSC 2012), this section also includes a discussion of a pre-treatment system to polish Arizona groundwater to California standards prior to injection. The decision by the SWRCB is anticipated to guide further direction from DTSC regarding the ultimate use of the fresh water source and what level of treatment if any will be required for various constituents. Additional freshwater source details will be included in an addendum to the Intermediate (60%) Design.

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. These sources of fresh water are consistent with the water supply options in the certified EIR (DTSC 2011d). 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 fresh water 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 proposed 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 naturally occurring arsenic concentration in water from the HNWR-1 well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona. Although geochemical modeling indicates that this arsenic will not migrate far from the injection points and will dissipate within a reasonable period of time after the completion of the remedy, the RWQCB, subject to its invitation for PG&E to seek review by the SWRCB, indicated that the HNWR-1 water would likely need treatment to remove naturally occurring arsenic prior to injection. With the RWQCB's consent, PG&E has opened discussions of the need to treat for arsenic with the SWRCB. As the SWRCB has not yet made a decision on this matter, PG&E continued to evaluate options for freshwater supply by seeking location(s) for new well(s) that could supply an adequate quantity of water of sufficient quality to not require treatment prior to use for remedy operation, and on November 20, 2012, submitted an Implementation Plan for Alternative Fresh Water Sources Evaluation. The Implementation Plan was revised and resubmitted on January 28, 2013 to incorporate comments received. Comments on the Revised Implementation Plan were received from DTSC on February 21, 2013. Further directions were received from DOI on March 26, 2013. As directed by DOI, a comment resolution meeting will be held prior to finalizing responses to comments and the Implementation Plan. The freshwater details will be incorporated into an addendum to the 60% design, after completion of planned source water studies.

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 fresh water 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.

3.3.2 Evaluation of Freshwater Supply Sources/Selection of Preferred Source

In response to specific comments received on the preliminary (30%) Basis of Design document (comments #142 DTSC-55 through #153 DTSC-66), the *Fresh Water Source Evaluation Technical Memorandum, PG&E Topock Compressor Station, Needles, California* (Fresh Water Tech Memo) (CH2M HILL 2012d) was prepared to present additional details and analysis on the evaluation of freshwater supply options, and is included in Appendix J of this report. Comments were received from agencies on the tech memo; responses to those comments are also included in Appendix J. The criteria used to evaluate the freshwater supply options in the Fresh Water Tech Memo include the following:

1. Influence of 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. Implementability and sustainability considerations.

Detailed evaluation and analysis of each freshwater supply sources against each of the above criteria are presented in Appendix J. For brevity, Exhibit 3.3-1 summarizes the results/conclusions from this evaluation.

In summary, all of the freshwater options evaluated have some advantages and some drawbacks.

Based on testing conducted to date, the HNWR-1 well is a proven water source and the initial testing shows that the capacity of nearby wells would not be affected if fresh water for the remedy was obtained from HNWR-1. The fact that it is an existing well means that there would be less disturbance associated with use of HNWR-1 than with construction of a new well or river intake. The primary drawback to the use of HNWR-1 is the elevated concentration of arsenic in the well. In addition to the slightly elevated levels of arsenic in the HNWR-1 water, fluoride is present at slightly elevated levels. Water quality data at the area of injection exhibits high levels of naturally occurring fluoride. Due to the elevated levels of fluoride at the point of injection the groundwater basin is not considered a high quality water for that constituent, and as a result treatment to remove fluoride is not anticipated to be required by either the RWQCB or the SWRCB pursuant to California standards. On December 31, 2012, DTSC directed PG&E to add into the 60% design a pre-treatment system to polish Arizona groundwater to California standards prior to injection. The decision by the SWRCB is anticipated to guide further direction from DTSC regarding the ultimate use of the freshwater source and what level of treatment, if any, will be required for various constituents. As such guidance is still forthcoming, in this 60% design BOD, PG&E has made the conservative assumption for freshwater treatment goals, specifically that the arsenic treatment goal is to achieve concentrations below the federal/state MCL of 10 µg/L and the fluoride treatment goal is concentrations below the state MCL of 2 mg/L. The freshwater source details will be included in an addendum to this 60% design, after such requirements are determined and completion of planned source water studies.

Water obtained from a well or wells near Moabi Regional Park in California would likely not have arsenic elevated above the MCL. Electric power is available nearby and there is a pipeline route along National Trials Highway to deliver the water to the compressor station. The primary drawback is that the aquifer at Moabi Regional Park does not appear to be capable of delivering a sufficient quantity of water for the remedial action without adversely affecting the quality and quantity of water available from the existing wells that supply water to Moabi Regional Park. It is also likely that the TDS of the water from a high capacity well would be greater than 3,000 mg/L, making it undesirable for injection into the less saline, upper portions of the aquifer at the Topock site. It might also contain iron and manganese at concentrations that would require conditioning prior to injection.

It is possible that a well or wells drilled some distance to the north of Moabi Regional Park might provide an adequate supply of fresh water, but these wells would be far outside the existing APE in a relatively undisturbed area with no power or improved roads. Exploratory drilling would be required to determine if the aquifer in this area north of the Park could provide a sufficient quantity and quality of water. Piping and power would need to be extended over relatively large distances through a relatively undisturbed area. There would likely be significant delays to the project associated with development of a water supply from wells north of Moabi Regional Park.

A river intake structure could offer a secure source of water for the duration of the remedy. Availability of water from the river would not be affected by development in the local area. The river water has low TDS, arsenic, and Cr(VI). One of the key drawbacks to a river intake is the process and the time needed for getting approvals (which may ultimately be infeasible) and authorizations necessary prior to construction. Multiple agencies will be involved in the consultation and approvals. Specifically, the DOI ROD states that remedial design will be performed in a manner that does not result in a “take” of threatened or endangered species, or damage their critical habitat (DOI 2010). California state law also prohibits the take of state-listed “Fully Protected Species”, such as the razorback sucker, except where a conservation plan has been approved and is being implemented to

EXHIBIT 3.3-1

SUMMARY OF DETAILED EVALUATION OF THREE FRESHWATER SOURCES

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Evaluation Criteria	Analysis Factors and Considerations	Evaluation Results/Conclusions
1. Influence of Freshwater Pumping on Remedy Performance	• Quantitative description of hydraulic effect on plume due to pumping	For criterion #1 (Influence of Freshwater Pumping on Remedy Performance), there are negligible differences between the three freshwater sources from a hydraulic perspective based on the solute transport model simulations. Particle tracking simulations using the flow model show that the flowlines for the HNWR-1 option and the river intake option are very similar, indicating that HNWR-1 pumping has only a minor effect on gradients. Pumping from Moabi Regional Park, however, has a noticeable effect on the direction of groundwater flow in the western portion of the site, where flowlines are drawn toward the hypothetical pumping well. While this has negligible effects on the rate of Cr(VI) removal, it could be important if there were some objectionable characteristic in the injected water because it is likely that some of the injected water would be drawn back close to or possibly within Park Moabi by the end of the active remedial action.
2. Quantity of Water Available	• Quantity of water available • Quantity of backup and contingency water supplies • Current demand of existing wells and how the current and future water demands of those wells will be met	In regard to criterion #2 (Quantity of Water Available), the Colorado River is the obvious best option amongst the three sources due to its plentiful supply. Without additional exploratory drilling in California, the Arizona groundwater option (existing HNWR-1 well) is more favorable than the California option (Moabi Regional Park wells). At the time of this writing, PG&E has conducted a longer-term constant-rate extraction test at HNWR-1 well to confirm the well capacity to meet the need of the remedy and other needs; results from this test will be presented when available. Note that the Topock-2 and Topock-3 wells can be used to augment the fresh water flow needed for the remedy, as applicable. To better assess the capacity of these wells, PG&E conducted step-drawdown testing at these wells in December 2011. Results of these tests are provided in Appendix J (see attachment to the RTC table in the Appendix). Based on the December tests, the Topock-2 well was found to be efficient (although the existing 200 gallons per minute (gpm) pump installed in the well was too small to provide a good test of the well capacity). It is estimated that Topock-2 could produce around 400 gpm, which is what it was able to produce when it was drilled. Topock-3 was found to be less efficient and has a maximum pumping rate of less than 200 gpm. Due to the close proximity of these two wells, it would not be possible to extract much more water by pumping them simultaneously than could be extracted from Topock-2 pumping alone. There is also a risk that if these wells were pumped more vigorously, the saline water present below the bottom of the well screens could be drawn up into the wells, and the water quality could be diminished. It is questionable whether the Topock-2 and -3 wells could supply sufficient water for the remedial action; however, they could be used as a supplementary or backup supply.

EXHIBIT 3.3-1

SUMMARY OF DETAILED EVALUATION OF THREE FRESHWATER SOURCES

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Evaluation Criteria	Analysis Factors and Considerations	Evaluation Results/Conclusions
3. Water Quality/ Potential Need for Conditioning Prior to Injection	• Comparison of source water quality to target water quality • The need for conditioning of water prior to reinjection	In regard to criterion #3 (Water Quality/Potential Need for Conditioning Prior to Injection), all three candidate water sources have pros and cons. The RWQCB, subject to its invitation for PG&E to seek review by the SWRCB, indicated that the HNWR-1 water would likely need treatment to remove naturally occurring arsenic prior to injection. On December 31, 2012, DTSC directed PG&E to add into this 60% design, a pre-treatment system to polish Arizona groundwater to California standards prior to injection. The decision by the SWRCB is anticipated to guide further direction from DTSC regarding the ultimate use of the freshwater source and what level of treatment, if any, will be required for various constituents. As such guidance is still forthcoming, in this 60% design BOD, PG&E has made the conservative assumption for freshwater treatment goals, specifically that the arsenic treatment goal is concentrations below the federal/state MCL of 10 µg/L and the fluoride treatment goal is concentrations below the state MCL of 2 mg/L. The freshwater source details will be included in an addendum to this 60% design, after such requirements are determined and completion of planned source water studies. River water currently has good quality, but the presence of TSS and organic carbon would likely be detrimental to well performance unless conditioned (filtration/disinfection) prior to injection. From a water quality perspective, the primary risk of using river water as a freshwater source is that it is susceptible to future contamination and the possibility that the water could contain compounds that may become emerging contaminants in the future and require cleanup. Amongst the two groundwater well options, the California option has significant unknowns. Exploratory drilling is required to find the best well location from a water quantity and quality perspective. If a Park Moabi well is considered, it would be prudent to condition the water since there were reports of sulfide odor in some of the early analyses. There were no iron, manganese, sulfide, or other redox indicators (dissolved oxygen, oxidation reduction potential, nitrate, total organic carbon, etc.) analyzed for the early samples to verify this, so it remains a possibility that the deeper water at Park Moabi could pose well clogging potential.

EXHIBIT 3.3-1

SUMMARY OF DETAILED EVALUATION OF THREE FRESHWATER SOURCES

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Evaluation Criteria	Analysis Factors and Considerations	Evaluation Results/Conclusions
4. Implementability Considerations (including Disturbance from Construction and Contingency)	• Significance and type of disturbance – Volume of soil disturbed, aesthetics, construction duration, new facilities – Number and size of components such as wells, pipes, access roads, treatment and support facilities – Infrastructure footprint – Ability to make use of existing facilities • Administrative requirements – Substantive permitting requirements/Approvals, access easements, compliance with ARARs and EIR mitigation measures • Maintenance requirements of facilities • Ease of replacement or redundancy, or implementation of potential contingencies • Flexibility of design – Ability to handle changes in flow and quality	For this criterion #4 (Implementability and Sustainability Considerations), the river water option carries many unknowns compared to the groundwater options. Consultation with Agencies on suitable locations and intake/fish screen design as well as substantive permitting requirements will be needed, and additional time will be required to comply with these requirements. Additionally, the DOI ROD states that remedial design will be performed in a manner that does not result in a "take" of threatened or endangered species, or damage their critical habitat. California state law also prohibits the take of state-listed "Fully Protected Species," such as the razorback sucker, except where a conservation plan has been approved and is being implemented to ensure protection of those species pursuant to the California Natural Community Conservation Planning Act. Preliminary discussion with CDFG indicated that approval of a fish screen and intake structure that would avoid incidental take of the razorback sucker may be difficult to obtain. This issue will need to be explored further, may not be feasible, and would likely add more time to the project. From a disturbance perspective, disturbance of soil/habitat in the river and on the river bank will occur from construction of the intake structure. Construction would require a coffer dam at the base of the river bank to allow for dewatering of the work area. Further up the bank, construction would require trenching and/or a shoring system within the area excavated for the river intake structure. The coffer dam would be approximately 10 feet by 10 feet if constructed using sheet piles and the trenched area further up the bank could be as wide as 50 feet. The exact footprint of these construction areas would depend on the contractor's means and methods. Operation of the river intake/fish screen will require routine inspections, and more inspections are needed for areas with high debris exposure. Replacement or modification of intake structure can be challenging and time-consuming, depending on the nature and extent of repairs needed. With advanced planning and approvals, replacement of a well can be less challenging and less time consuming. The river supply and California groundwater supply are assumed to require conditioning prior to use. All new conditioning facilities or an arsenic treatment facility will require electricity and strong chemicals for operations and will also generate wastes (e.g., sludge) that will need to be managed. Trained and qualified personnel will be required to operate these facilities. It is anticipated that waste sludge will be disposed of offsite at appropriate permitted landfills. The electricity needed to operate these new facilities will add to the electrical loads for the remedy in California. The existing HNWR-1 well will continue to use existing power supplied by Mojave Electric Cooperative in Arizona. Using the existing HNWR-1 well is consistent with the mitigation directives in the EIR to give priority to re-use of existing physical improvements. PG&E is working with the Havasu National Wildlife Refuge to confirm that this well has sufficient capacity to meet the Refuge's use and that of the remedy. The Topock-2/3 wells can be used as backup for the HNWR-1 well. As previously mentioned, a pre-injection treatment system for the removal of arsenic and fluoride is included in this 60% design. PG&E continues to evaluate options for freshwater supply by seeking location(s) for new well(s) that could supply an adequate quantity of water of sufficient quality to not require treatment prior to use for remedy operation. To that end, PG&E submitted an Implementation Plan for Alternative Fresh Water Sources. If approved, the Plan will be implemented and the results will be reflected in an addendum to the 60% design.

ensure protection of those species pursuant to the California Natural Community Conservation Planning Act. Preliminary discussion with CDFW indicated that approval of a fish screen and intake structure that would avoid incidental take of the razorback sucker may be difficult to obtain. This issue will need to be explored further, may not be feasible, and would likely add more time to the project.

In addition, river water needs to be conditioned to remove suspended solids and bacteria. Presuming that a river intake structure could be allowed to be built within the Project Area, there would be disturbance associated with the construction of the structure and a cofferdam and the associated conditioning facility. Lastly, the river water contains some trace contaminant compounds such as perchlorate, pharmaceuticals, and personal care products; these might in the future become contaminants of concern, requiring treatment or possible remediation of the area affected by the freshwater injection.

After reviewing the available options for a freshwater supply, the use of the HNWR-1 well presents less uncertainty, less risk to project schedule, and less disturbance of the site. For the purpose of the 60% design, HNWR-1 well is the preferred freshwater source and as mentioned above, a pre-injection treatment system for the removal of arsenic and fluoride is included as part of the design.

Uncertainties and Assumptions

The performance and health of the fresh water supply well (HNWR-1 or an alternative well) will be monitored throughout the life of the remedy and the well will be repaired or replaced as needed to assure a continued supply of fresh water. A well performance tracking and maintenance program and a water quality monitoring program are proposed in Volumes 1 and 2 of the Draft O&M Manual (Appendix L of this report), respectively.

Exhibit 3.3-2 presents a contingency matrix for some of the more serious types of problems that might be associated with a well as the fresh water source or with the injection of fresh water at the Topock site. If large changes in water quality occurs in the freshwater supply well, it may be necessary to change the location or the design of the freshwater well, or change the freshwater pre-injection treatment system (FWPTS) (see Exhibit 3.3-2).

As detailed in the *Revised Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL 2013a), a contingent well location has been identified along the northern bank of Sacramento Wash, north of HNWR-1 (see Figure 3.0-1). As detailed in the Implementation Plan, the quality and quantity of groundwater in this area of the aquifer will be evaluated to determine if this alternative location is a viable source of fresh water (either as a primary or contingency well). Drilling a replacement well near HNWR-1 is another contingency option, although this would more likely be used to alleviate a decline in flow rate rather than a decline in water quality.

Source Water Assessment

In response to comments received at the May 16, 2012 TWG meeting on protection of the water quality at HNWR-1 and the potential need for additional monitoring wells for source protection, a source water assessment was conducted to identify potential sources of contaminants within the radius of influence of a supply well (HWNR-1). Arizona guidelines provide a method of calculating the appropriate radius for this assessment, based on a simple equation that represents the area from which water would be drawn over a specific period of time. Arizona uses a travel time of five years for public water supply assessments.

The calculated fixed-radius equation from Arizona guidance (ADEQ 1999) is as follows:

$$r = \sqrt{\left(\frac{Qt}{\pi n H}\right)}$$

Where:

Q = well's discharge in cubic feet per year (31,620,321 ft^2/yr)
t = time of travel in years (5 years for public supply wells in Arizona)
π = 3.1416
n = aquifer porosity (11 percent)
H = screen length in feet (65 feet)
r = radius (defines the boundary of the delineated source water protection area in feet around the well)

EXHIBIT 3.3-2

CONTINGENCY MATRIX FOR POTENTIAL PROBLEMS WITH FRESHWATER SUPPLY (HNWR-1) INJECTION

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

	Potential Problems	Likely Causes for Problems	Effects of Problems if Not Resolved	Possible Operational Actions	Possible Contingency Measures
Potential Problems Associated with HNWR-1 Source	Well yield declines below the minimum required for optimal remedy operation	• Pump failure • Extraction well fouling • Excessive drawdown due to competing water users	• Delay in reaching RAOs	• Replace pump • Rehab well • Replace well • Install contingent well (the proposed location of this provisional well is shown in Figure 3.0-1)	• Seek other location for well(s) • Seek alternative freshwater supply to augment or replace primary supply • Establish institutional control to prevent excessive drawdown from competing water users
	Quality of water in freshwater well declines over time	• Pumping draws in saline water from below or geochemically reduced water containing iron and manganese	• Could result in shutting down remedial action if water quality is not suitable for injection	• Add additional pre-treatment within footprint of the Fresh Water Pre-Injection Treatment system	• Seek other sources of fresh water or other locations for well(s)
	Freshwater pumping causes adverse effects on water quality or capacity in nearby wells	• Over pumping of aquifer in areas with marginal groundwater quality / transmissivity	• Could result in shutting down remedial action if affected water users cannot be made whole	• None	• Seek other sources of fresh water or other locations for well(s) • Provide alternate water supply for affected water users

For the HNWR-1 well, with a screened interval spanning 65 feet and pumping at the current design (modeled) flow rate of 450 gpm, this equation resolves to a radius of 2,653 feet, or approximately half a mile. This radius extends to within 500 feet of the EPNG Mojave Topock Compressor Station in Arizona and encompasses the Topock Marina area (see Exhibit 3.3-3). As shown in Exhibit 3.3-3, the majority of the property in this radius is undeveloped (most is HNWR land); known/planned developments in the area include the Topock Marina on Historic Route 66, Topock Mobile Home Park, nearby private properties, Southwest Water Company, BNSF Railroad, Interstate 40, and EPNG Mojave Topock Compressor Station. Also within this radius is a former dump area which DTSC expressed concern about. This dump consists of small area of rusty cans and other metal debris scattered on the land surface. The source and date of deposition of this debris is currently unknown. It is located adjacent to a flat area that may have housed a military or work crew encampment.

Most of the water produced by HNWR-1 is expected to come from the Colorado River (via its partial diversion into Topock Marsh), although some will be derived from groundwater flowing down from the Sacramento Valley to the east (CH2M HILL 2012d). There are currently no monitoring wells in Sacramento Wash. The property upstream in Sacramento Wash is undeveloped for miles. The ADEQ conducted a survey of water quality in the Sacramento Valley in 1999 (ADEQ 2001). This survey found fluoride, chloride, and TDS to be the only constituents present in slightly elevated concentrations in the Topock area. Considering the lack of existing contaminant sources in the Sacramento Valley (Exhibit 3.3-3), the installation of monitoring wells in Sacramento Wash upstream of HNWR-1 for source water protection is not considered warranted. The Topock-2 and -3 wells are located between HNWR-1 and the former dump area, so in the unlikely event that groundwater contaminants are migrating from the dump area, they would be expected to be detected first at Topock-2 and -3.

As mentioned previously, the majority of the water produced from HNWR-1 will likely originate from the Colorado River. The travel time of constituents in river water to a nearby well may take many years, depending on their mobility (CH2M HILL 2012d); therefore, river water quality is a good indicator and should be used for source water protection of HNWR-1. There is an abundance of water quality data available for the Colorado River. The river in the immediate vicinity of the site and downstream is monitored by the Metropolitan Water District of Southern California (MWD). MWD samples for a wide range of parameters, including emerging contaminants. In addition, the Lower Colorado River Regional Water Quality Database <http://www.snwa.com/apps/wq_database/index.cfml> contains more than 2 million records covering nearly 1,000 different parameters, including depth, temperature, pH, conductivity, dissolved oxygen, nutrients, metals and organics. Information in the database is provided by Southern Nevada Water Authority, City of Las Vegas, Clark County Water Reclamation District, University of Las Vegas (UNLV), Bureau of Reclamation Denver, Bureau of Reclamation Lower Colorado River, City of Henderson, MWD, Clark County Regional Flood Control District, and the Colorado River Regional Sewer Coalition. Considering the large volume of good quality data available on water quality in the Lower Colorado River, additional river sampling for the purposes of source water protection of HNWR-1 is not considered warranted.

3.3.3 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 fresh water 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).

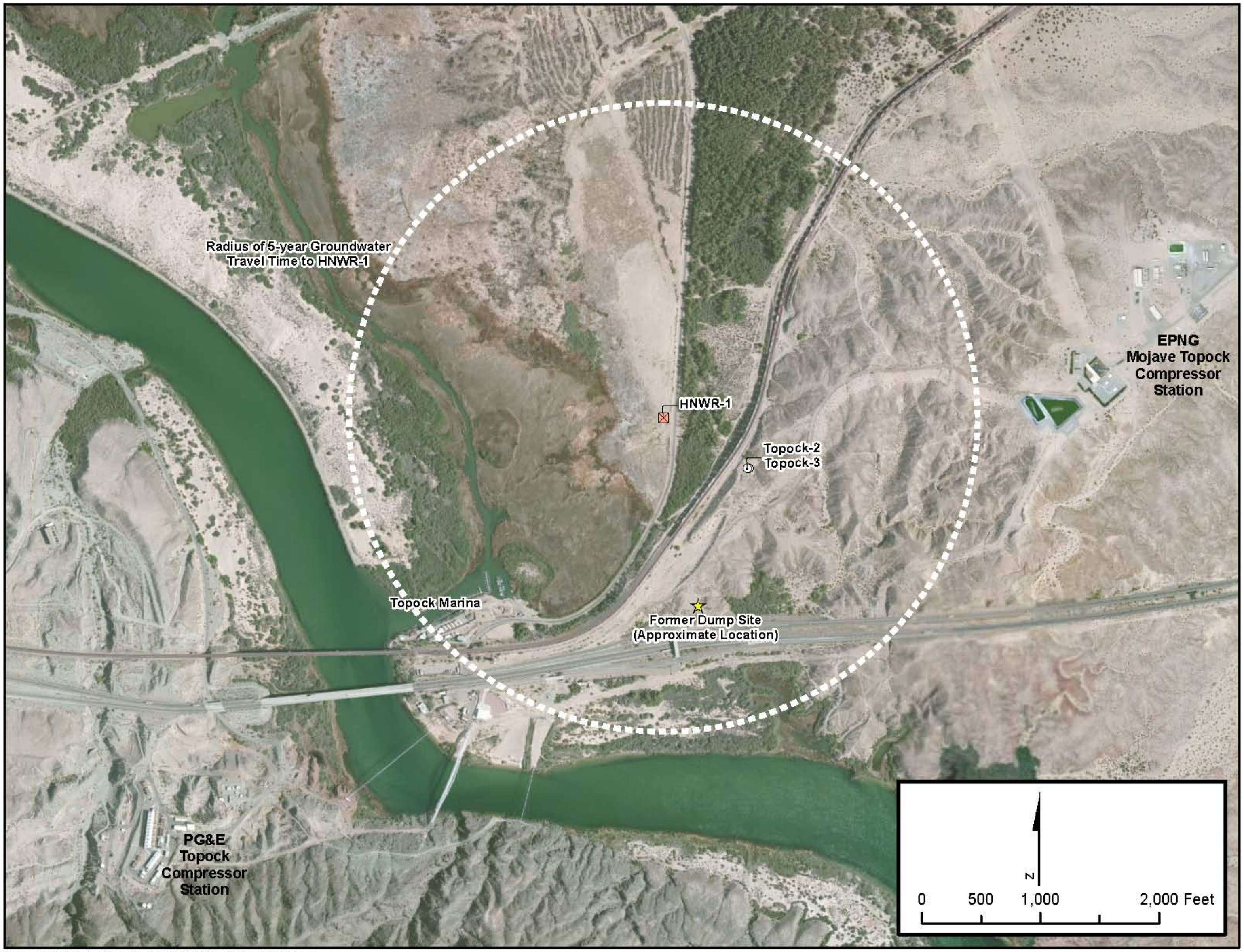


EXHIBIT 3.3-3

RADIUS OF FIVE-YEAR GROUNDWATER TRAVEL TIME TO HNWR-1 WELL

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

The freshwater supply system consists of the following:

- Extraction well or well(s) in Arizona (HNWR-1 well is the primary freshwater supply well, freshwater can be augmented with water from current TCS supply wells [Topock-2/3] if needed)
- Freshwater piping network
- Freshwater storage
- Freshwater pre-injection treatment
- Freshwater Injection Wells

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 3.3-4. Additional design parameters and operational provisions are also presented in Exhibit 3.3-4.

EXHIBIT 3.3-4

FRESHWATER SUPPLY DESIGN BASIS

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item	Design Parameters (gpm)		
	Minimum	**Nominal**	**Maximum (Design)**
Freshwater supply injection flow rate			
FW-01[b]	50	100	200
FW-02[b]	25	50	100
IRL-01[a]	35	75	200
IRL-02[a]	35	75	200
IRL-03[a]	35	100	200
IRL-04[a]	35	200	200
IRL--05, -06, -07 (Future provisional wells)[c]	*0*	*0*	*200*
IRL Injection Wells Total[b,c]	150	450	900
Freshwater supply extraction flow rate[d]			
Supply well or well(s) in Arizona – HNWR-1	260	560	1,010

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	1,010[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.

EXHIBIT 3.3-4

FRESHWATER SUPPLY DESIGN BASIS

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item	Design Parameter
Supply pump	The pump will operate on an as needed basis to maintain the designated minimum water level of 65 percent full to supply Compressor Station and Remedy project needs. A flow meter, pump discharge pressure, and water level transducer will be monitored remotely (requiring transmitters) to evaluate performance. A separate flow meter and connection for the Refuge to use. A detailed sampling and monitoring program associated with the HNWR-1 well is presented in Volume 2, Sampling and Monitoring Plan of the Operation and Maintenance Manual.
Power for the supply pump	If the supply well is the HNWR-1 well, power will be supplied by Mohave Electric Cooperative.
Pre-injection treatment of freshwater source	See Section 3.3.3.3.

Notes:

gpm = gallons per minute

[a] The minimum scenario assumes all IRL wells receive Riverbank well groundwater. The nominal scenario assumes IRL-1 and IRL-2 will receive carbon-amended River Bank Extraction Well water if Cr(VI) concentrations in the River Bank Extraction Wells exceed the clean-up goal; and IRL-3 and IRL-4 will receive fresh water. However, injection wells IRL-1 through IRL-4 (and future provisional wells IRL-5 through IRL-7, if constructed) will be constructed for flexibility to inject either/both fresh water and/or River Bank Extraction Well water during the lifetime of the remedy.

[b] Injection flow rate includes 300 gpm of fresh water for the nominal flow (and 150 gpm of River Bank Extraction Well water), and up to 900 gpm of fresh water for the maximum flow, as needed (see Table 3.3-1).

[c] Individual IRL injection well minimum and maximum flow rates are provided herein. However, the minimum and maximum aggregate flow rates for the entire IRL injection well network are estimated to be 150 gpm (may include all River Bank extraction well water) and 900 gpm, respectively (see Table 3.2-2).

[d] These values are a sum of the Compressor Station usage and freshwater flows into the Freshwater and IRL Injection Wells. Any shortage in flow will be made up by the groundwater supply wells currently in use by the TCS (Topock-2/-3)

The demand for fresh water may change over the projected 30-year life of the remedy. For example, it is possible that fresh water may be needed for injection at one or more Inner Recirculation Loop 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 fresh water 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 3.3.3.2 for details).

3.3.3.1 Freshwater Supply Piping Network

Figure 3.0-1 presents the alignment of the fresh water piping network. The total length of freshwater pipe is approximately 18,400 feet, with about 11 percent aboveground and 89 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.

For the most part, 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 (Appendix A2) as a guide, and is also placed to avoid known utilities, cultural, archaeological, and historical resources. PG&E fully recognizes that the Disturbed Areas Map is currently a work in progress and as such, will only be used as a guide and that consultation with Tribes will be a prerequisite for such planning regardless of whether the land is categorized as disturbed or not on the map.

A 12-inch fresh water pipeline that connects to the HNWR-1 well, will follow the 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 Kinder Morgan and PG&E) to cross the Colorado River. The previous co-owner of this bridge, 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). In its evaluation report, EPNG concluded that the proposed 12-inch freshwater line load is within the acceptable design loads for the bridge. EPNG recommended that equipment larger than 16 kips not be used in any 18.5foot-long deck section and that the bridge deck supports be visually inspected prior to construction.

PG&E has also completed its own structural evaluation of the capacity of the Arched Bridge to support the 12-inch water line and to check for current design codes. As a result of its evaluation, PG&E recommended modifications to select structural members of the Arched Bridge (see Appendix G). PG&E is in communication with Kinder Morgan regarding the recommended structural modifications.

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. A new freshwater pipe will connect the existing storage tanks to the pre-injection treatment system. After exiting the treatment system, fresh water will be conveyed along the Compressor Station access road to the north. Along the way, freshwater will be provided for use at the TW Bench. Freshwater conveyance piping will run along NTH and split down to the floodplain with a short leg crossing under I-40 and the BNSF railroad tracks. The northern branch will connect to and serve the MW-20 Bench; and from the MW-20 Bench, fresh water piping will go north and south to connect to the remaining floodplain and NTH IRZ wells. A branch of the fresh water piping will cross underneath the NTH to the access road west of the NTH. This pipe will continue westward and serve the westernmost Freshwater Injection Well FW- 1 and the four Inner Recirculation Loop Injection Wells (IRL-1 through -4) as needed. The Bat Cave Wash crossing near the IM-3 treatment plant will be an aerial crossing with a steel support structure complete with access ladders for piping inspection.

The freshwater injection well FW-2, located in Bat Cave Wash, will be served by a water line that goes aerially across Bat Cave Wash on a pipe support (see Figure 3.0-1). Once it crosses the wash, the pipe will go underground until it reaches the injection well.

3.3.3.2 Freshwater Supply Storage

Storage of fresh water 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 facilities located on the Compressor Station, Transwestern Bench, and MW-20 Bench.

Consistent with the mitigation directives to use existing facilities where possible, PG&E has evaluated 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 fresh water from Southwest Water Inc. in Arizona.

An analysis of the fire protection water system hydraulic performed at the 60% design stage suggested that there is adequate storage capacity to meet the fire flow storage requirement that can be shared with the remedy, as long as there is sufficient supply; this analysis is included in Attachment E of Appendix C (Design Criteria). 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.

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

3.3.3.3 Freshwater Pre-Injection Treatment System (FWPTS)

In compliance with DTSC's directive (DTSC 2012), a pre-treatment system to polish Arizona groundwater to California standards prior to injection is included in this 60% BOD. The decision by the SWRCB is anticipated to guide further direction from DTSC regarding the ultimate use of the freshwater source and what level of treatment, if any, will be required for various constituents. Pending additional agency guidance regarding what level of treatment (if any) will be required for various constituents, this design includes a FWPTS for the removal of arsenic and fluoride to conservative treatment goals— specifically, the arsenic treatment goal is to achieve concentrations below the federal/state MCL of 10 µg/L, and the fluoride treatment goal is concentrations below the state MCL of 2 mg/L. It is assumed that the primary source of the Arizona groundwater will be water from HNWR-1, and the secondary source will be water from the current TCS source wells (Topock-2 and -3). This assumption will be revisited after completion of the alternative freshwater source evaluation—that work plan is currently under review by DTSC and DOI. The FWPTS is located at the TCS, next to the planned remedy-produced water conditioning plant (see Figures ES-5, 3.0-1, and 3.5-2). All components of the FWPTS are located on previously disturbed areas within the PG&E-owned parcel. Because of its location, the FWPTS must be designed to achieve a safe, harmonious, and sustainable operation within the Compressor Station over the anticipated decades-long life of the remedy.

The design information presented herein is based on ongoing bench scale studies and experience in designing and operating arsenic and fluoride groundwater treatment systems on non-Topock projects. Additional engineering efforts are being conducted to complete the detailed design of the FWPTS and to optimize the system from a physical footprint perspective (system layout, building design including coordination of facilities with the adjacent remedy-produced water conditioning building, etc.) and a long-term operational footprint perspective (waste generation, management of waste including coordination with the remedy-produced water conditioning operation, etc.). The design information will be updated as additional bench-scale testing results become available, and as the detailed design/optimization efforts progresses (target completion in summer 2013). The goal is to include the additional design information in the 60% addendum. A detailed description of the basis of design for the FWPTS and results from the bench scale test to date are presented in the FWPTS Design Basis Memo included as Appendix M of this 60% BOD.

Technology Selection/Ongoing Bench Scale Testing

The USEPA, water and wastewater utilities, industry groups, and academia have published numerous case studies and reports on testing and performance of technologies to treat arsenic and fluoride in water (American Water Works Association [AWWA] 1999; Odell 2010). The initial list of technologies evaluated for freshwater pre-injection treatment at Topock was developed from those technologies that have been successfully used by municipalities and industry. Unproven technologies or technologies that have not been used in full-scale applications were not considered in the screening. This initial list included anion exchange, activated alumina (AA), reverse osmosis (RO), electrodialysis reversal (EDR), lime softening, distillation, iron-based adsorbents, titanium-based adsorbents, and coagulation/filtration. PG&E evaluated and screened these technologies in a two-step process: the initial screening was based the experience of the engineering team with the individual technology, and the second-level screening was based on a set of criteria, namely treatment effectiveness, reliability and flexibility, operational complexity, waste generation, footprint, and cost-effectiveness. A complete discussion of available treatment technologies and the evaluation/selection of technology for bench-scale testing is provided in Appendix A of the FWPTS Design Basis Memo (Appendix M).

As a result of this evaluation and screening process, AA was selected for bench scale testing; AA works similarly to ion exchange by exchanging hydroxide ions with arsenic and fluoride on the surface of an adsorptive media. Two types of AA media were tested – disposable AA (i.e., the adsorptive media is disposed of after it loses its adsorptive capacity) and regenerable AA (i.e., the adsorptive media is regenerated for reuse after it loses its adsorptive capacity). As discussed at the January 16, 2013 CWG and January 17, 2013 TWG meetings, the bench scale test is being conducted using HNWR-1 water at an offsite laboratory, CH2M HILL's Applied Science Laboratory. The purpose of this bench scale test is to verify treatment effectiveness, refine treatment processes, and to obtain site-specific data on key process parameters (e.g., waste quantity/quality, cost effectiveness). Bench scale testing results available to date showed that regenerable AA is effective in removing arsenic and fluoride in HNWR-1 water to the conservative treatment goals, while disposable AA is not. Therefore, disposable AA was eliminated from further consideration. The bench scale testing is currently ongoing to verify the effectiveness of various optimization techniques to better under waste quantity/quality, reduce waste generation, and chemical use (see below for additional details).

Process Description

Exhibit 3.3-5 presents a preliminary process schematic using regenerable AA. As shown, the influent freshwater stream is first treated with hypochlorite tablets to oxidize arsenic for improved removal efficiency in downstream AA adsorption. After hypochlorite treatment, the water is passed through filter(s) to remove solids that would otherwise clog the media and reduce its performance and runtime. After the first filtration step, the water is passed through three in-service media vessels configured for parallel operation; automatic valves will divert the flow and control the flow rate into each in-service vessel. A fourth media vessel is either in standby mode or in regeneration mode. To maximize media life, the vessels are brought online in a staggered manner. Once the combined effluent concentration reaches a target range, the vessel with the longest runtime is taken out of service for regeneration and replaced with the unit in standby. The treated water then flow to the treated water tank.

At some point along the treatment process, the adsorptive media loses its adsorptive capacity and will need to be regenerated. Media regeneration is generally conducted in a four-step process (AWWA 1999):

1. **Backwash** - Backwashing "fluffs up" the media to prevent compaction (enabling good flow conditions) and removes fines that form through physical abrasion of the media grinding itself into smaller particles during forward and backwash flows. Backwashing occurs in an upflow mode, the reverse of normal forward down-flow operation.
2. **Caustic regeneration** – this step removes the adsorbed arsenic and fluoride from the media using sodium hydroxide (NaOH). Arsenic and fluoride de-sorb from the media when the pH rises above 10.5. The regeneration step occurs in an upflow mode.
3. **Bed-rinsing with treated water** – in this step, the media is rinsed using treated water to flush any residual arsenic and fluoride from the media (again, this step occurs in an upflow mode).
4. **Neutralization** - Finally, to reduce the pH back to operating levels (pH 6 to 6.5), the media is neutralized with an acid solution (sulfuric or hydrochloric acid).

The exact sequencing and duration of the entire regeneration process will be verified and optimized during the ongoing bench-scale testing. Wastewater generated from the regeneration process will be directed through filter(s) and then to the backwash storage tanks. Based on bench scale testing results to date, a regeneration frequency of about every 5 days at maximum flow (900 gpm) is assumed. This will result in wastewater volumes of 3.3 to 11 million gallons per year. Additional bench scale testing is being conducted to verify various optimization techniques to reduce wastewater generation and quantities of chemical use. This information will provide further clarification on the waste quantities and qualities which refine the management approach for wastewater (for example, disposal of the wastewater in the evaporation ponds, reuse in the TCS cooling towers, reinjection in the in situ reactive zone wells, or offsite disposal). Exhibit 3.3-6 presents the design criteria for the FWPTS.

EXHIBIT 3.3-5

PRE-INJECTION TREATMENT PROCESS SCHEMATIC

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

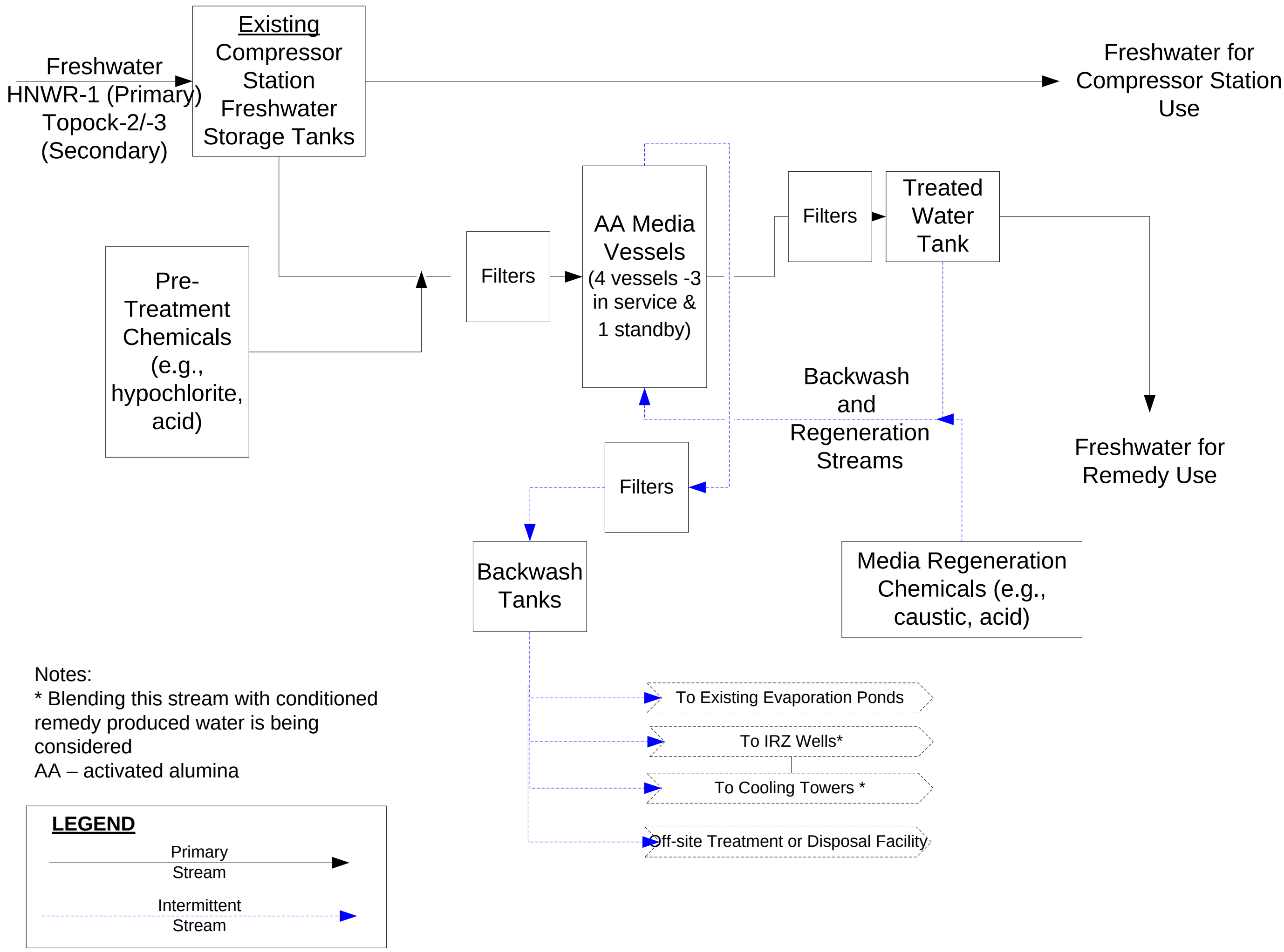


EXHIBIT 3.3-6

FRESHWATER PRE-INJECTION TREATMENT DESIGN CRITERIA

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
Flow – Average	450 gpm	Based on modeling and Tables 3.2-2 and 3.3-1.
Flow – Peak	900 gpm	Based on modeling and Table 3.2-2 and 3.3-1.
Equalization volume	420,000 gallons/ approx. 6 hrs	Shared use of existing Compressor Station storage tanks.
Effluent water quality requirements	Arsenic <10 µg/L Fluoride <2 mg/L pH – 6.5-8.5	Treatment goal for arsenic is to below federal/state MCL of 10 µg/L and for fluoride is to below the state MCL of 2 mg/L. Effluent pH will be approximately 6.5 to 8.5 to achieve improved constituent removal and maintain injection well health
Degree of automation	Full	System is to be able to run un-manned (such as nights, weekends, and holidays).
Uptime	80%	
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 existing freshwater storage tanks.
Backwash regeneration wastewater management	Ability to convey water to all reuse/ disposal options	Include connections to allow for trucking of wastewater from backwash tanks.

Major equipment includes the following:

- AA Media Vessels – Steel pressure vessels with piping to house the activated alumina media
- Caustic Tank and Feed System – Store and inject 25% caustic
- Hypochlorite Feeder – Tablet feeder using calcium hypochlorite pellets
- Sulfuric Acid Tank and Feed System – Store and inject 93% sulfuric acid
- Treated Water Tank – Stores water prior to injection and to store water for backwash and regeneration steps
- Booster Pumps – Convey the water through the media vessels, filters, and into the Treated Water Tank
- Backwash and Regen Pumps – Convey the water through the media vessels and filters into the backwash pumps
- Backwash Water Transfer Pumps – Convey the water from the Treated Water Tank to the reuse or disposal options
- Filters – Bag or cartridge type filters for the pre-treated and post-treated water and backwash/regeneration streams to remove any solids.

Design Philosophy/Uncertainties in Design

As previously mentioned, the FWPTS must be designed to achieve a safe, efficient, and sustainable operation within the Compressor Station over the anticipated decades-long life of the remedy. Although regenerable AA was selected as the adsorption media for removal of arsenic and fluoride in this design, additional engineering efforts and ongoing bench scale testing are currently being conducted to complete the detailed design of the FWPTS and to optimize the system from both physical and long-term operational footprint perspectives. The forthcoming agency guidance on what level of treatment if any will be required, will also affect the design; for example, it could change the treatment technology selected for design.

Therefore, pending results from the continued efforts and the forthcoming agency guidance, the design can be thought of in terms of two main elements, each with its own design approach:

Core Elements

These are components that are considered to be neutral of the technology selected or process variables such as wastewater generation and will not likely sustain a large shift from the ongoing efforts (for example, bag filters and treatment vessel size). This flexibility is possible in the design because the bag filters are sized based on flow rate, and the treatment media vessels are sized based on hydraulic loading rates (volumetric flow divided by cross-section area) and media depth and are not dependent on media selected.

Flexible Elements

These are components that could sustain a large shift from the ongoing efforts and will most likely change in terms of quantities (not types). For example, the volume of backwash water could be reduced if the effectiveness of regeneration techniques exceed expectation. For these elements, a conservative design basis is being selected for the frequency of regeneration and chemical usage. This resulted in larger storage vessels, increased chemical usage, and larger volumes of wastewater generated. The continued efforts will help to reduce the uncertainty in these elements.

3.3.3.4 Freshwater Injection Wells

Injection of fresh water 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.

Following installation and development, each injection well will be tested to evaluate its maximum injection flow rate. This testing will involve extracting water from the well, storing the water in one or more large (~20,000-gallon) portable tanks, testing the extracted water to confirm that it is suitable for injection back into the aquifer, and then injecting the water back into the well through a filter to remove particulate matter. The pumping and injection rate will be increased in three or more steps. This type of step test provides data that can be used to estimate the ultimate capacity of a well. These same test procedures were used for the IM-3 injection wells.

Injection wells invariably lose capacity over time. In order to last for the life of the remedial action, it will be necessary for the injection wells to have initial capacity significant greater than their design flow rates. If the step testing indicates that the capacity of any injection well is less than three times the design flow rate, consideration will be given to installation of an additional well to ensure that sufficient injection capacity is available for the life of the remedy. If the low capacity of the well appears to be due to low permeability in the aquifer, the new well should be located some distance away from the existing well in hopes of finding better aquifer materials. The groundwater model will be utilized to evaluate the need for any additional injection wells and the locations where additional wells would be most effective.

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 several dozen 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 maintain 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 3.4-1 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 7.6 million gallons per year.

EXHIBIT 3.4-1
SUMMARY OF REMEDY-PRODUCED WATER VOLUME BY SOURCE AND TYPE
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Source/Type	Wells [c]	Events/ Year	Annual Volume, MG/year [a]	Comments
Backwash				
Injection Wells	32	30-51 [b]	4.67	Weekly backwashing
Well Rehabilitation				
Injection/IRZ Extraction Wells	36	1	2.42	Annual rehabilitation
Extraction Wells (non-IRZ)/Supply Well	13	0.2	0.14	Rehabilitation every 5 years
Other				
Rainwater	-	-	0.3	
Monitoring well sampling purge water and equipment decontamination water	-	-	0.1	
Total			**7.6**	

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.
[c] The well count is as follows: 32 Injection Wells = 24 IRZ, 4 IRL, 2 TCS, and 2 Freshwater Injection Wells; 36 Injection/IRZ Extraction Wells = 32 Injection Wells plus 4 IRZ extraction wells; 13 Extraction Wells (non-IRZ)/Supply Well = 5 Riverbank Extraction Wells, 5 East Ravine Extraction Wells, 2 TW Bench Extraction Wells, and 1 Freshwater supply well.

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 reuse (or disposal, if necessary). 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 all injection wells (including IRZ injection wells). Backwashing rates will be set at twice the injection rate (see Table 3.2-2) 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 other remedy piping to service the wells as shown on Figure 3.0-1. All utility corridors are located in existing roadways/ROWs or previously disturbed areas. Pipelines will be installed in pre-cast concrete trenches or direct buried 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 Remedy-produced Water Conditioning Plant (located at the Compressor Station) 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 is shown on Sheet I-02-03 of Appendix D. 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 a 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 (note that an infiltration gallery in Bat Cave Wash is not being planned at this time pending completion of the Soil RFI/RI and CMS/FS). Remedy-produced water might also be used as cooling water at the Compressor Station. Even though some of the remedy-produced water would be evaporated in the cooling towers or ponds, it would offset the groundwater pumping that would otherwise be needed for cooling water. Thus, the use of remedy-produced water in the cooling towers would decrease the consumptive use of the existing water source at the Compressor Station.

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 fresh water and use in TCS cooling towers
4. Reuse by blending with other water (e.g., backwash water from IRL Injection Wells, well rehab water after first flush [referred to herein as “second flush” well rehab water]) and injection into the 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 3.4-2 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 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 3.4-2

REUSE/DISPOSAL OPTIONS AND ASSOCIATED DEGREE OF CONDITIONING REQUIRED

Groundwater Remedy Basis of Design Report/Intermediate (60%) 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. The TCS ponds are located outside of the EIR project area, but are still inside the APE. Sending water to the TCS ponds would be achieved by running a pipe to the existing cooling tower blowdown system. This new pipe would be located on the TCS property; therefore no construction would occur outside of the approved project area.
3. Reuse by blending with fresh water 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 from the existing source wells for cooling and should not be considered consumptive use.
4. Reuse by blending with carbon-amended water and injection into the 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 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 are retained for further evaluation and are not dropped from consideration as part of the remedy design, These options include the Infiltration Gallery in Bat Cave Wash which is retained until the completion of the Soil RFI/RI and CMS/FS and the Moabi Regional Park sewage ponds which is under evaluation.

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 3.4-3 describes the management plan in a narrative format, and Figures 3.4-1 and 3.4-2 illustrate the management plan in a graphical format to facilitate visualization and understanding of the proposed plan . Note that the plan is intended to be flexible and to evolve with operational experience during the groundwater remedy implementation and is subject to change if underlying assumptions prove incorrect or change. Additional description of the rationale is included in Appendix F.

EXHIBIT 3.4-3

REUSE/DISPOSAL MANAGEMENT PLAN FOR WATER PRODUCED DURING FINAL GROUNDWATER REMEDY

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Source	Volume (MG/year)	Management Plan – Listed in Order of Preference
Backwash of freshwater injection wells/IRL injection wells receiving fresh water	2.32	1. Compressor station cooling towers 2. IRZ injection wells
Backwash of IRZ injection wells, TCS injection wells, IRL injection wells receiving water from river bank extraction wells, and IRZ CIP[c]	2.35[a]	IRZ injection wells
Well rehabilitation (all wells) - first flush	0.77[a,b]	1. TCS ponds 2. Trucked offsite 3. If first flush water is neutralized in the field and/or filtered with a transportable treatment unit, send water to Remedy-produced Water Conditioning Plant for processing and re-inject into IRZ injection wells.
Well rehabilitation (all wells) – second flush	1.8 [a,b]	Same as backwash from corresponding well
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. IRZ injection wells 2. TCS ponds 3. 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: IRZ injection wells

Note:
MG = million gallons
[a] Assumes half of the flow to the IRL injection wells is fresh water with the remainder amended with carbon.
[b] Testing of IRZ well maintenance schemes at Hinkley is complete and confirmed the weekly backwashing and annual rehabilitation frequency. 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.
[c] Spent solutions from Clean-in-Place System could also be shipped off-site for disposal.

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 for additional wells, the need to further condition the water produced, new disposal or reuse options, or new 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 facility 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 system will include solids removal with neutralization**.** Exhibit 3.4-4 shows the process schematic for this system. This is based on the assumptions that:

- Remedy-produced water that has significantly higher concentrations of solids or dissolved constituents (e.g., byproducts) 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. If first flush water is neutralized in the field and/or filtered with a transportable treatment unit at the well head, the water may be sent to the Remedy-produced Water Conditioning Plant for processing prior to reinjection into the IRZ injection wells.
- 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 an offsite disposal facility, or neutralizing with permitted transportable treatment units at the well head.

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 IRZ Injection Wells. Temporary fluctuations in water quality will occur during remedy implementation prior to achieving RAOs. Institutional controls will prevent use of affected groundwater while the remedy is being implemented (note that there are currently no municipal or private wells in the chromium plume area, to PG&E's knowledge). 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 SWRCB Resolution No. 68-16.

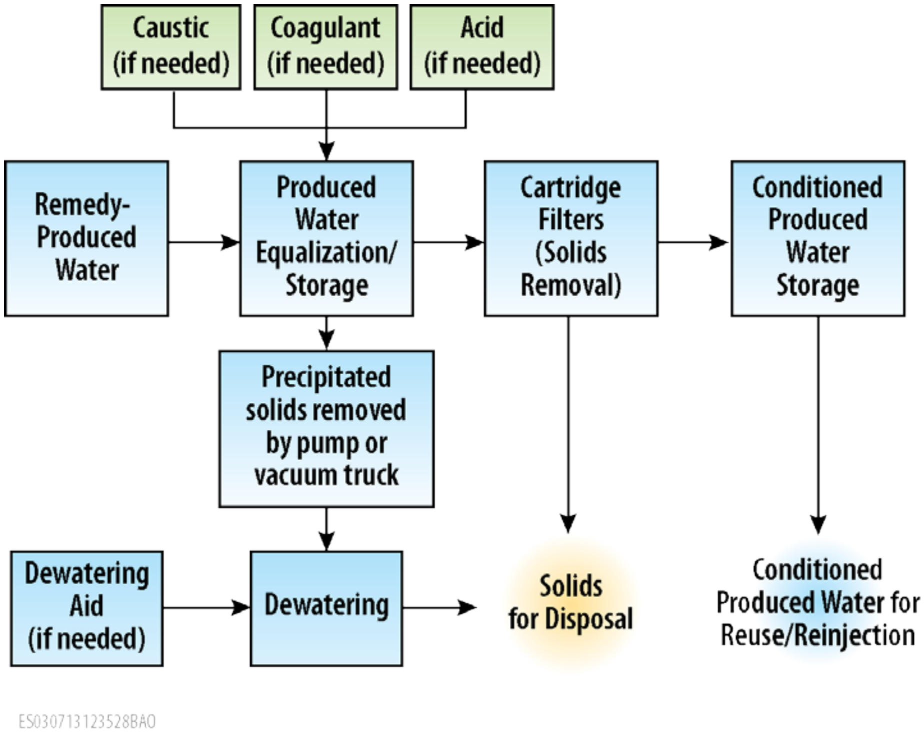


EXHIBIT 3.4-4

REMEDY-PRODUCED WATER CONDITIONING PROCESS SCHEMATIC

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

The design basis for the remedy-produced water conditioning system is shown in Exhibit 3.4-5.

Additional description of key system components is provided below:

- 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 in an area with secondary containment. All tanks will be equipped with pumps and Venturi eductors to aid in pH adjustment or solids coagulation. Solids that settle in the tanks will be pumped to the solid/liquid separation (dewatering) system.
- 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 in each process stream. 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-volts alternating current (VAC) power for instruments and other low voltage equipment.

EXHIBIT 3.4-5

REMEDY-PRODUCED WATER CONDITIONING SYSTEM DESIGN CRITERIA

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
Flow – Average	20 gpm	Best current estimate is 7.6 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. All tanks will be equipped with pumps and Venturi eductors to aid in pH adjustment or coagulation. To allow for operational flexibility to segregate/manage various produced water streams and to optimize processes in the future, the conditioning system will be configured with two parallel trains: 1) A-side Remedy and 2) B-side Freshwater. Both trains will be equipped initially with identical processes/units as illustrated in Exhibit 3.4-4.
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. Will 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. Parallel process streams (A-Side Remedy and B-side Freshwater) equipped with two pairs of duplex 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 conditioned water from system effluent tanks.

- The pH neutralization system will include chemical metering pumps to inject 25 percent sodium hydroxide (caustic) and sulfuric or hydrochloric acid into the remedy-produced water conditioning system. Other components will include pH probes, analyzers, and controllers for remote installation from chemical supply and pumps. 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.
- Storage of conditioned produced water will be as follows:
  - One 42,000-gallon steel tank will be installed near the existing TCS freshwater storage tanks to receive conditioned water from the Freshwater B-side. The tank will be of standard steel construction with epoxy coating on the steel.
  - Four 21,000- gallon frac tanks will be installed on the flat portion of the AOC 4 (Debris Ravine) area, to receive conditioned water from the Remedy Water A side. These tanks will have secondary containment and will be equipped with capabilities for local acidic or basic pH adjustment and mixing.
- 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 (influent) produced water tanks and future conditioning.
- Two truck-loading stations will be installed for unconditioned produced water. The stations will be equipped with a truck loading pump (150 gpm at 90 ft w.c. 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. 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 for belowground, or Sch. 40 steel with AWWA C205 cement mortar lining for aboveground. Pipe sizes will be 2- to 4-inch diameter for conditioned water, and 4- to 8inch diameter for unconditioned water (see Appendix C for hydraulic calculations).
- Space is 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 and/or at the sources (e.g., TW Bench decon pad).
- Coagulants or flocculants are being evaluated for potential benefits in improving settling of suspended solids in produced water. Space is being provided for installation of chemical storage tanks, chemical feed or metering pumps, and controls. A dewatering aid is being evaluated as a possible future step to assist in the dewatering of the influent tank bottoms prior to pumping to the liquid phase separators.

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), security provisions, as well as access roads and pathways, operator's facilities, equipment and materials storage, equipment maintenance and testing areas, office space, bathrooms, waste or refuse containers, and onsite laboratories (one central lab at the TW Bench and two satellite process control labs, one at the Remedy-produced Water Conditioning/Freshwater Pre-injection Treatment Plant and one at the MW-20 bench).

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

At this 60% design stage, it is estimated that the groundwater remedy could require up to 3.7 million kilowatt-hours of electricity annually (see Appendix D, drawing E-00-32 for electrical load details). The primary power supply source for the remedy facilities in California will be power generated by the PG&E Topock Compressor Station and/or supplied from the City of Needles. For the freshwater supply well (HNWR-1) in Arizona, the power supply source will be power provided by Mohave Electric Cooperative. Secondary power supply will be power generated from small photovoltaic solar panels at various locations such as at the Central Maintenance Facility at the TW Bench and at select remote well locations.

The power system will be transmitted at 480 VAC to 12K VAC along the pipeline corridors to serve all remedy facilities located in California - including wells, aboveground buildings, etc . At each load center, a step-down transformer will return the voltage to 480 VAC 3 phase. Six load centers are currently planned with a transformer and distribution equipment at each one (in addition, one future provisional load center may be needed to serve the future provisional well IRL-7 if this well is needed to be installed/operated). The transformers will range in size from 75 kilovolt-amperes (kVA) to 300 kVA, and will be mounted aboveground on shallow concrete foundations. 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 system will consist of electrical cable installed in conduits that are directly buried or placed in underground concrete trenches. While the National Electrical Safety Code (NESC) requires burial depths of 30 inches for medium voltage, depths of 30 or 36 inches are usual with 48 inch being favored for greater protection from digging and other underground operations, especially those associated with other utilities, such as sewer, water, gas, etc. 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 inside the Central Maintenance Building. From the control terminals (and potentially mobile tablets), 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 at the 90% design. The main components of the SCADA system include the following:

- A human–machine interface (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 system 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 Central Maintenance Facility.

3.5.3 Buildings/Structures for Major Equipment and Key Supporting Functions

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 tanks, etc.), electrical/control equipment, onsite laboratory, and operator's control room. Major equipment associated with the Remedy-produced Water Conditioning Plant includes storage tanks, phase separators, cartridge filters, chemical storage/dosing, electrical/control equipment, onsite laboratory, and operator's office. Similarly, major equipment associated with the FWPTS includes storage tanks, filters, adsorptive media vessels, chemical storage/ dosing, as well as electrical/control equipment.

Major equipment associated with the freshwater supply well (HNWR-1) includes two equipment pads with sunshades, one for the well and one for electrical/control equipment. Major equipment associated with general remedy O&M includes onsite laboratory, sampling vehicles, maintenance vehicles, mechanical/hand tools, equipment staging, equipment storage, sample storage, work benches, equipment decontamination areas, area for O&M documents (including Standard Operating Procedures [SOPs], training materials, permits, etc.), and crew room.

In addition to the major equipment listed above, key supporting functions for long-term remedy O&M include training, quality control, inspection, information management (including cataloguing and storage of project documents as required by the CACA and CD), overall site operations management, Tribal liaison, and community/ stakeholders outreach and engagement.

The following criteria were used to identify candidate locations for building/structures to house major equipment and key supporting functions:

- Previously disturbed areas (PG&E fully recognizes that consultation with Tribes will be required regardless of whether the land is previously disturbed or not;
- Avoiding or minimizing adverse effects on cultural, archaeological, and historical resources to the maximum extent practicable;
- Avoiding or minimizing adverse effects on sensitive biological resources to the maximum extent practicable;
- 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 with major gas pipelines in the area);
- Limited interference with Compressor Station operations during construction and O&M of the remedy (health and safety concerns);
- Shared use of existing improvements to the extent practicable (except for buildings with potential historical significance); and
- Minimize footprint outside of PG&E property.

Based on these criteria, buildings and structures for major equipment and key supporting functions have been located in three main areas, namely the Compressor Station, the Transwestern Meter Station Bench (also called the TW Bench), and the MW-20 Bench. The Compressor Station and a large portion of the TW Bench are located on PG&E property, and the MW-20 Bench is located on federal lands. A small portion of the TW Bench is on HNWR land. Both the MW-20 Bench and the TW Bench areas are located on previously disturbed areas next to existing graded roads, and have been used to support various field and IM activities since 2004.

Today, a portion of the MW-20 Bench is used to house IM equipment and to support IM operations (e.g., extraction wells, an electrical room, three frac tanks, and a truck loading/unloading facility). There is fencing around the equipment area and nighttime lighting for health and safety and security purposes. The remaining portion of the MW-20 Bench is used for vehicle parking and equipment staging, and provides an alternative access route around the fenced facility.

The TW Bench area is currently used to support various field/IM activities, the ongoing groundwater and surface water sampling activities, well drilling activities, equipment decontamination activities, soil sampling activities, temporary waste management activities, and various field surveys to collect baseline data to support design. The TW Bench houses a field trailer, a decon pad, and several conex boxes for temporary storage. These facilities are regularly used by the groundwater and surface water sampling crew, PG&E staff, and field personnel/staff onsite for ad-hoc field tasks. In addition to PG&E's use of the TW Bench area, Transwestern has been operating its metering station on the easternmost portion of the bench since 1991.

In general, the rationale for placement of remedy buildings/structures is as follows:

1. Buildings/structures that house carbon amendment equipment will be located at the MW-20 Bench and TW Bench in proximity to the injection piping locations. The reconfigured yard will be enclosed with a fence and security measures will be incorporated in the design.
2. The building/structure that houses the water conditioning equipment and pre-injection treatment equipment will be located at the Compressor Station in proximity to the shared TCS freshwater storage tanks, the reuse option for conditioned water (TCS cooling towers), and the source of power for the remedy. Based on further discussions with TCS Operations, available space at the Compressor Station for non-gas operation is very limited; therefore, only essential remedy functions can be located inside the fence line. In compliance with this guideline, the previously planned use of existing buildings at the Compressor Station (e.g., operations building, onsite laboratory, and full size crew room) has been reduced and these functions will be consolidated at the TW Bench.
3. A Central Maintenance Building will be located at the centrally located TW Bench to house all key supporting functions for remedy construction and long-term O&M. A storage building is located next to the maintenance building to house equipment, parts, and tools needed for the remedy. The TW Bench will be enclosed with a fence and appropriate security measures. To accommodate the shared use of this bench by the Topock remediation project and Transwestern, a new access road will be built east of the bench to allow for access to Transwestern's gas transmission equipment.
4. A fence will be installed at the current HNWR-1 well location in Arizona to protect the well and associated electrical/control equipment. Sunshades will also be provided to protect the equipment.

Exhibit 3.5-1 provides a summary of currently planned remedy buildings/structures for major equipment and key supporting functions. Figures 3.5-1 through 3.5-8 present layouts and photo simulations of remedy buildings/structures at the Compressor Station, the TW Bench, and MW-20 Bench.

EXHIBIT 3.5-1
REMEDY BUILDINGS AND STRUCTURES
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Compressor Station	TW Bench	MW-20 Bench	HNWR-1 Well
• Remedy-produced Water Conditioning Plant/Fresh Water Pre-Injection Treatment System and associated tanks/ chemical storage • Truck loading/unloading station • Existing freshwater storage tanks (share use with Compressor Station)	• Carbon Amendment Building and Carbon Storage Tank for TCS Loop • Central Maintenance Building • Equipment Storage Building • Truck loading/unloading station • Existing equipment decontamination pad (reuse)	• Carbon Amendment Building and Carbon Storage Tank for NTH IRZ • Truck loading/unloading station • Existing storage tanks (reuse 3 frac tanks)	• A fence around the well house similar to Topock-2/3 • HNWR-1 (reuse existing well)

3.5.4 Site Safety and Security

In general, the security for remedial facilities located inside the Compressor Station will be provided for by PG&E's security system. Remedial facilities located outside of the fenced portion of the Compressor Station will be equipped with security features/systems that are consistent with PG&E's current security standards. Such features, as determined necessary and in compliance with project and landowners' requirements, could include, but are not limited to, security fencing to protect the equipment and provide safety for personnel and the public; locks and chains to prevent unauthorized access; security devices and instrumentation; security communication systems; alarms to notify PG&E's security operations; key card systems; and security cameras. In compliance with the EIR mitigation measure CUL-1a-6 (DTSC 2011d), any additional phone calls and alarms associated with remedial activities will not be routed through PG&E's existing alarm system at the Compressor Station. See Appendix C (Design Criteria) for additional details.

Communications for system controls and site security will be routed through fiber optic cabling and data radios. The communications system will collect data from each of the remote facilities and record and present the data on a graphical computer system. Operations personnel will monitor alarms and the process on a near real-time basis. Manual process functions may be executed from the computer system. Automated functions will be based in the distributed control system and will not need operations involvement unless changes are required or an alarm is activated.

As required by the EIR mitigation measure CUL-1a-3b, a Site Security Plan will be developed as part of the final design with the goal to report human-caused disturbance at remedial facilities to DTSC and affected landowners during construction and operation of the final remedy. PG&E plans to submit the Site Security Plan at the 90% design stage after remedy infrastructure has been confirmed.

To protect the health and safety of personnel, the public, and animals in the surrounding environment, and to ensure non-interference with remedy operations, engineering controls will be used to restrict access to remedial facilities located outside of the Compressor Station. Access to remedial facilities located inside the Compressor Station will be in accordance with established protocols for the facility. Besides consideration for health and safety and remedy operations, another aspect of access is related to preserving Tribal members' access to, and use of, the project area for religious, spiritual, or other cultural purposes. To address this aspect of access, an Access Plan will be developed in coordination with the federal agencies with land management responsibilities in the project area, as required by EIR mitigation measure CUL-1a-2. On November 26, 2011, BLM issued a Tribal Access Plan for Federal Properties, the purpose of which is to assure the rights of Tribes to access their places of spiritual and cultural importance located on federal lands within the boundary of the APE. In contrast, the Access Plan required by the EIR mitigation measure CUL-1a-2 that PG&E is responsible for will address Tribal access for religious, spiritual, or other cultural purposes to the portion of the project area that PG&E has authority to facilitate access to. PG&E plans to submit the Access Plan at the 90% design stage after remedy infrastructure has been confirmed. Additionally, pursuant to the 2006 Easement Agreement and the Access Agreement between the FMIT and PG&E, PG&E will provide the FMIT with reasonable access to the FMIT property and IM-3 facility for religious, spiritual or cultural purposes, so long as such access does not interfere with remediation activities.

In addition, as required by EIR mitigation measures CUL-1a-3c, PG&E will design and fund the installation of an informational kiosk to be installed within Park Moabi that will inform visitors of work activities being done at the project site. PG&E will involve the tribes to the maximum extent feasible, as determined by DTSC, in the design and development of the informational kiosk. As required by EIR mitigation measure CUL-1a-3d, PG&E will work with landowners and land management entities to develop, design, and fund the installation of easily visible signs that specify which parts of the project will be off limits to off-road vehicle use due to health and safety concerns, and to protect environmental resources. PG&E's efforts may include coordinating with BLM to install signs that note the designation of the areas as an ACEC 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.

3.5.5 Access Roads and Pathways

To the extent necessary, new access roads will be built to service remedial structures (buildings, wells, vaults, 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. 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.

Care has been taken to place remedy facilities where the use of existing graded roads and access pathways can be maximized, thereby minimizing the need to build new permanent access roads. When complete avoidance of building new roads is not feasible, the new roads are to be placed in previously disturbed areas to the extent practicable. Figure 3.5-9 shows existing and new access roads and pathways to service remedy facilities. As shown in this figure, two new permanent roads will be needed to construct and service the following remedy infrastructures:

- **Well IRL-4** – In response to comments on the 30% design (see Appendix I, #185HA-36), this freshwater injection well was relocated to the bottom of a ravine from its previous location (at the top of the plateau). A new permanent, engineered road has been designed and will be built to access and service this well, the nearby monitoring well, and associated piping. In addition, a portion of the ravine bottom will be partially filled in to create a sturdy, flat area with adequate work space for a) wells installation, b) well maintenance and sampling activities during remedy operations, and c) future decommissioning of these wells and associated piping.
- **Well IRL-2** - In response to comments on the 30% design (see Appendix I, #185HA-36), this well was relocated. A new permanent, engineered road has been designed and will be built to service this well and associated piping. The new road will be connected to old Route 66.

In addition, significant erosion was observed on the existing road just to the west of freshwater well FW-2, monitoring well MW-S, and associated piping (see Exhibit 3.5-2). These remedy infrastructures will need to be protected. Drainage will be engineered to divert flow/debris away from the remedy features.

EXHIBIT 3.5-2

SEVERE EROSION OBSERVED ON ROAD, WEST OF FRESHWATER INJECTION WELL FW-2

3.6 Monitoring Well Design

In addition to the remediation and freshwater injection wells discussed in Sections 3.2 and 3.3, respectively, the final groundwater remedy also includes a monitoring well network that comprises both existing and new supplemental monitoring wells. This section discusses the approach and considerations for new monitoring well design, well design options, and the process for well design selection. The proposed monitoring program, monitoring well network (includes 19 new well locations), and data quality objectives are discussed in the Sampling and Monitoring Plan, Volume 2 of the Draft Operation and Maintenance Manual (Appendix L to this Basis of Design Report).

There are several variables that must be considered when designing the supplemental monitoring wells for the monitoring program of the final groundwater remedy. Therefore, a flexible approach to monitoring well design is required to meet the planned objectives of each monitoring location. This section addresses these variables and the effect that each has on well design considerations. Preliminary screen interval estimates for each of the proposed supplemental monitoring locations are provided in Table 3.6-1. However, the details included in this table are estimated and will likely change as additional data are collected during construction. Key information that will be collected and considered prior to determination of the final monitoring well design for each location is discussed in the following subsection.

3.6.1 Key Variables and Well Design Considerations

Key uncertainties and constraints that must be considered prior to determining the design of supplemental monitoring wells for the Compliance and Process Control Monitoring Programs include the following:

- Hydrogeologic conditions at the well site
- Borehole quantity constraints
- Well utility for data collections
- Constructibility and longevity constraints

Hydrogeologic Conditions. The thickness of the saturated, unconsolidated sediments above bedrock varies considerably across the site. Further, based on lithologic data collected at the site to date, variations in the stratigraphy of the unconsolidated sediments cannot be reliably mapped between boreholes. Therefore, the number and depth of the monitoring zones required at each location to supplement plume characterization and/or monitor remedy performance cannot be completely determined prior to drilling. The data collected from boreholes drilled during remediation and monitoring well construction (e.g., depth to bedrock and additional hydrostratigraphic detail) will be used to select appropriate monitoring intervals for each supplemental monitoring location. Depth-specific samples and continuous core collected during drilling have been useful at the Topock site when designing monitoring wells intended to characterize the plume. However, the effort to obtain this data to determine screened intervals of remediation monitoring wells, which may be located in a plume undergoing active remediation, may not be warranted at all locations.

Borehole Quantity Constraints. Multiple monitoring depths will likely be needed at each monitoring location. Using conventional well design most commonly used at Topock, each monitoring interval would require a separate borehole. However, the number of available boreholes is limited (DTSC 2011d). No more than 60 boreholes can be installed for the construction of monitoring wells. To date, 16 of the allotted 60 boreholes have been installed as part of the investigation activities in the East Ravine area. As a result, 43 boreholes remain available for monitoring well construction associated with the final groundwater remedy. If an alternate well design were used that could monitor multiple zones within a single borehole and meet groundwater monitoring objectives, the 19 proposed locations would require 19 total boreholes and 24 boreholes would remain available for future groundwater monitoring requirements. However, if multiple boreholes are required at some or all of the 19 locations, the flexibility to install wells later on to meet future monitoring requirements may be limited. Therefore, monitoring well designs that require fewer boreholes to meet the monitoring objectives are strongly preferred at the Topock site.

Well Utility for Data Collection. The type of data required for a given monitoring location must be considered such that the final well design is suitable for the collection of representative data. Key variables that must be considered include:

- Depth to water – influences the sample collection methods and equipment, and diameter of the well casing used for monitoring well construction.
- Well materials – site experience has shown that not all well materials are suitable for the different hydrogeologic environments observed across the site. This is especially important when considering specialized multiple-depth monitoring systems.
- Sample and data collection protocol – The protocol and equipment used to collect groundwater samples and field measurements from the monitoring well will influence the well design. In addition to practicability considerations, optimizing the monitoring well design based on groundwater sample collection and field measurement protocol requirements will yield more reliable data (e.g., repeatability) and decreased environmental impact (e.g., lower volumes of purged groundwater equates to less ex-situ handling, treatment, and disposal).
- Need for water level transducers – In some locations, it may be desirable to deploy transducers to provide continuous water level monitoring. In this case, the need to accommodate a transducer may determine the minimum diameter of the well casing.

Constructibility and Longevity. All monitoring wells must be constructed in accordance with applicable regulatory and industry standards. Considerations for the number of boreholes necessary for the number of monitoring intervals identified, and data collection requirements, must be evaluated for constructibility. As the number of casings within a borehole and borehole depth increases, the drilling method(s) used and the complexity of the well installation process must be evaluated for practicability. In addition to the constructibility of a given well design, the operational longevity of the well and associated groundwater sample and data collection components must be considered to minimize the need for future reconstruction and/or replacement. For example, monitoring well(s) that cannot be effectively developed or that contain dedicated, non-removable in-well equipment may not last through the anticipated duration of the final groundwater remedy. Over the duration of the groundwater remedy, monitoring wells located in areas that are influenced by the IRZ may require more frequent maintenance than wells outside of these areas.

3.6.2 Well Design Options

Multiple monitoring well designs will be considered to address the uncertainties and constraints discussed above. These designs and the key advantages and disadvantages associated with each, are presented below. In general, the monitoring well design for a given monitoring location will include one or a combination of the following well types:

- Conventional wells – Consist of a single screen and casing string within a single borehole.
- Dual-screen wells – Consist of a conventional well with two separate screen intervals within a single borehole (the screened intervals separated by a section of blank casing and a packer).
- Nested wells – Consist of more than one conventional well (i.e. multiple single-screen casing strings) constructed within a single borehole.
- Multi-level wells – Consist of a specially engineered assembly with multiple sampling ports separated by packers along a single casing string, within a single borehole.
- Clustered wells – Consist of multiple conventional, nested, or multi-level wells in more than one borehole at a single monitoring location.

For example, the solution for monitoring at a location requiring an arbitrary four monitoring zones can be accomplished using any of the following designs, which are grouped by the number of boreholes the design would require:

- 4 boreholes (clustered) – Four conventional wells
- 3 boreholes (clustered) – Two conventional wells and one nested or multi-level well
- 2 boreholes (clustered) – One conventional well and one multi-level well or nested well
- 1 borehole – One nested or multi-level well

Based on this example, the design utilizing one borehole is the best choice for minimizing the degree of environmental impact and is favorable with respect to project borehole quantity constraints; however, the design is complex and may introduce complications that limit the types of data that can be collected or the ability to build and maintain the well or dedicated downhole equipment. Beyond the example of four monitoring zones, more or fewer monitoring zones at a location may clearly favor one design over another.

Key design details associated with conventional, nested, and multi-level well types as they relate to the design constraints are provided below.

Conventional Wells. This well type consists of a single well screen and casing constructed within a single borehole, and is the monitoring well type most widely utilized at the Topock site.

- **Borehole Requirements** – This design requires one borehole per monitoring interval, and is the least efficient design when multiple monitoring intervals are required at a given monitoring location (i.e., requires the most boreholes); however, this is the default design if only one monitoring interval is required.
- **Well Utility** – Utility constraints are minimized with this well design. Conventional well casings can be scaled to the diameter required for sample equipment regardless of the depth to water or sample/measurement collection protocol. This well type can be constructed using materials standard in the industry including PVC well screen and casing, which is known to be stable in the subsurface environment at the Topock site.
- **Constructibility and Longevity** – The relatively simple design of a conventional well (i.e., one casing with standard, basket-type centralizers) can be constructed in boreholes as small as 6 inches in diameter if 2-inch diameter PVC well casing is used, which allows for the widest range of options for borehole drilling methods. In addition, the conventional wells can be cleaned or re-developed if well performance diminishes over time.

Dual-screen Wells. This well type is essentially the same as a conventional well, but contains two well screens separated by an un-perforated section of well casing. The two well screens are isolated within the well casing, typically using an inflatable or mechanical packer. This design has been used in two bedrock boreholes in the East Ravine area, and is also planned for many of the IRZ wells associated with the final groundwater remedy. The dual-screen well design provides a more efficient use of boreholes than a conventional well, but the necessity of packers to isolate sampling intervals can present well utility and longevity constraints.

- **Borehole Requirements** – Two or possibly more monitoring zones can be monitored within one borehole.
- **Well Utility** –Well casings can be scaled to the diameter required for sample equipment regardless of the depth to water or sample/measurement collection protocol. This well type can be constructed using the same materials as a conventional, but require the use of an inflatable packer or equivalent, which could introduce materials that are less stable in the subsurface environment at the Topock site.
- **Constructibility and Longevity** – Dual-screen wells must be larger in diameter than conventional 2-inch diameter wells to provide separate access to each screen interval, once isolated. Typically, the packer used to isolate the screens can be removed for well maintenance, as needed. Inflatable packers can be maintenance-intensive, requiring frequent checks to maintain gas pressure and periodic repair or replacement. In general, the removal of the packer in a monitoring well is not desirable because the isolation of the two monitoring intervals is lost, which could adversely affect the evaluation of data trends over time a given interval.

Nested Wells. This well type consists of more than one conventional well (i.e., multiple single-screen casing strings) constructed within a single borehole. A number of nested wells have been installed at the Topock site; however, they are not as common as single-screen conventional wells. In general, nested wells provide the utility of conventional wells within one borehole, but can present significant constructibility challenges depending on the depth and number of monitoring intervals required.

- **Borehole Requirements** – Two or more nested conventional or dual-screen wells (i.e., two or more monitoring intervals) can be constructed within a single borehole; however, the quantity and combination is entirely dependent on the depth of the monitoring interval and diameter of the well casings required.
- **Well Utility** – Well utility constraints are minimized with this well design provided borehole diameters large enough to accommodate the multiple casing strings can be drilled. As mentioned above, conventional well casings (in this case nested) can be scaled to the diameter required for sample equipment regardless of the depth to water or sample/measurement collection protocol, and the same conventional well construction materials can be used.
- **Constructibility and Longevity** – As more well casings are nested within one borehole the constructibility becomes increasingly complex (e.g., specialized casing centralizers and installation procedures). Depending on the depth and diameter of the borehole required, the drilling methods capable of installing the borehole become more limited. For example, the construction of two nested 2-inch wells in the same borehole requires a minimum borehole diameter of 10 inches, which is near the upper limit of rotosonic drilling technology for the depths needed at Topock. This diameter is required to accommodate the two casings, provide a minimum two-inch grout seal between casings, and provide a minimum two-inch annular space between the borehole wall and casing. Based on drilling experience at the Topock site, boreholes that are larger than about 10 inches in diameter and that extend greater than 250-300 feet below ground surface will require a drilling method other than rotosonic (e.g., mud rotary). Boreholes larger than 12 inches in diameter, which would be required to nest more than two 2-inch casings, are commonly installed with rotary drilling methods. Nested wells offer the opportunity for re-development or equipment repair/replacement similar to conventional wells.

Multi-level Wells. This well type consists of a specially engineered and constructed string of multiple sample ports and sealed intervals along a single casing assembly, within a single borehole. Perhaps the best known design of this type is the Westbay multilevel sampling system. A small number of multi-level wells have been installed at the Topock site to collected groundwater samples for specialized data needs (e.g., angle wells beneath the Colorado River). Multi-level wells provide the ability to monitor several intervals within one borehole; however, the complex and compact design of these systems can present significant well utility and longevity constraints.

- **Borehole Requirements** – This well design presents the most efficient use of a single borehole when multiple monitoring intervals are required.
- **Well Utility** – Multi-level wells are specialized systems that often require specific methods groundwater sample collection or data collection (e.g., water level monitoring). In some cases these methods may be different than those typically used at the Topock site. It may not be practical to obtain three casing volume purge due to low pumping rates associated with many multi-level well design. Multi-level well designs vary significantly by manufacturer, but many of them include elastomeric materials in the sealed intervals which may not be stable in the subsurface environment at the Topock site.
- **Constructibility and Longevity** – Multi-level systems can typically be installed in a 10-inch diameter borehole, or smaller. Although these systems are relatively complex, constructibility constraints are minimized as installation is factored into the manufacturer's design. However, multi-level systems typically include dedicated and non-removable pumping equipment which may require the destructive removal of the entire system for repair or replacement. These systems are not conducive to cleaning or redevelopment if they become fouled.

3.6.3 Well Design Selection

Table 3.6-2 provides a summary of the various well types, estimated depths and numbers of intervals to be monitored, and other factors pertinent to the design of the new monitoring wells. A plan identifying the criteria that will be evaluated to select a monitoring well design for each location will be provided in the 90% design document pending changes is monitoring well location and/or purpose; however, the final design will be based on data collected in the field during installation. The optimal well design for most locations is a conventional or nested well depending on the required number of monitoring intervals. As discussed above, these well designs offer the flexibility to use various types of sampling and water level monitoring equipment and also provides for well maintenance and rehabilitation in the future, assuming a minimum 2-inch diameter casing is installed. Most of the wells that comprise the existing monitoring network at the Topock site are 2-inch diameter monitoring wells (some are nested), so new, similarly designed wells could be sampled using the same tools and techniques as the existing wells. As an alternate well design in the event the hydrogeology and/or data objectives for a given location present constructibility issues for a nested well, multilevel and dual-screen wells also offer the possibility for monitoring multiple intervals in one borehole. However, while multilevel wells can be designed to monitor as many specific intervals within a single borehole as nested wells (or in some cases more), a greater percentage of the entire saturated thickness of the aquifer may go unmonitored due to the small “screened” length associated with some multilevel well designs. For remediation monitoring purposes, wells with screen lengths consistent with the existing monitoring well network, or longer in some instances, are preferred.

As discussed above, there is a practical limit to the number of casings that can reliably be nested in a single borehole. Depending on the depth, hydrogeology, and drilling method, that limit is probably between three and five. Specialized centralizers and means of supporting the casing assembly would need to be used in order to insure that there was adequate separation between the individual casings and the borehole wall. In addition, the placement of annular materials (e.g., filter sand and grout) during construction becomes more complicated as the number of casings in the well increases.

The majority of monitoring wells at the Topock site, which were installed for groundwater plume characterization purposes, generally have screened intervals between 10 and 20 feet in length, while the compliance wells (CW) and observation wells (OW) associated with the IM-3 groundwater remediation have screen lengths of 20 to 50 feet. The longer screen lengths are required to understand the average properties of the majority of the aquifer. The new monitoring wells are also designed to monitor remedial activities and will generally have longer screen lengths. The exception to this may be the wells designed to monitor the distribution of carbon along the IRZ line, where higher resolution may be desired for optimization of the groundwater remedy. The thickest part of the aquifer is estimated to be about 350 feet at location A in the northern portion of the floodplain. A nested well at this location designed with four 50-foot long screens in a single borehole would monitor approximately 60 percent of the aquifer thickness. This is a larger fraction of the aquifer thickness than is monitored by many of the current monitoring wells and should be adequate for observing the hydraulic and water quality effects of the nearby extraction wells.

TABLE 3.2-1
Intermediate Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)			Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
Well Location ID[a]	**Nominal**	**Minimum**	**Maximum**			**Intermediate Well Depiction**	**Intermediate Well Count**		**X**	**Y**
IRZ-1 (Extraction)[b]									7615297.081	2104063.768
Layer 1	20	20	80	120	65	Dual Screen Well	1			
Layer 2					93					
Layer 3	20	20	80	180	124					
Layer 4					79					
IRZ-2									7615285.325	2104003.565
Layer 1	*0*	*0*	*6*	*50*	*71*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*70*	*93*					
Layer 3	*0*	*0*	*6*	*100*	*119*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*50*	*72*					
IRZ-3									7615415.553	2103957.160
Layer 1	*0*	*0*	*6*	*70*	*86*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*80*	*96*					
Layer 3	*0*	*0*	*6*	*90*	*109*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*63*					
IRZ-4									7615366.847	2103836.663
Layer 1	*0*	*0*	*6*	*70*	*90*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*70*	*93*					
Layer 3	*0*	*0*	*6*	*80*	*100*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*57*					
IRZ-5 (Extraction)[b]									7615445.427	2103825.736
Layer 1	40	20	80	150	93	Dual Screen Well	1			
Layer 2					93					
Layer 3	40	20	80	140	99					
Layer 4					56					
IRZ-6									7615416.147	2103730.089
Layer 1	*0*	*0*	*6*	*70*	*91*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*70*	*90*					
Layer 3	*0*	*0*	*6*	*70*	*94*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*54*					
IRZ-7									7615514.912	2103691.892
Layer 1	*0*	*0*	*6*	*70*	*92*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*60*	*87*					
Layer 3	*0*	*0*	*6*	*70*	*93*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*52*					

TABLE 3.2-1
Intermediate Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
IRZ-8									7615474.408	2103599.816
Layer 1	*0*	*0*	*6*	*60*	*84*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*60*	*81*					
Layer 3	*0*	*0*	*6*	*60*	*84*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*51*					
IRZ-9 (Extraction)[b]									7615566.330	2103560.751
Layer 1	40	20	80	130	81	Dual Screen Well	1			
Layer 2					75					
Layer 3	40	20	80	120	80					
Layer 4					50					
IRZ-10									7615542.976	2103457.231
Layer 1	*0*	*0*	*6*	*40*	*69*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*40*	*65*					
Layer 3	*0*	*0*	*6*	*40*	*68*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*49*					
IRZ-11									7615636.156	2103409.075
Layer 1	10	0	20	40	65	Dual Screen Well	1			
Layer 2	10	0	20	40	62					
Layer 3	10	0	20	40	66	Dual Screen Well	1			
Layer 4	10	0	20	40	51					
IRZ-12									7615617.157	2103306.813
Layer 1	*0*	*0*	*6*	*40*	*60*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*40*	*57*					
Layer 3	*0*	*0*	*6*	*40*	*59*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*40*	*51*					
IRZ-13									7615701.692	2103307.059
Layer 1	9	0	20	40	54	Dual Screen Well	1			
Layer 2	9	0	20	40	52					
Layer 3	9	0	20	40	59	Dual Screen Well	1			
Layer 4	9	0	20	40	53					
IRZ-14									7615660.560	2103190.162
Layer 1	*0*	*0*	*6*	*40*	*55*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*40*	*53*					
Layer 3	*0*	*0*	*6*	*40*	*50*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*30*	*44*					

TABLE 3.2-1
Intermediate Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
IRZ-15									7615766.310	2103145.565
Layer 1	7	0	15	40	49	Dual Screen Well	1			
Layer 2	7	0	15	40	48					
Layer 3	7	0	15	40	48	Dual Screen Well	1			
Layer 4	7	0	15	30	43					
IRZ-16									7615794.469	2103038.226
Layer 1	6	0	15	40	51	Dual Screen Well	1			
Layer 2	6	0	15	40	49					
Layer 3	6	0	15	30	42	Dual Screen Well	1			
Layer 4	6	0	15	20	36					
IRZ-17									7615861.490	2102994.285
Layer 1	7	0	15	40	51	Dual Screen Well	1			
Layer 2	7	0	15	40	49					
Layer 3	7	0	15	30	39	Dual Screen Well	1			
Layer 4	7	0	15	20	33					
IRZ-18									7615834.113	2102912.441
Layer 1	*0*	*0*	*6*	*40*	*51*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*40*	*49*					
Layer 3	*0*	*0*	*6*	*20*	*30*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*15*	*23*					
IRZ-19									7615930.424	2102846.991
Layer 1	7	0	13	35	44	Dual Screen Well	1			
Layer 2	7	0	13	30	41					
Layer 3	7	0	13	20	28	Dual Screen Well	1			
Layer 4	7	0	13	15	24					
IRZ-20									7615807.564	2102769.249
Layer 1	4	0	13	35	47	Dual Screen Well	1			
Layer 2	4	0	13	30	42					
Layer 3	4	0	13	15	24	Dual Screen Well	1			
Layer 4	4	0	13	10	20					
IRZ-21									7615815.994	2102691.507
Layer 1	5	0	10	40	48	Dual Screen Well	1			
Layer 2	5	0	10	20	29					
Layer 3	5	0	10	10	18	Dual Screen Well	1			
Layer 4	5	0	10	15	26					

TABLE 3.2-1
Intermediate Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)			Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
Well Location ID[a]	Nominal	Minimum	Maximum			Intermediate Well Depiction	Intermediate Well Count		X	Y
IRZ-22									7615783.643	2102612.482
Layer 1	*0*	*0*	*6*	*35*	*44*	*Dual Screen Well*		*1*		
Layer 2	*0*	*0*	*6*	*15*	*27*					
Layer 3	*0*	*0*	*6*	*10*	*19*	*Dual Screen Well*		*1*		
Layer 4	*0*	*0*	*6*	*15*	*27*					
IRZ-23 (Extraction)									7615824.866	2102534.901
Layer 1					33					
Layer 2					28					
Layer 3	100	40	160	70	24	Single Screen Well (Layers 2, 3, & 4)[d]	1			
Layer 4					24					
IRZ-24									7615783.643	2102461.071
Layer 1	*0*	*0*	*13*	*40*	*31*					
Layer 2					*28*	*Dual Screen Well*		*1*		
Layer 3	*0*	*0*	*13*	*40*	*26*					
Layer 4					*25*					
IRZ-25									7615826.121	2102415.641
Layer 1	8	0	18	40	29					
Layer 2					27	Dual Screen Well	1			
Layer 3	8	0	18	40	26					
Layer 4					24					
IRZ-26									7615818.538	2102313.742
Layer 1	*0*	*0*	*13*	*40*	*28*					
Layer 2					*26*	*Dual Screen Well*		*1*		
Layer 3	*0*	*0*	*13*	*40*	*24*					
Layer 4					*24*					
IRZ-27									7615801.341	2102238.870
Layer 1	8	0	18	40	27					
Layer 2					25	Dual Screen Well	1			
Layer 3	8	0	18	40	23					
Layer 4					24					
IRZ-28									7615797.904	2102180.167
Layer 1	*0*	*0*	*13*	*40*	*26*					
Layer 2					*24*	*Dual Screen Well*		*1*		
Layer 3	*0*	*0*	*13*	*40*	*23*					
Layer 4					*22*					

TABLE 3.2-1
Intermediate Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
IRZ-29									7615792.463	2102082.530
Layer 1	7	0	15	40	25	Dual Screen Well	1			
Layer 2					22					
Layer 3	7	0	15	35	21					
Layer 4					20					
IRZ-30									7615780.610	2102010.804
Layer 1	*0*	*0*	*13*	*40*	*26*	*Dual Screen Well*		*1*		
Layer 2					*20*					
Layer 3	*0*	*0*	*13*	*30*	*19*					
Layer 4					*18*					
IRZ-31									7615790.562	2101946.996
Layer 1	6	0	13	35	26	Dual Screen Well	1			
Layer 2					16					
Layer 3	6	0	13	25	16					
Layer 4					16					
IRZ-32										
Layer 1	*0*	*0*	*13*	*30*	*21*	*Dual Screen Well*		*1*	7615812.857	2101863.292
Layer 2					*14*					
Layer 3	*0*	*0*	*13*	*20*	*14*					
Layer 4					*13*					
IRZ-33									7615828.110	2101792.506
Layer 1	4	0	13	25	17	Dual Screen Well	1			
Layer 2					14					
Layer 3	4	0	13	20	14					
Layer 4					11					
IRZ-34									7615853.907	2101666.998
Layer 1	*0*	*0*	*26*	*35*	*13*	*Single Screen Well (All Layers)*		*1*		
Layer 2					*12*					
Layer 3					*12*					
Layer 4					*10*					
IRZ-35									7615903.592	2101664.688
Layer 1	6	0	15	30	10	Single Screen Well (All Layers)	1			
Layer 2					10					
Layer 3					10					
Layer 4					10					

TABLE 3.2-1
Intermediate Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)			Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
Well Location ID[a]	**Nominal**	**Minimum**	**Maximum**			**Intermediate Well Depiction**	**Intermediate Well Count**		**X**	**Y**
IRZ-36									7615948.819	2101605.697
Layer 1	*0*	*0*	*25*	*25*	*7.4*	*Single Screen Well (All Layers)*		*1*		
Layer 2					*7.6*					
Layer 3					*7.6*					
Layer 4					*7.6*					
IRZ-37									7616003.877	2101554.571
Layer 1	4	0	10	20	5.7	Single Screen Well (All Layers)	1			
Layer 2					5.9					
Layer 3					5.9					
Layer 4					5.9					
IRZ-38									7615965.222	2101400.445
Layer 1	*0*	*0*	*25*	*15*	*5.0*	*Single Screen Well (All Layers)*		*1*		
Layer 2					*5.3*					
Layer 3					*5.3*					
Layer 4					*5.3*					
IRZ-39										
Layer 1	4	0	5	10	2.8	Single Screen Well (All Layers)	1		7616112.476	2101375.588
Layer 2					3.1					
Layer 3					3.1					
Layer 4					3.1					
IRZ-40 (Extraction)									7616191.542	2101358.005
Layer 1	*0*	*0*	*25*	*5*	*1.7*	*Single Screen Well (All Layers)*		*1*		
Layer 2					*2.0*					
Layer 3					*2.0*					
Layer 4					*2.0*					
Extraction Total:	**300**	**200[c]**	**400[c]**	**---**	**---**	**---**	**4**	**1**	**---**	**---**
Injection Total:	**300**	**200[c]**	**400[c]**	**---**	**---**	**---**	**24**	**30**	**---**	**---**

Notes:

"Tracked changes" edits represent changes made to table provided as a part of the Response to Comments on the Draft Basis of Design Report/Preliminary (30%) Design Submittal transmitted on April 13, 2012.

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. One well location ID may consist of multiple wells or screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discreet screen intervals separated by a packer. Some well location IDs include two dual screen wells which will be installed in separate boreholes.

[b] Wells are constructed with a dedicated pump for each well screen with the intervals separated using a pneumatic packer.

[c] 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.

[d] Extraction well design and operation will target extraction of groundwater from all four model layers without being screened across all layers.

TABLE 3.2-2
Intermediate Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
River Bank Extraction Wells										
RB-1									7615763.621	2103917.990
Layer 1				160[g]	106					
Layer 2					99					
Layer 3	25	25	170	150	104	Single Screen Well (Layers 3 & 4)[g]	1			
Layer 4					56					
RB-2									7616012.005	2103398.007
Layer 1				70[g]	58					
Layer 2					56					
Layer 3	0	25	170	125	73	Single Screen Well (Layers 3 & 4)[g]	1			
Layer 4					60					
RB-3									7616210.553	2103172.847
Layer 1				70[g]	56					
Layer 2					58					
Layer 3	50	25	170	100	51	Single Screen Well (Layers 3 & 4)[g]	1			
Layer 4					50					
RB-4									7616337.509	2102908.528
Layer 1				60[g]	50					
Layer 2					55					
Layer 3	50	25	170	80[g]	37	Single Screen Well (Layers 3 & 4)[g]	1			
Layer 4					50					
RB-5									7616397.623	2102423.944
Layer 1				15[g]	24					
Layer 2					24					
Layer 3	25	25	170	25	16	Single Screen Well (Layers 3 & 4)[g]	1			
Layer 4					16					
Inner Recirculation Loop Injection Wells[b]										
IRL-1									7614358.205	2103364.829
Layer 1					62					
Layer 2	75	35	200	270	71	Single Screen Well (All Layers)	1			
Layer 3					74					
Layer 4					64					
IRL-2									7614133.272	2103058.411
Layer 1					62					
Layer 2	75	35	200	260	63	Single Screen Well (All Layers)	1			
Layer 3					65					
Layer 4					64					

TABLE 3.2-2
Intermediate Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
Well Location ID[a]	**Nominal**	**Minimum**	**Maximum**						**X**	**Y**
IRL-3									7613976.088	2102799.301
Layer 1					55					
Layer 2	100	35	200	230	55	Single Screen Well (All Layers)	1			
Layer 3					59					
Layer 4					61					
IRL-4									7613953.827	2102380.665
Layer 1					46					
Layer 2	200	35	200	200	46	Single Screen Well (All Layers)	1			
Layer 3					49					
Layer 4					51					
IRL-5									*7613918.895*	*2102638.058*
Layer 1					*51*					
Layer 2	*0*	*35*	*200*	*220*	*51*	*Single Screen Well (All Layers)*		*1*		
Layer 3					*54*					
Layer 4					*57*					
IRL-6[f]									*7615133.885*	*2101497.005*
Layer 1					*24*					
Layer 2	*0*	*35*	*200*	*120*	*33*	*Single Screen Well (All Layers)*		*1*		
Layer 3					*34*					
Layer 4					*27*					
IRL-7									*7615236.320*	*2102323.901*
Layer 1					*26*					
Layer 2	*0*	*35*	*200*	*150*	*41*	*Single Screen Well (All Layers)*		*1*		
Layer 3					*40*					
Layer 4					*41*					
Extraction Total:	**150**	**150[c]**	**500[c]**	**---**	**---**		**5**	**---**	**---**	**---**
Injection Total:	**450[d]**	**150[e]**	**900[d,e]**	**---**	**---**		**4**	**3**	**---**	**---**

Notes:

"Track changes" edits represent changes made to table provided as a part of the Response to Comments on the Draft Basis of Design Report/Preliminary (30%) Design Submittal transmitted on April 13, 2012.

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation.

[b] The intermediate nominal scenario assumes IRL-1 and IRL-2 will receive carbon-amended River Bank Extraction Well water if Cr(VI) concentrations in the River Bank extraction wells exceed the clean-up goal; and IRL-3 and IRL-4 will receive fresh water. However, injection wells IRL-1 through IRL-4 (and future provisional wells IRL-5 through IRL-7, if constructed) will be constructed for flexibility to inject either/both freshwater or/and River Bank extraction well water during the lifetime of the remedy.

[c] 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.

[d] Injection flow rate includes 300 gpm of fresh water for the nominal flow, and up to 900 gpm of fresh water for the maximum flow, as needed.

[e] 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 900 gpm, respectively.

[f] Future provisional well IRL-6 may alternatively be considered as an extraction well with extracted groundwater re-injected into other IRL injection wells.

[g] River Bank extraction wells will be installed with a second shallow screen interval for potential future use which will be isolated from the deeper screen interval with a pneumatic packer.

TABLE 3.2-3
Intermediate Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates X	Y
Transwestern Bench Extraction Wells										
TWB-1									7615955.4503	2100972.6347
Layer 1	13	1	15	20	11	Single Screen Well (Layers 3 & 4)[e]	1			
Layer 2					11					
Layer 3					11					
Layer 4					11					
TWB-2									7616023.8105	2100965.7550
Layer 1	9	1	15	15	8.3	Single Screen Well (Layers 3 & 4)[e]	1			
Layer 2					8.7					
Layer 3					8.7					
Layer 4					8.7					
TWB-3									*7615776.618*	*2101143.378*
Layer 1	*0*	*1*	*15*	*25*	*12*	*Single Screen Well (Layers 3 & 4)[e]*		*1*		
Layer 2					*13*					
Layer 3					*13*					
Layer 4					*13*					
TWB-4									*7616088.146*	*2100858.533*
Layer 1	*0*	*1*	*15*	*20*	*5.5*	*Single Screen Well (Layers 3 & 4)[e]*		*1*		
Layer 2					*5.9*					
Layer 3					*5.9*					
Layer 4					*5.9*					
East Ravine Extraction Wells[b]										
ER-1									7616510.976	2101089.290
Layer 1	0.5	2 Total	4 Total	90	30	Single Screen Well or Open Bore	1			
Layer 2					20					
Layer 3					20					
Layer 4					20					

TABLE 3.2-3
Intermediate Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates X	Y
ER-2									7616666.277	2100998.762
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1			
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-3									7616855.469	2100897.942
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1			
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-4									7616934.556	2100761.269
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1			
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-5									*7616995.304*	*2100677.912*
Layer 1	*0*	*0.5*	*1*	*90*	*30*	*Single Screen Well or Open Bore*		*1*		
Layer 2					*20*					
Layer 3					*20*					
Layer 4					*20*					
ER-6									*7615840.000*	*2100512.000*
Layer 1	*3*	*1*	*5*	*90*	*29*	*Single Screen Well or Open Bore*	*1*			
Layer 2					*20*					
Layer 3					*20*					
Layer 4					*20*					
TCS Injection Wells										
TCS-1									7615167.690	2101171.376
Layer 1	6.75	2	20	50	37	Dual Screen Well	1			
Layer 2					21					
Layer 3	6.75	2	20	40	21					
Layer 4					25					

TABLE 3.2-3
Intermediate Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
TCS-2									7615149.128	2100899.663
Layer 1	6.75	2	20	40	27	Dual Screen Well	1			
Layer 2					26					
Layer 3	6.75	2	20	40	27					
Layer 4					17					
Extraction Total:	**27**	**10[c]**	**75[c]**	---	---	---	**7**	**3**	---	---
Injection Total:	**27**	**10[c]**	**75[c,d]**	---	---	---	**2**	---	---	---

Notes:

"Track changes" edits represent changes made to table provided as a part of the Response to Comments on the Draft Basis of Design Report/Preliminary (30%) Design Submittal transmitted on April 13, 2012.

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation . One well location ID may consist of multiple screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discreet screen intervals separated by a packer.

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

[c] Individual well minimum and maximum flow rates are provided herein. However, the total aggregate minimum and maximum extraction/injection flow rates are limited to 10 gpm and 75 gpm, respectively.

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

[e] Extraction well design and operation will target extraction of groundwater from all four model layers without being screened across all layers.

TABLE 3.3-1
Intermediate Remediation Well Design Parameter Summary: Freshwater Injection Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Intermediate Injection/Extraction Rate per Model Layer (gpm)			Intermediate Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Intermediate Well Depiction	Intermediate Well Count	Intermediate Future Provisional Well Count	Intermediate Well Coordinates	
	Nominal	**Minimum**	**Maximum**						**X**	**Y**
FW-1									7613249.217	2102881.616
Layer 1	100	50	200	250	57	Single Screen Well (All Layers)	1			
Layer 2					57					
Layer 3					56					
Layer 4					78					
FW-2									7614682.700	2100511.512
Layer 1	50	25	100	60	15	Single Screen Well (All Layers)	1			
Layer 2					15					
Layer 3					15					
Layer 4					15					
Total:	**150**	**75**	**300**	---	---	---	**2**		---	---

Notes:
gpm = gallons per minute
[a] Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation . One well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well.

TABLE 3.6-1
Preliminary Construction of Proposed Groundwater Monitoring Wells
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Monitoring Category/ Well ID	Projected Depth to Groundwater (ft bgs)	Projected Saturated Thickness Above Bedrock (ft)	Projected Depth to Bedrock (Projected Well Depth) (ft bgs)	Preliminary Number of Screened Intervals1	Preliminary Screened Interval Thickness (ft)[1]	Preliminary Estimate of Screened Intervals (ft bgs)1			
Northern NTH IRZ Extraction Monitoring Well									
A	13	359	372	4	40	40 to 80	140 to 180	230 to 270	310 to 350
B	17	327	344	4	40	40 to 80	130 to 170	220 to 260	290 to 330
NTH IRZ Dose Response Monitoring Well									
C	22	197	219	4	20	30 to 50	80 to 100	130 to 150	180 to 200
D	21	166	187	4	20	40 to 60	90 to 110	130 to 150	160 to 180
E	36	99	135	2	20	50 to 70	105 to 125		
F	54	81	135	2	20	70 to 90	105 to 125		
G	57	32	89	1	20	65 to 85			
NTH IRZ Downgradient Well and Riverbank Extraction Monitoring Well									
H	14	184	198	4	20	30 to 50	80 to 100	120 to 140	170 to 190
NTH IRZ Riverbank Extraction Monitoring Well									
O	1	254	255	4	40	20 to 60	80 to 120	140 to 180	200 to 240
IRL Downgradient Monitoring Well									
M	59	169	228	4	20	70 to 90	110 to 130	155 to 175	195 to 215
R	100	184	284	4	20	115 to 135	160 to 180	205 to 225	250 to 270
IRL Dose Response Monitoring Well									
P	57	274	331	4	30	75 to 105	140 to 170	210 to 240	285 to 315
Q	105	195	300	4	30	110 to 140	160 to 190	210 to 240	260 to 290
IRL Byproduct Monitoring Well									
I	67	281	348	4	30	85 to 115	55 to 185	220 to 250	300 to 330
J	118	217	335	4	30	130 to 160	180 to 210	230 to 260	290 to 320
TCS Loop Transwestern Bench Extraction Monitoring Well									
K	94	24	118	1	20	95 to 115			
Freshwater Injection Observation Well									
S	13	149	162	2	40	30 to 70	100 to 140		
Compliance Monitoring Well- Inside Plume									
L	76	177	253	4	20	90 to 110	140 to 160	180 to 200	220 to 240
N	112	124	236	3	20	130 to 150	170 to 190	210 to 230	

Notes:

[1] The identification of separate, laterally-continuous lithostratigraphic or hydrostratigraphic zones by means of correlation from borehole to borehole is not facilitated by the information given on the borehole logs. Therefore, the screened intervals as shown are preliminary, and only based in part on the total projected thickness of the saturated sediments as well as the function of the proposed monitoring. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the wells. The objective will be to screen across the most permeable portions of the vertical section and also potentially zones that have the highest concentrations of hexavalent chromium. See report text for more information.

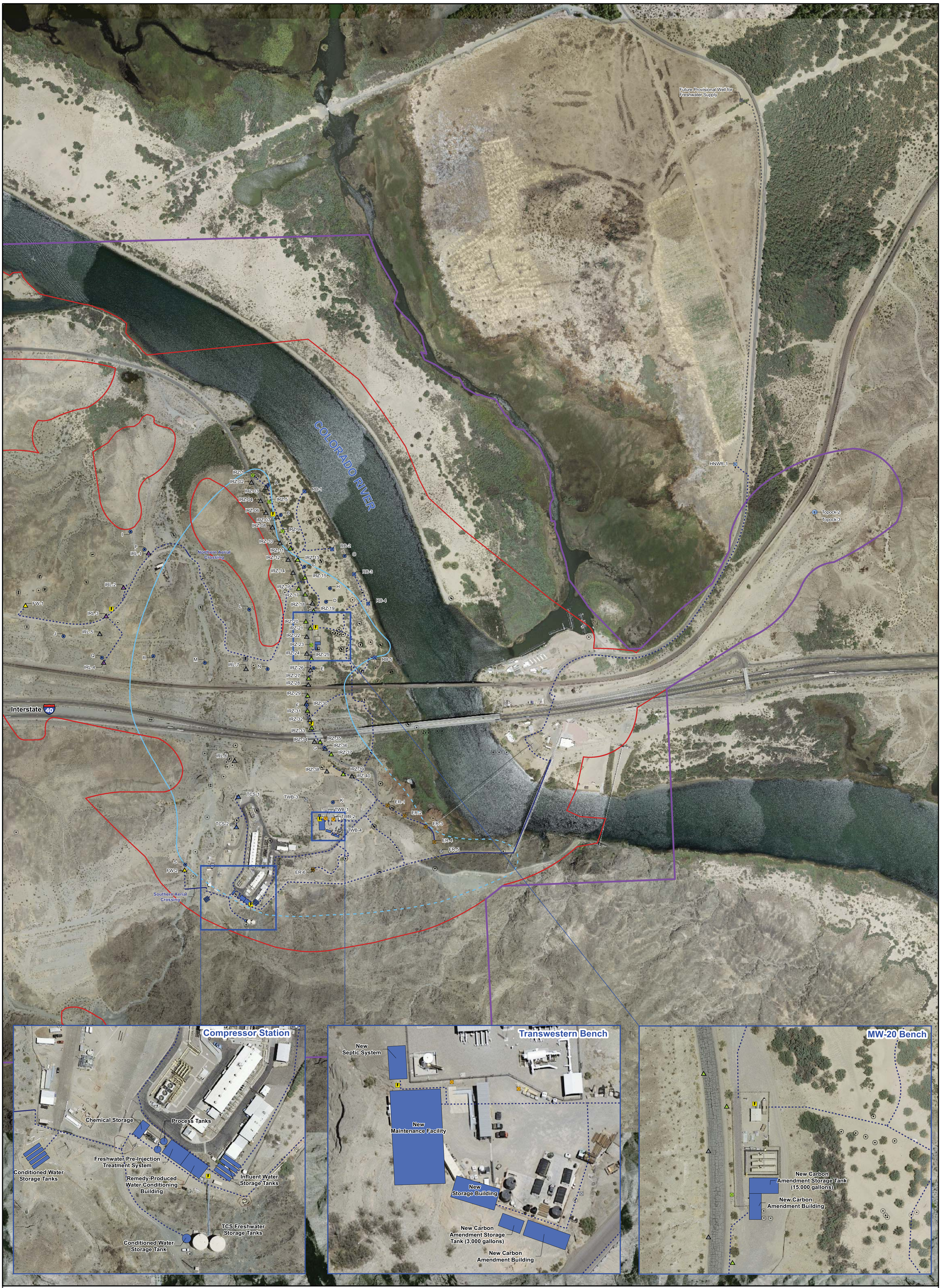
Abbreviations:

IRL Inner Recirculation Loop
NTH IRZ National Trails Highway In-Situ Reactive Zone
TCS Topock Compressor Station

TABLE 3.6-2
Monitoring Well Design Matrix
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Type of Monitoring	Monitoring Objectives	Well ID	Estimated Aquifer Thickness	Estimated Number of Monitoring Intervals	Screen Length in Each Interval	Optimal Well Design	Alternate Well Design
Dose Response, By-product, and Downgradient Monitoring	Observe specific distribution of substrate, by-products, and chromium across the aquifer thickness	C, D, E, F, G, H, I, J, M, P, Q, and R	< 100 feet	2 to 3	10 to 20	Nested	Dual-screen, Multilevel
			100 to 275 feet	3 to 4	20 to 50	Nested	Multilevel
Extraction Well Monitoring	Monitor water levels and average water quality near extraction wells at the northern end of the IRZ line, river bank , and Transwestern Bench	A, B, H, K, and O	180 to 350 feet	3 to 4	20 to 50	Nested	Multilevel
Freshwater Injection Well Monitoring	Monitor water levels and migration of arsenic from freshwater injection wells	J, Q, and S	50 to 205 feet	1 to 3	20 to 50	Conventional, Nested	Multilevel, Dual Screen
Plume Monitoring	Monitor average changes in chromium plume as the remediation progresses	L and N	120 to 180 feet	2 to 3	20 to 50	Nested	Multilevel, Dual Screen

Insert Figures



LEGEND

- Existing Monitoring Well
- Existing Freshwater Supply Well
- Area of Potential Effects (APE)
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (μg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Remedy Wells

- Contingent Freshwater Source
- Freshwater Source
- Remedy Monitoring Well
- Extraction Well (East Ravine)
- Extraction Well (NTH IRZ)
- Extraction Well (Riverbank)
- Extraction Well (Transwestern Bench)
- Freshwater Injection Well
- Injection Well (Inner Recirculation Loop)
- Injection Well (NTH IRZ)
- Injection Well (Topock Compressor Station)
- Future Provisional Extraction Well
- Future Provisional Injection Well

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/Contingent Fresh Water Pipe

Remedy Facilities

- Proposed New Remedy Structure

- Future Provisional Electrical Transformer
- Proposed Electrical Transformer Location

Note:
Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10, PA, and CHPMP mitigation measures .

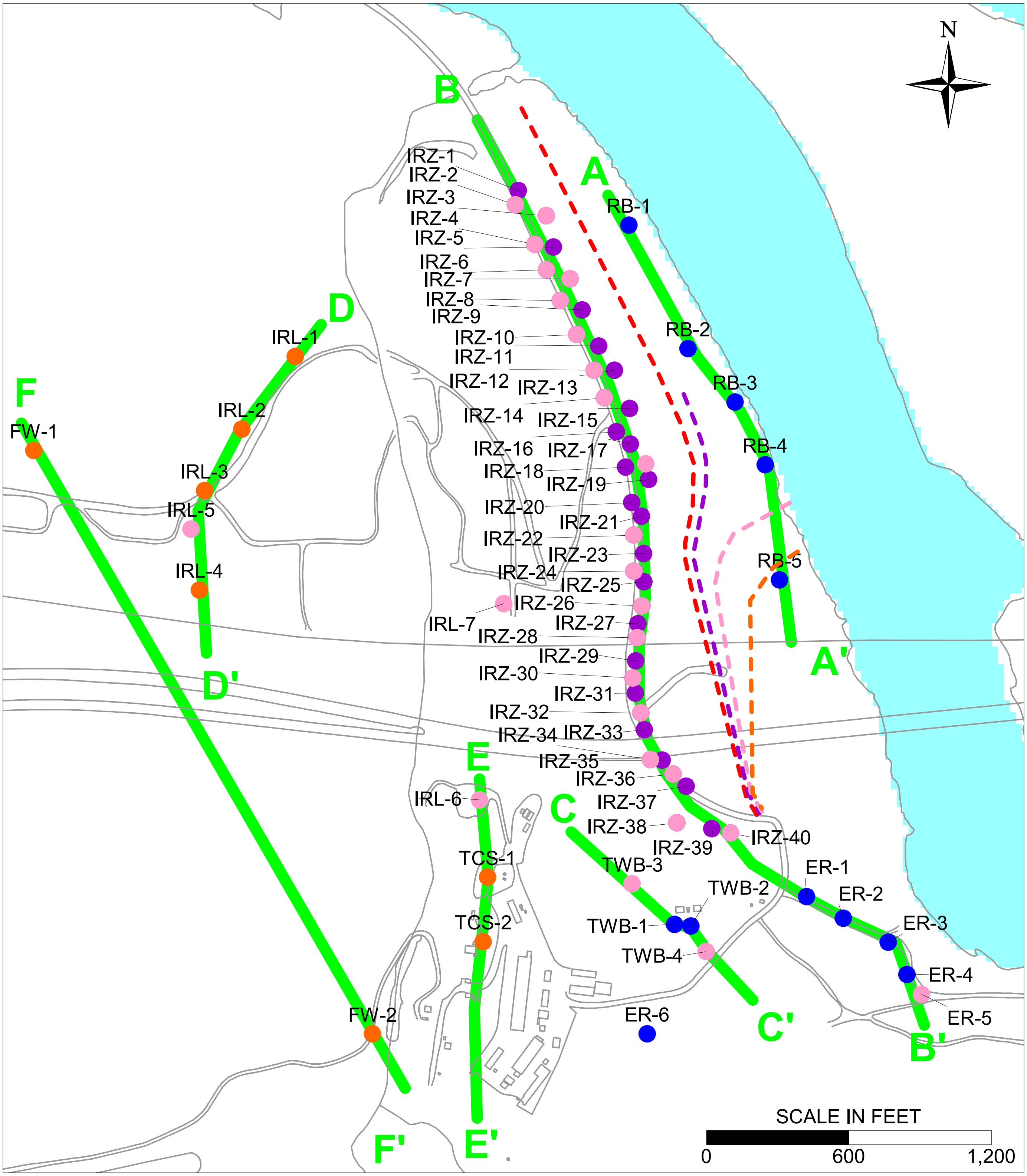
N

0 300 600 1,200 Feet

FIGURE 3.0-1
GENERAL REMEDY SYSTEM LAYOUT
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: D:\Projects\Topock\MapFiles\2013\CMS\60%Report\GeneralRemedyLayout.mxd



LEGEND

- NTH IRZ WELL LOCATIONS
- FUTURE PROVISIONAL WELL LOCATIONS
- RIVERBANK, TRANSWESTERN BENCH, AND EAST RAVINE EXTRACTION WELLS
- FRESHWATER, IRL, AND TCS INJECTION WELLS
- CROSS-SECTION LOCATIONS

APPROXIMATE EXTENT OF REDUCING RIND

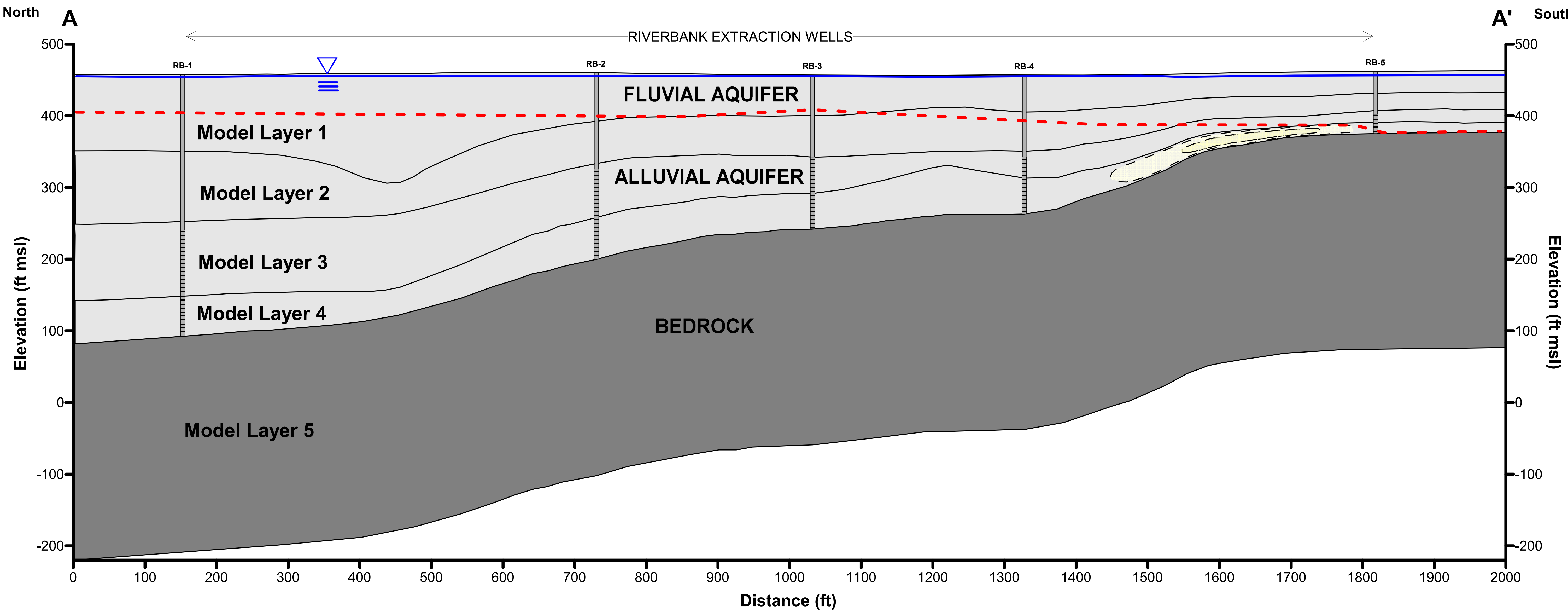
- MODEL LAYER 1
- MODEL LAYER 2
- MODEL LAYER 3
- MODEL LAYER 4

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION LOCATIONS

ARCADIS

FIGURE
3.1-1



Approximate extent of reducing rind

Hexavalent Chromium Concentration (ppb)

32 | 100 | 500 | 1,000 | 5,000 | 10,000 | 15,000

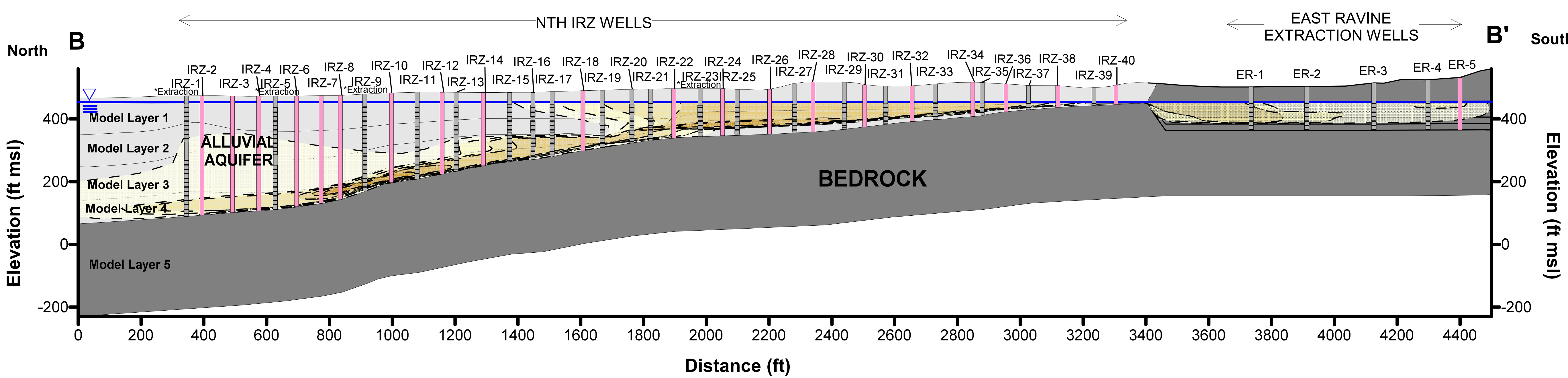
* Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. River Bank Extraction wells will be installed with a second shallow screen interval for potential future use which will be isolated from the deeper screen interval with a pneumatic packer.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

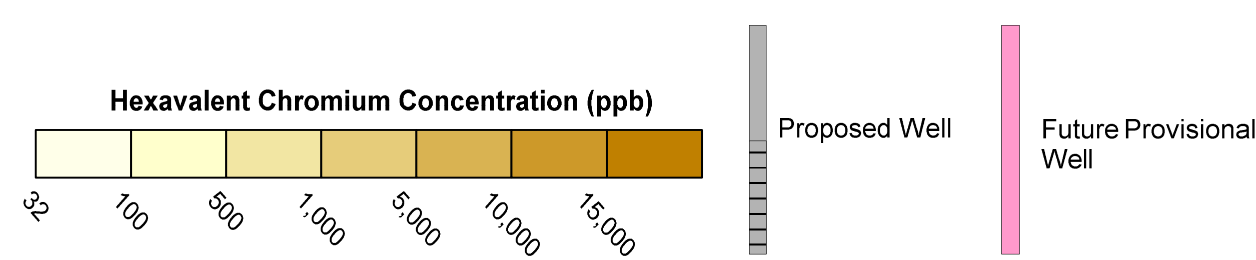
CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION A-A'

ARCADIS

FIGURE
3.1-2



* Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. One well location ID may consist of multiple wells or screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discrete screen intervals separated by a packer. Some well location IDs include two dual screen wells which will be installed in separate boreholes. Wells IRZ-1, 5, and 9 are constructed with a dedicated pump for each well screen with the intervals separated using a pneumatic packer. IRZ-23 well design and operation will target extraction of groundwater from all four model layers without being screened across all layers. East Ravine extraction wells are not expected to produce significant water and automated pump cycling could be required.

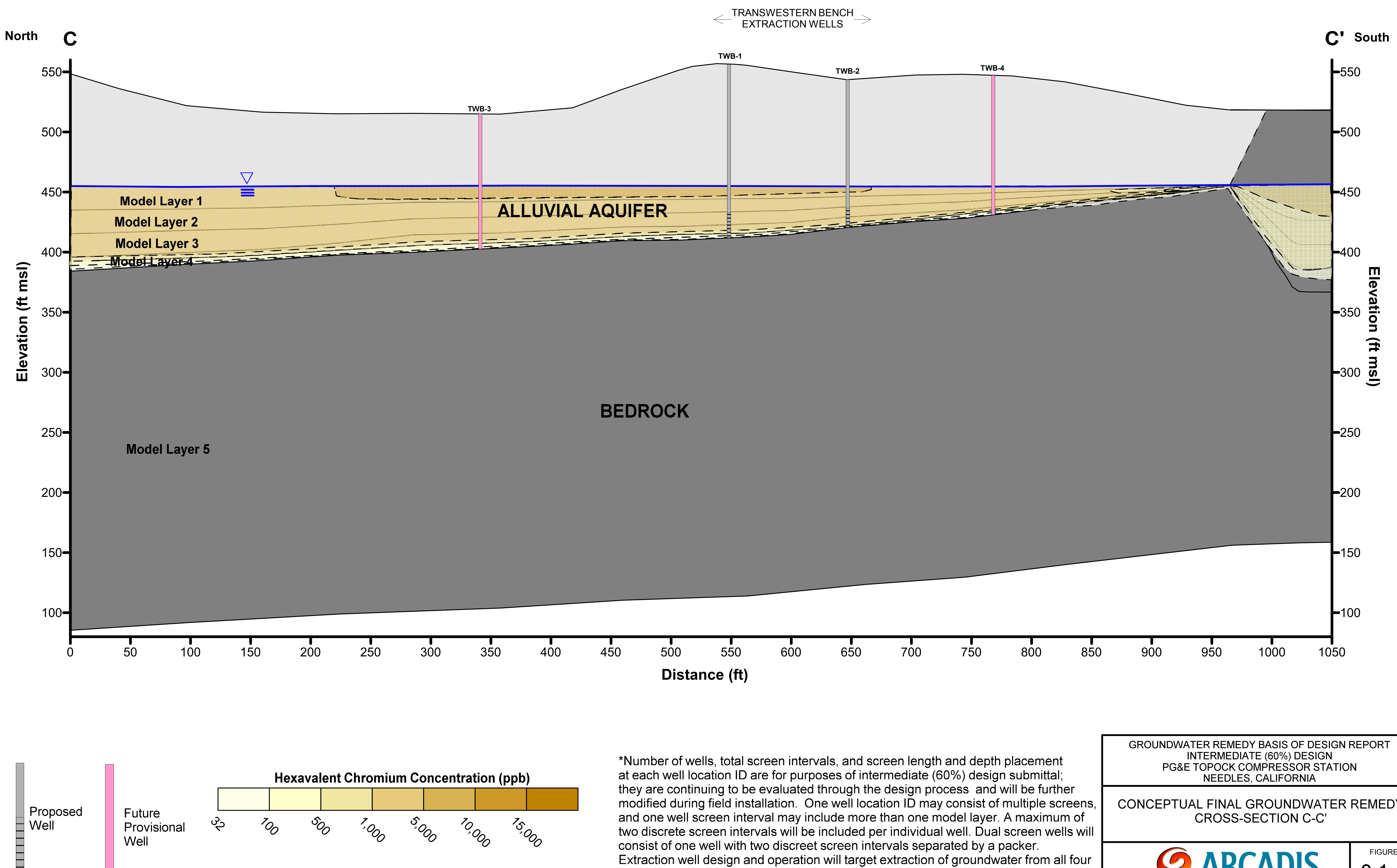


GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION B-B'

ARCADIS

FIGURE
3.1-3



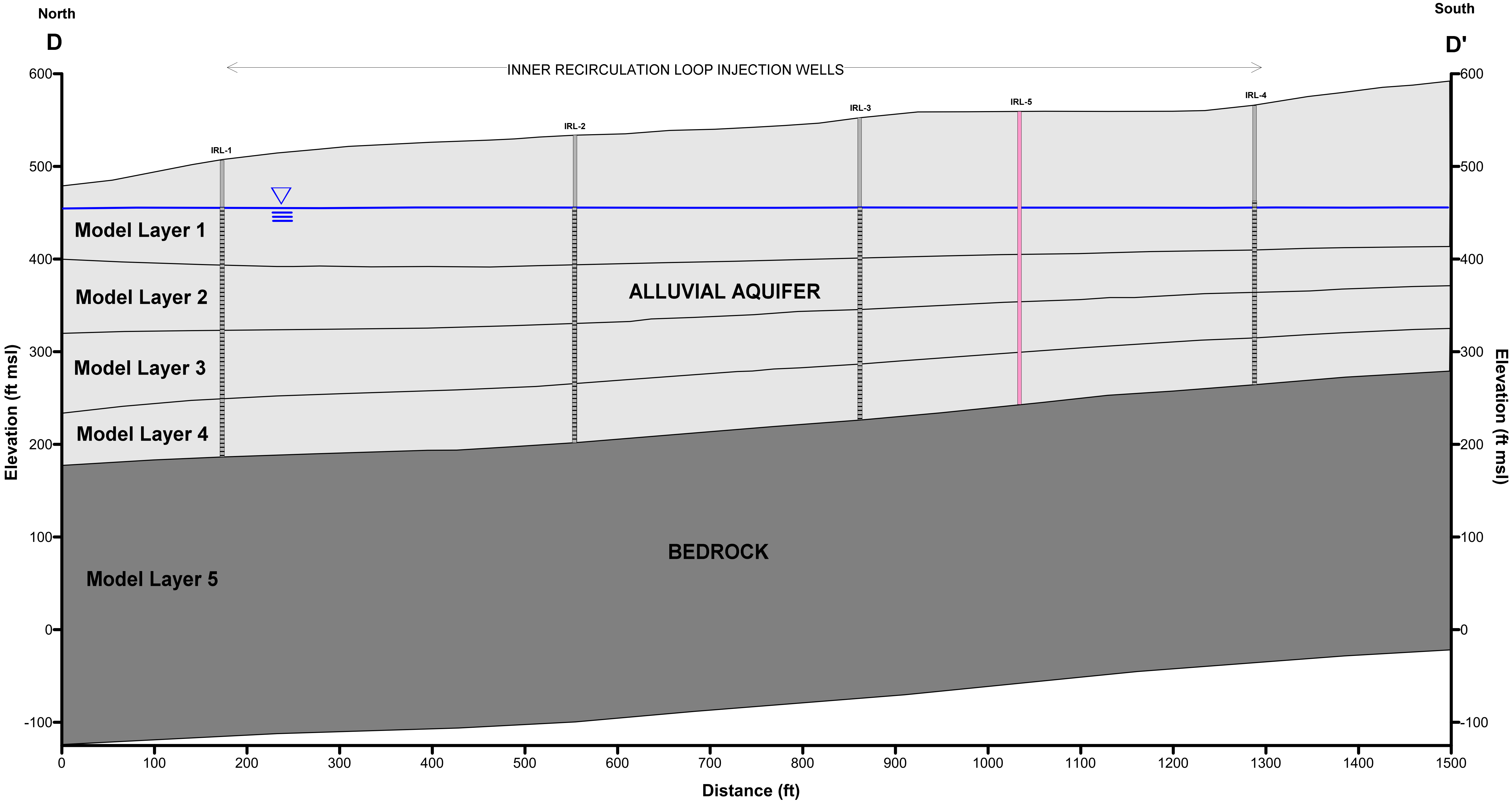
*Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. One well location ID may consist of multiple screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discreet screen intervals separated by a packer. Extraction well design and operation will target extraction of groundwater from all four model layers without being screened across all layers.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION C-C'

ARCADIS

FIGURE
3.1-4



* Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation.

Proposed Well

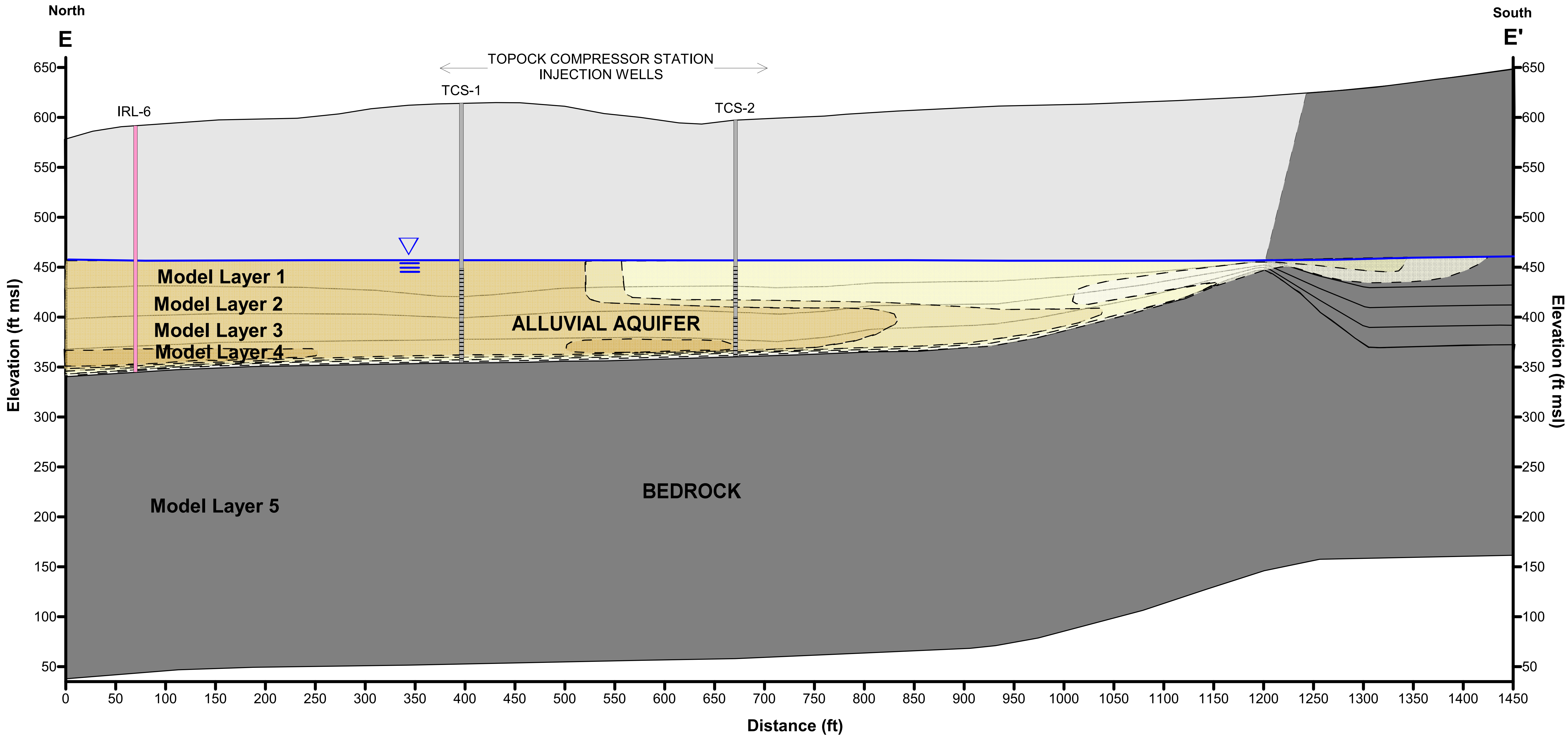
Future Provisional Well

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION D-D'

ARCADIS

FIGURE
3.1-5



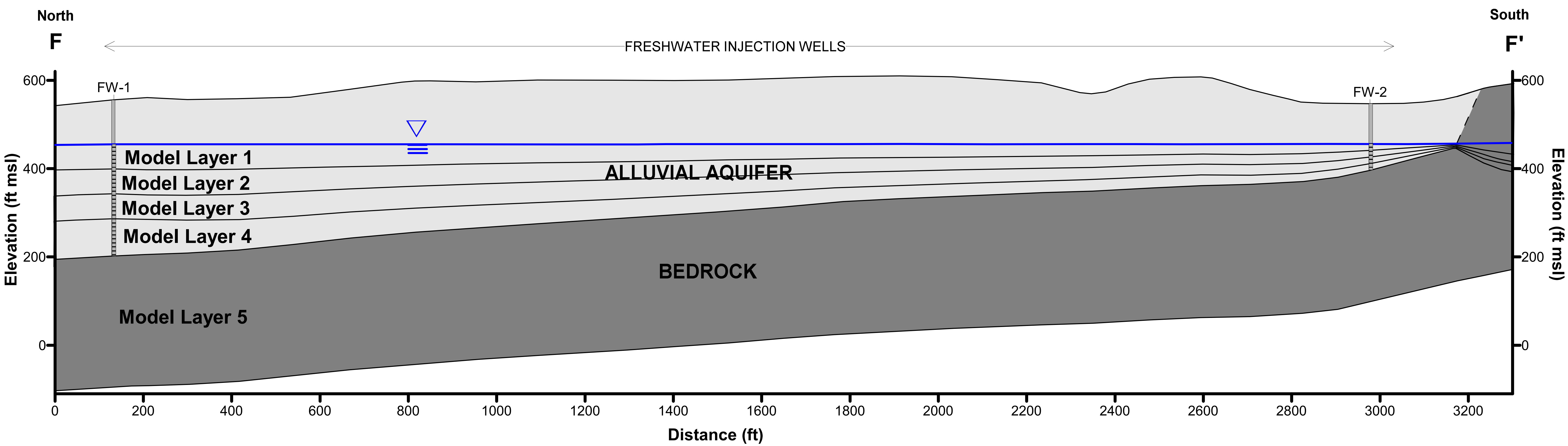
*Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. One well location ID may consist of multiple screens, and one well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well. Dual screen wells will consist of one well with two discreet screen intervals separated by a packer.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION E-E'

ARCADIS

FIGURE
3.1-6



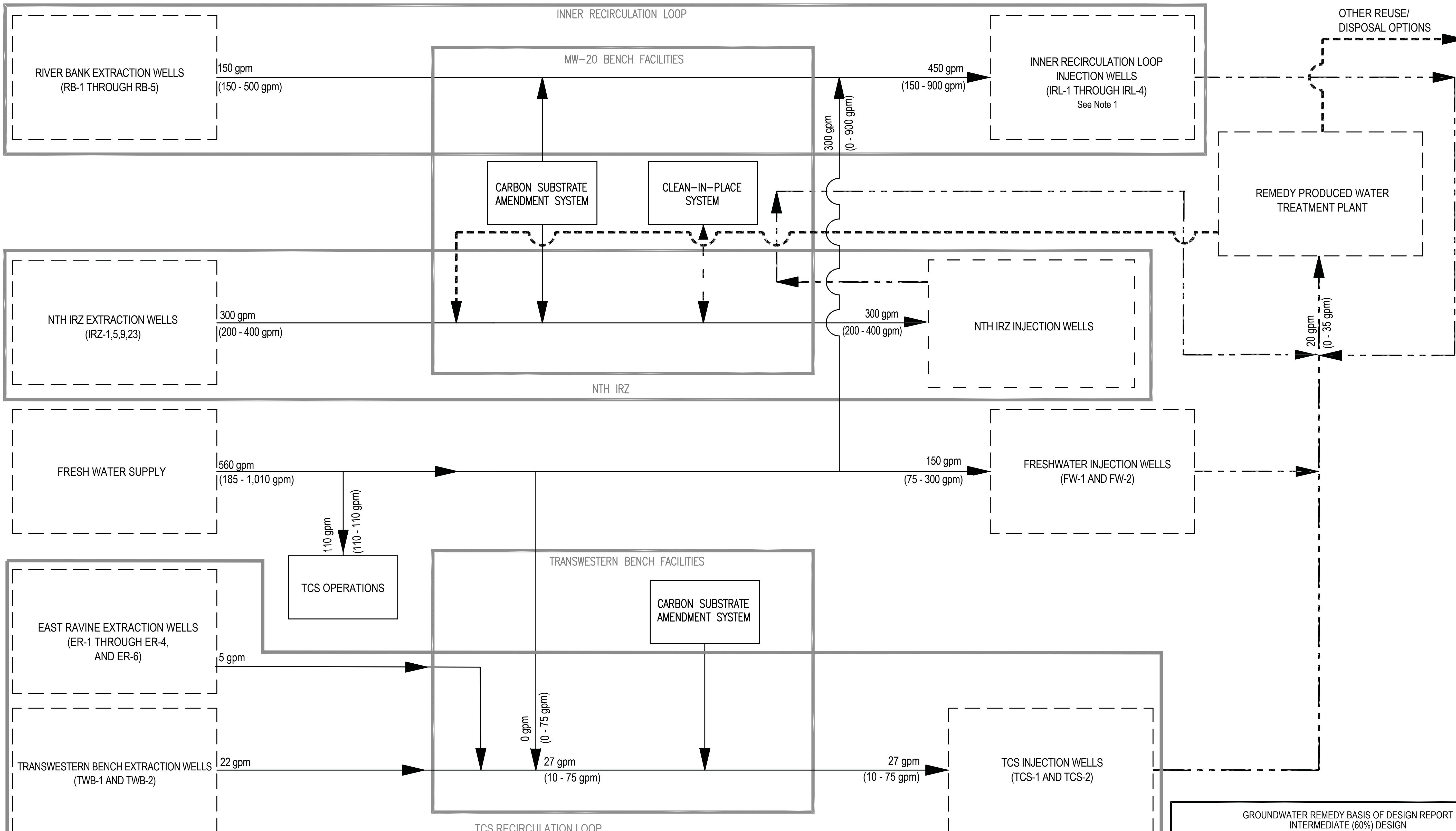
* Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of intermediate (60%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION F-F'

ARCADIS

FIGURE
3.1-7



EXPLANATION:

———	PRIMARY PROCESS LINE	150 gpm	NOMINAL FLOW RATE
— — —	CLEAN-IN-PLACE LINE	(150–500)	REASONABLE MINUMUM – MAXIMUM FLOW RATE
—·—·—	REMEDY PRODUCED WATER LINE (BACKWASH)	gpm	GALLONS PER MINUTE
- - - - -	TREATED WATER LINE	NTH	NATIONAL TRAILS HIGHWAY
		IRZ	IN-SITU REACTIVE ZONE
		TCS	TOPOCK COMPRESSOR STATION

NOTES:
1. The intermediate nominal scenario assumes IRL-1 and IRL-2 will receive carbon-amended River Bank Extraction Well water if hexavalent chromium concentrations in the River Bank Extraction Wells exceed the clean-up goal; and IRL-3 and IRL-4 will receive freshwater. However, injection wells IRL-1 through IRL-4 will be constructed for flexibility to inject either/both freshwater or/and River Bank Extraction Well water during the lifetime of the remedy.

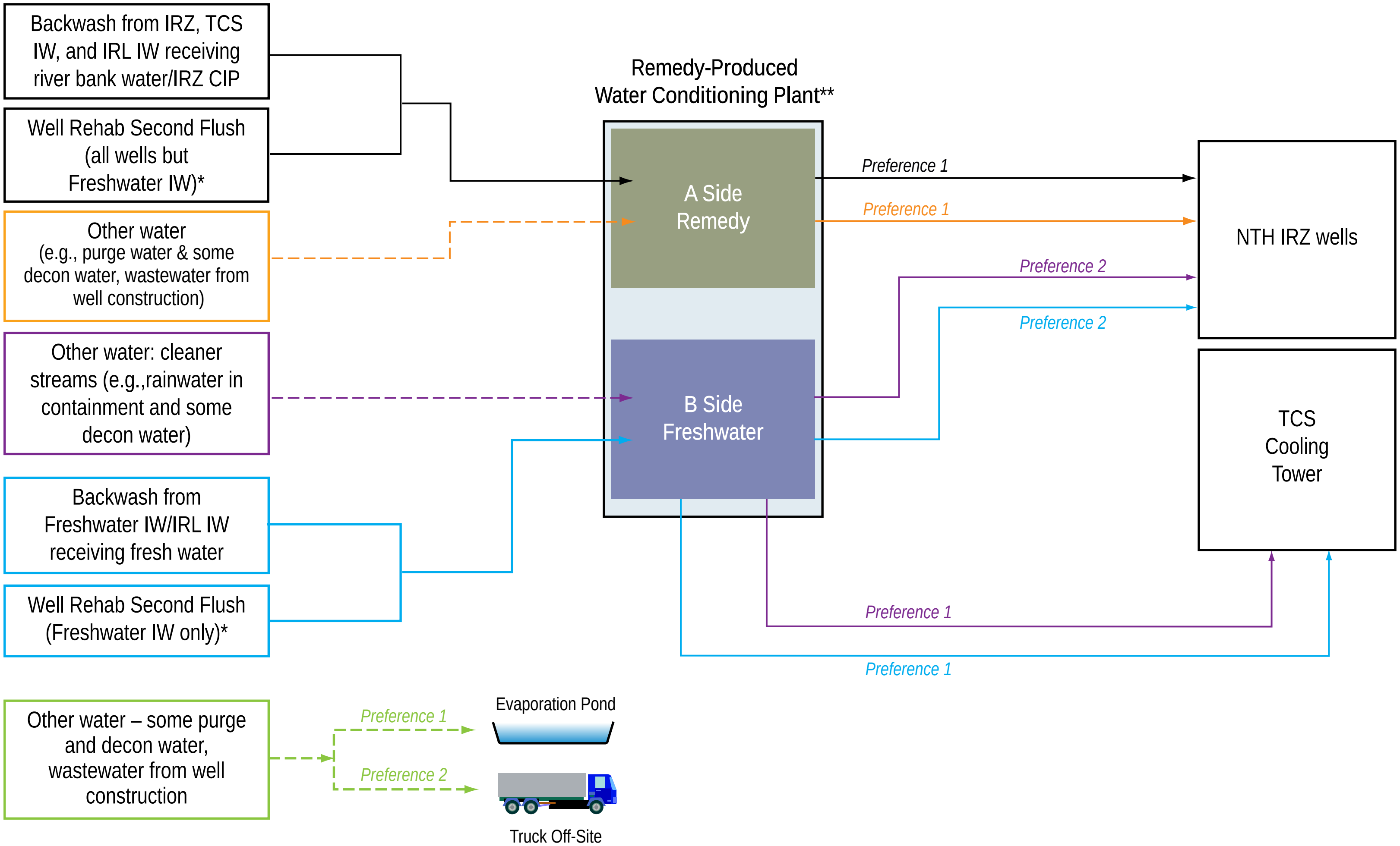
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY INTERMEDIATE (60%) SYSTEM FLOW DIAGRAM

ARCADIS

FIGURE
3.2-1

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\Emeryville\ACT\RC000753\0008\RC000753 ConRemPrelim FD REV2.dwg LAYOUT: 3-10 SAVED: 10/12/2011 5:15 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 10/12/2011 5:20 PM BY: REYES, ALEC



LEGEND

Piping

Conveyed by truck

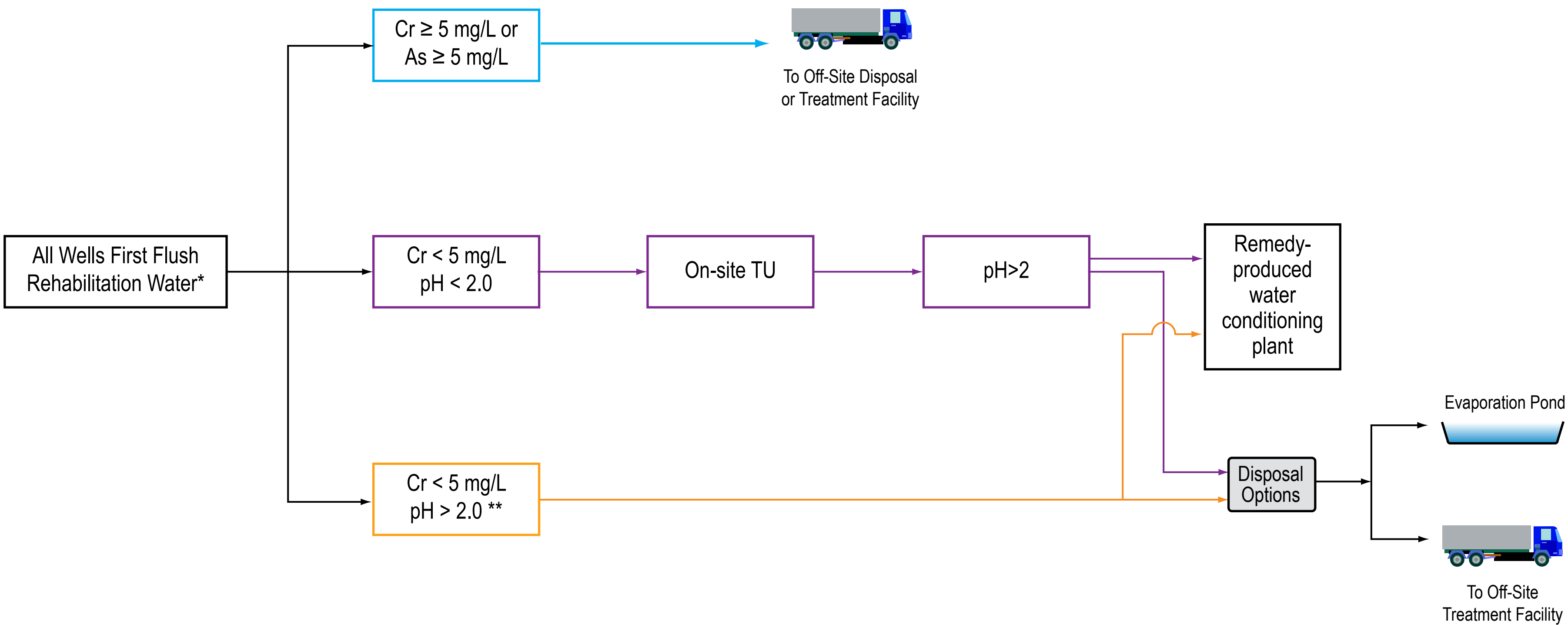
* Conveyance by trucking is backup option for IRZ and injection wells. For extraction wells, some trucking may be required.

** Lowest preference options for disposing of Remedy Produced Water in Evaporation Ponds, offsite facility, and future options including Bat Cave Wash infiltration gallery and Moabi Regional Park Ponds are not shown.

CIP	Clean in Place
IRZ	In-situ Reactive Zone
TCS	Topock Compressor Station
IW	Injection wells
IRL	Inner recirculation loop
NTH	National Trails Highway

FIGURE 3.4-1
REMEDY-PRODUCED WATER SCHEMATIC – BACKWASH AND SECOND FLUSH REHABILITATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.



LEGEND

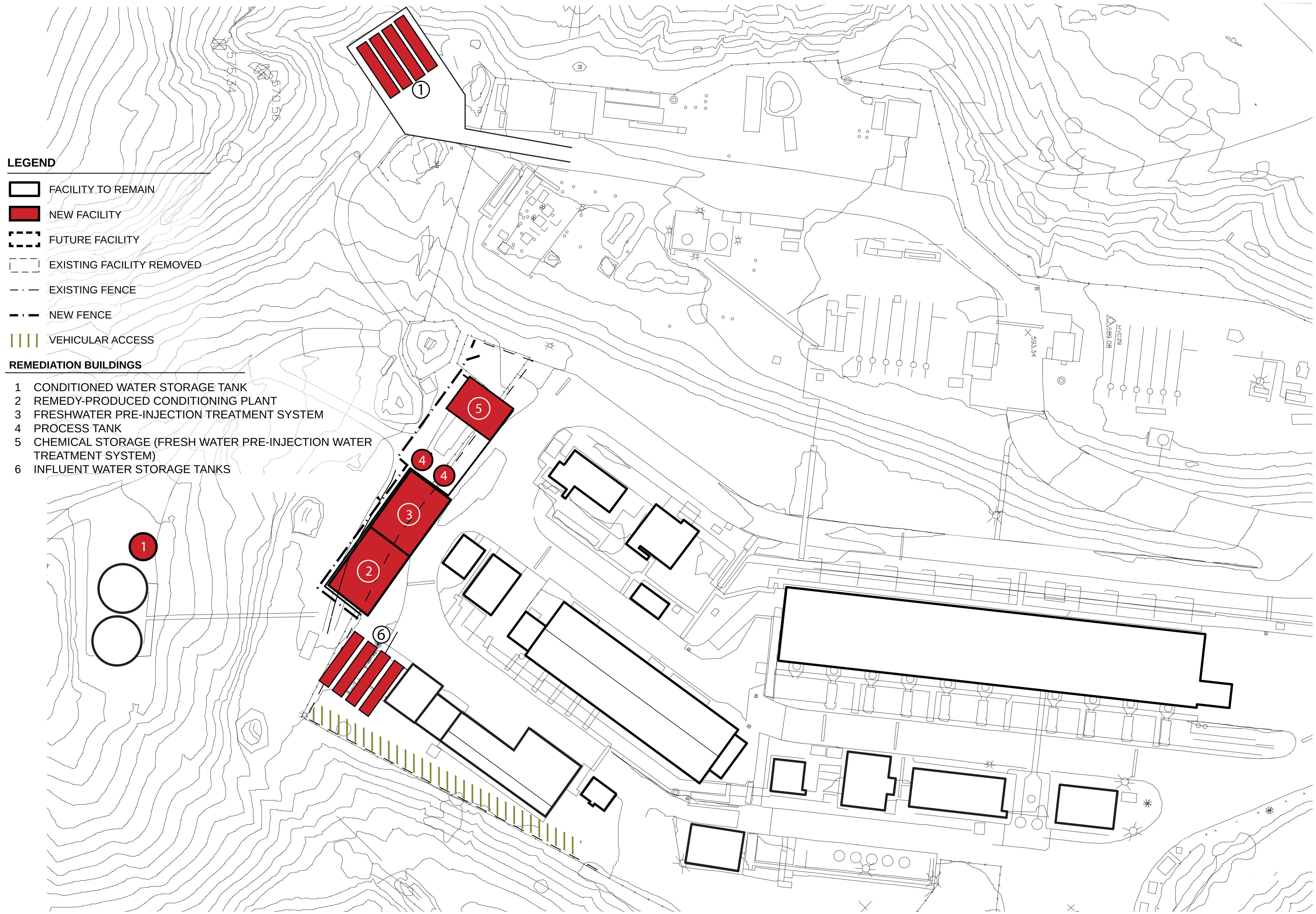
Piping

Conveyed by truck

TU Treatment Unit permitted for (pH adjustment) hazardous waste treatment per California Code of Regulations Title 22
Cr Chromium (dissolved)
As Arsenic (dissolved)
IRZ In-situ Reactive Zone
* Conveyance by trucking is backup option for IRZ and injection wells. For extraction wells, some trucking may be required.
** An optional approach to pH adjustment at the Remedy-Produced Water Conditioning Plant is to adjust it in the field with an On-Site TU

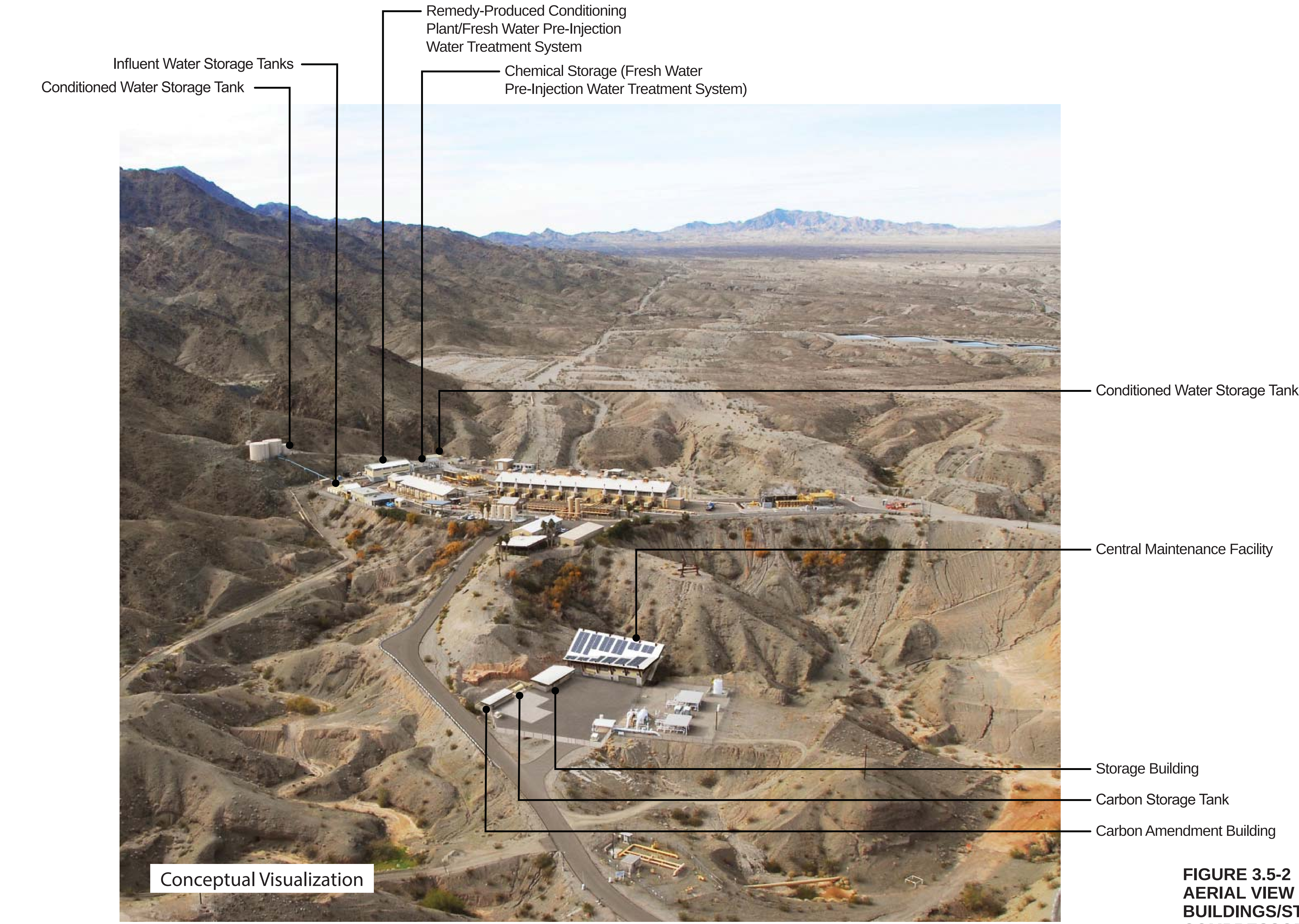
FIGURE 3.4-2
REMEDY-PRODUCED WATER SCHEMATIC – FIRST FLUSH REHABILITATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL



Source: IDC Architects 2013.

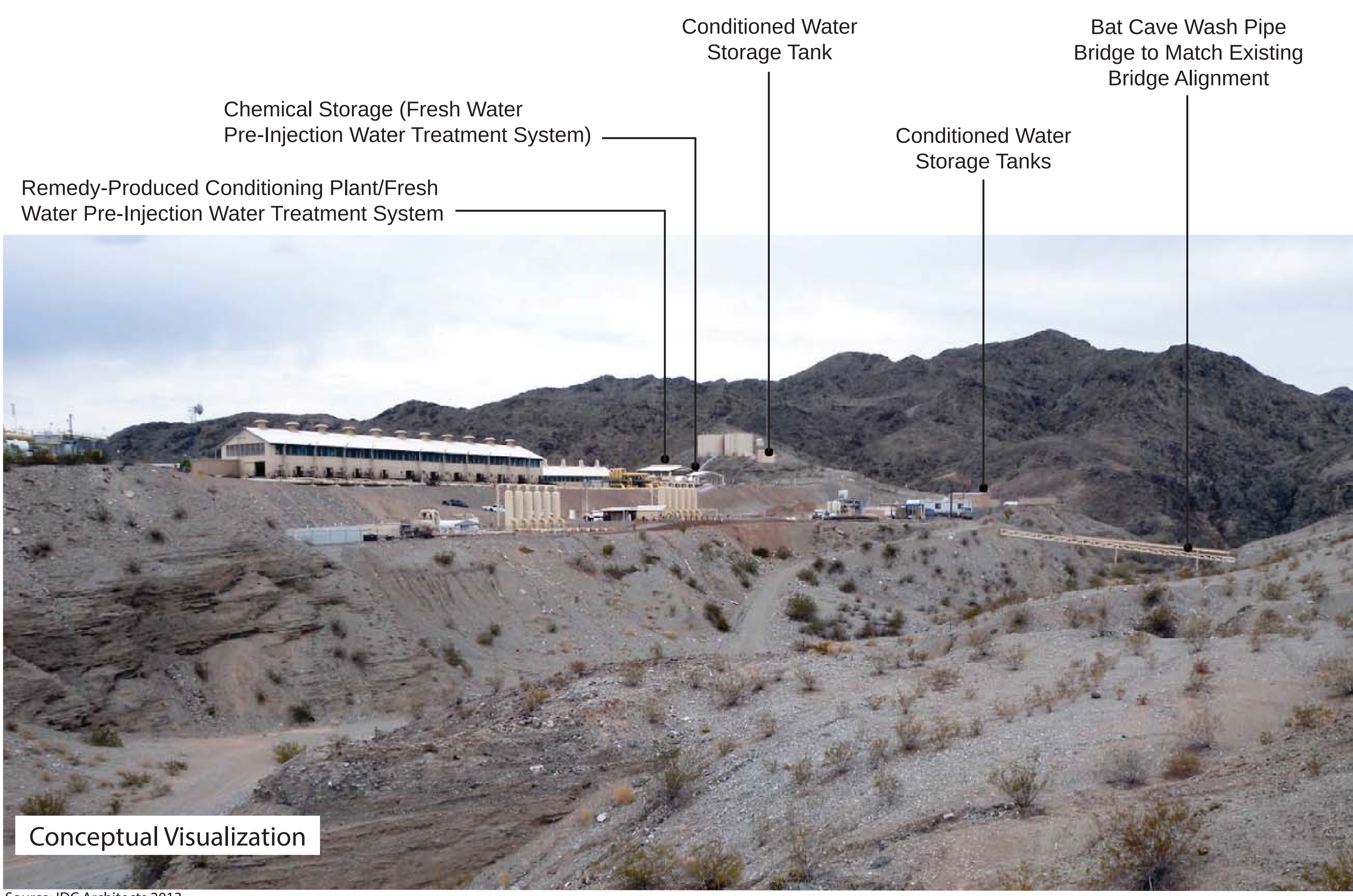
FIGURE 3.5-1
LAYOUT OF NEW REMEDY BUILDINGS AND STRUCTURES INSIDE THE COMPRESSOR STATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



Source: IDC Architects 2013.

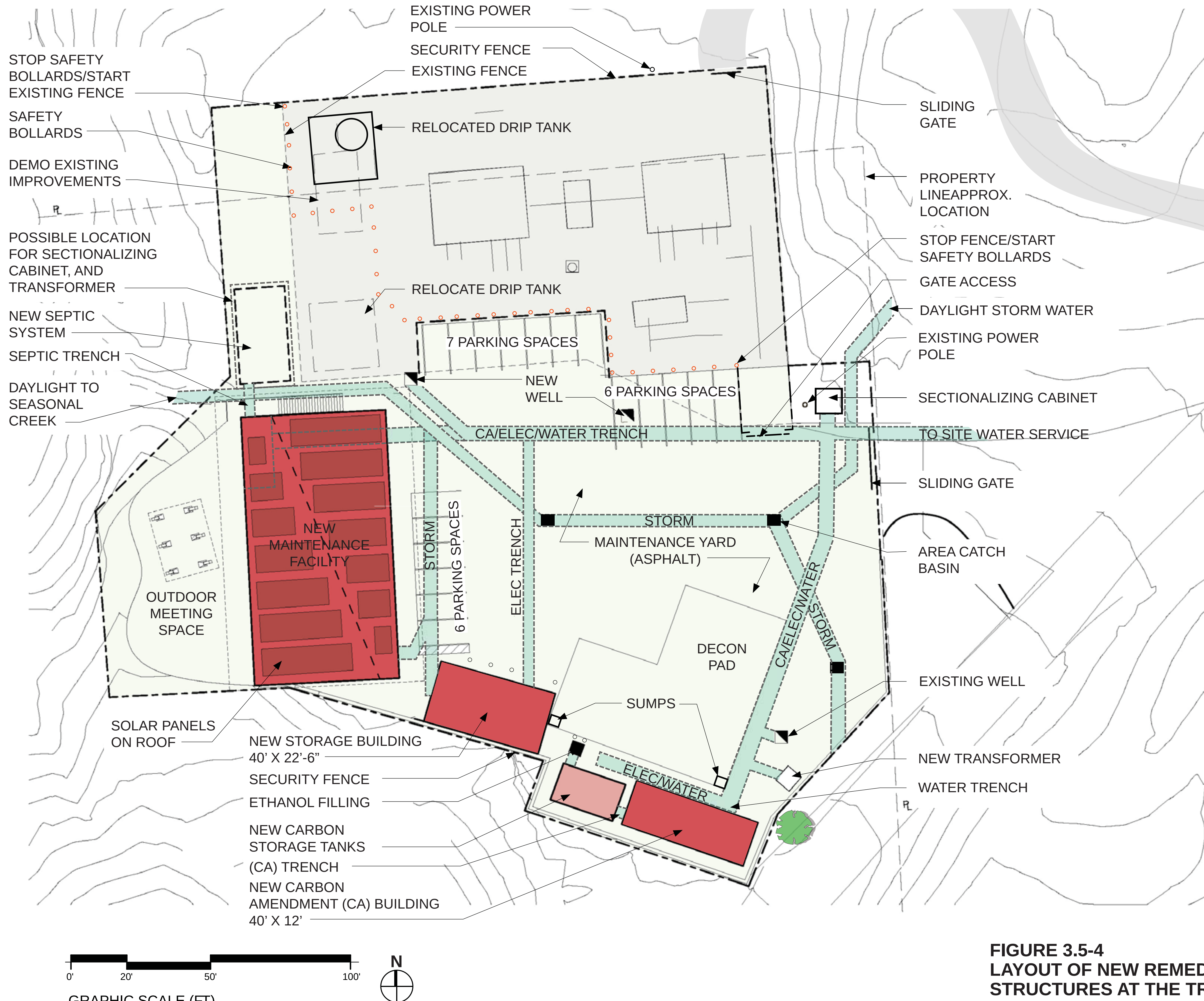
FIGURE 3.5-2
AERIAL VIEW OF NEW REMEDY BUILDINGS/STRUCTURES IN COMPRESSOR STATION AND TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Source: AECOM, January 2011.



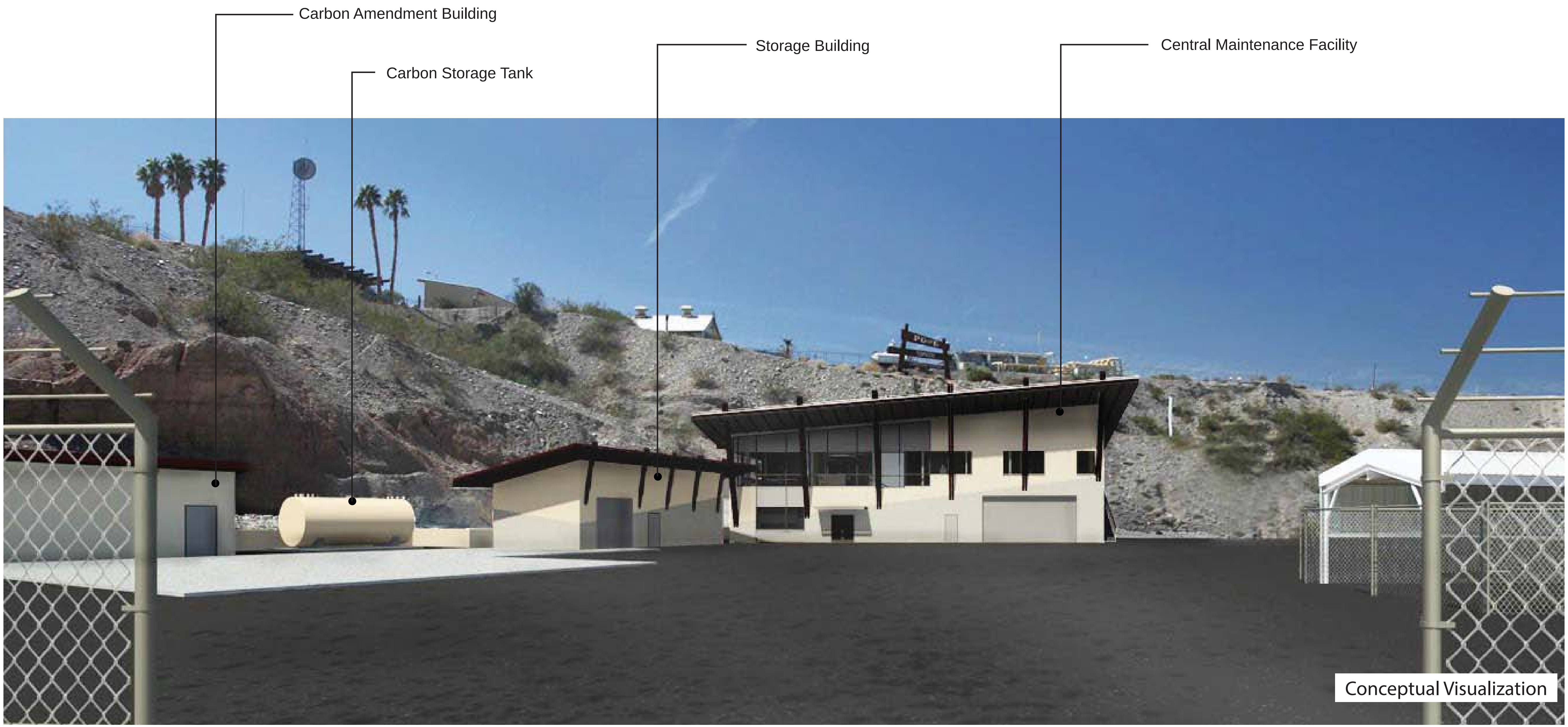
Source: IDC Architects 2013.

FIGURE 3.5-3
PHOTO SIMULATIONS OF EIR KEY VIEW 2 VS. 60% DESIGN
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



Source: IDC Architects 2013.

FIGURE 3.5-4
LAYOUT OF NEW REMEDY BUILDINGS AND STRUCTURES AT THE TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

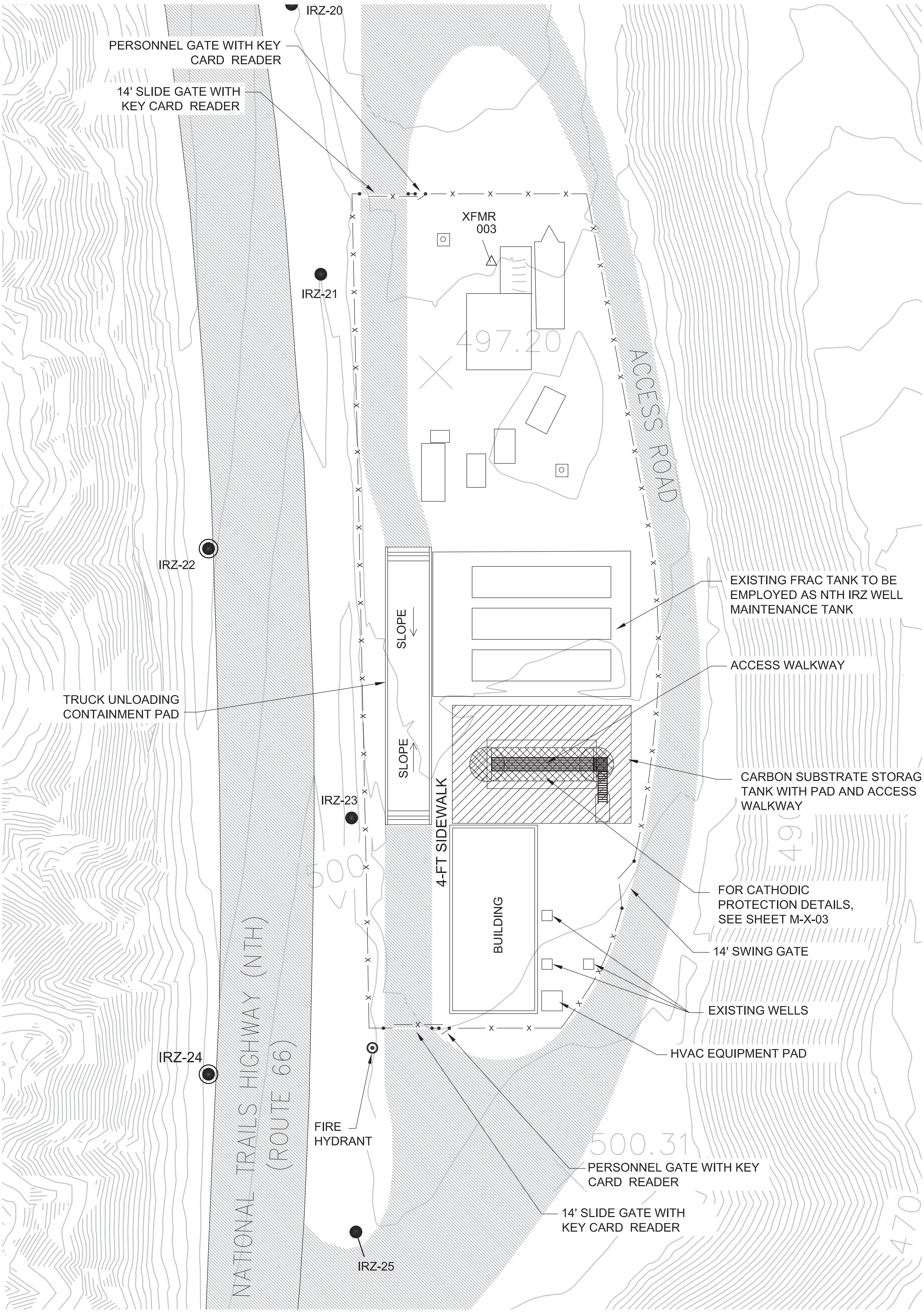


Source: IDC Architects 2013.

FIGURE 3.5-5
NEW REMEDY BUILDINGS AND STRUCTURES AT THE TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Source: IDC Architects 2013.

FIGURE 3.5-6
NEW MAINTENANCE FACILITY – VIEW FROM I-40
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



Source: Arcadis, August 2012.

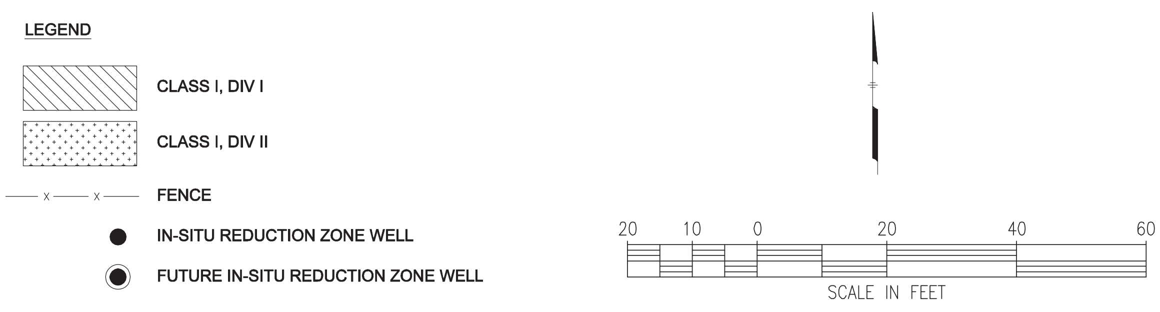
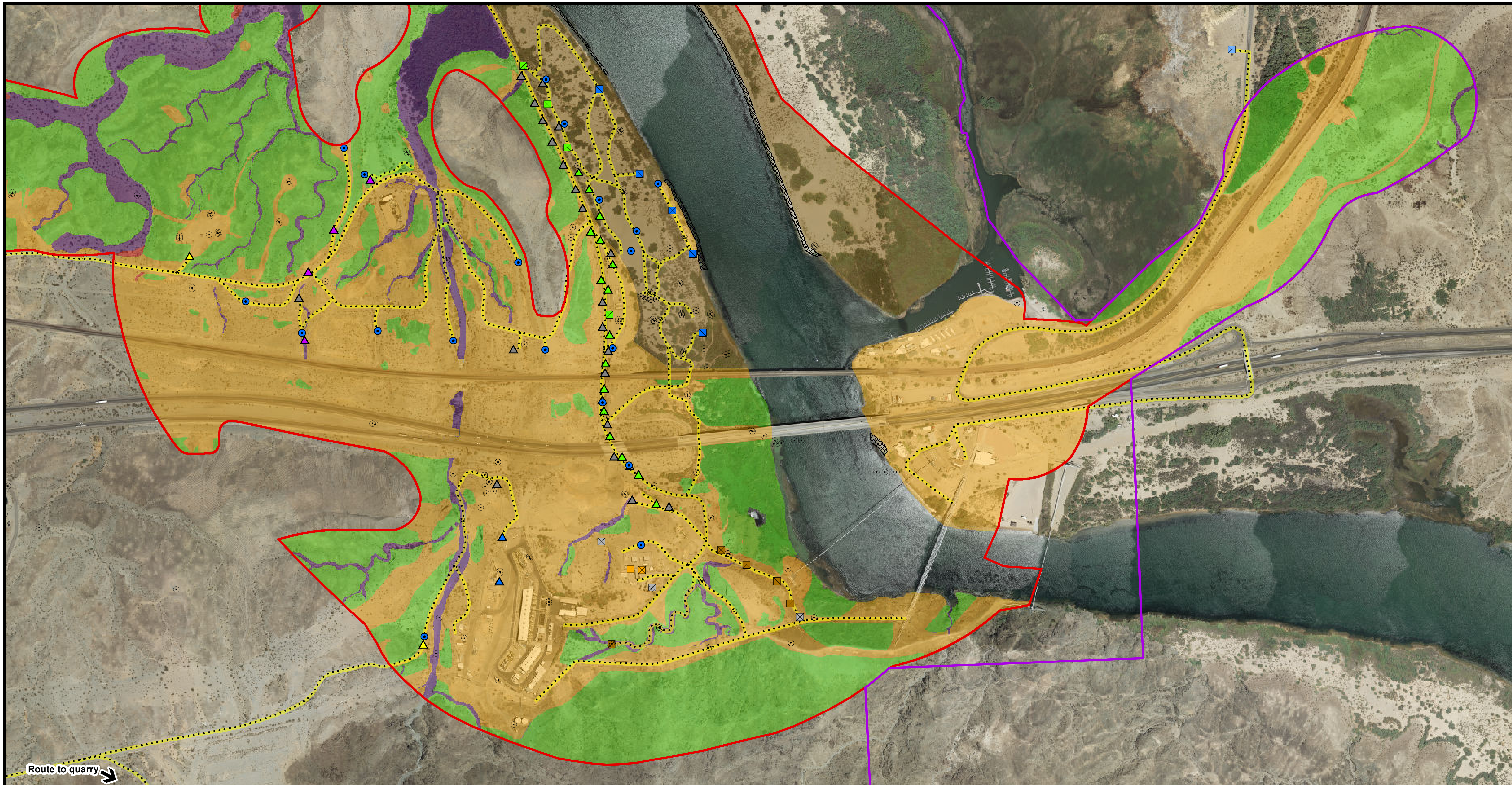


FIGURE 3.5-7
LAYOUT OF REMEDY BUILDING AND STRUCTURES AT THE MW-20 BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Source: IDC Architects, April 2013.

FIGURE 3.5-8
NEW REMEDY BUILDING AT THE MW-20 BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.



LEGEND

- Existing Monitoring Well
- Proposed Access Routes
- Area of Potential Effects (APE)
- EIR Project Area

Remedy Features

- Future Provisional Extraction Well
- Future Provisional Injection Well
- Remedy Monitoring Well
- Freshwater Source
- Extraction Well (East Ravine)
- Extraction Well (NTH IRZ)
- Extraction Well (Riverbank)
- Extraction Well (Transwestern Bench)
- Freshwater Injection Well
- Injection Well (Inner Recirculation Loop)
- Injection Well (NTH IRZ)
- Injection Well (Topock Compressor Station)

Surface Condition

- Mechanical Soil Surface Damage
- Dredged Sand
- Active Wash Channel
- Inactive Wash Channel
- Rip Rap
- Undisturbed and Archaeological/Historical Sites

Source Map:
Aerial Map of Disturbed Areas, November 2011

Note:
Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Highway is located in an existing, previously disturbed, access road. In addition, the location of the road and the pipeline was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures.

FIGURE 3.5-9
PROPOSED ACCESS ROUTES FOR REMEDY FEATURES

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

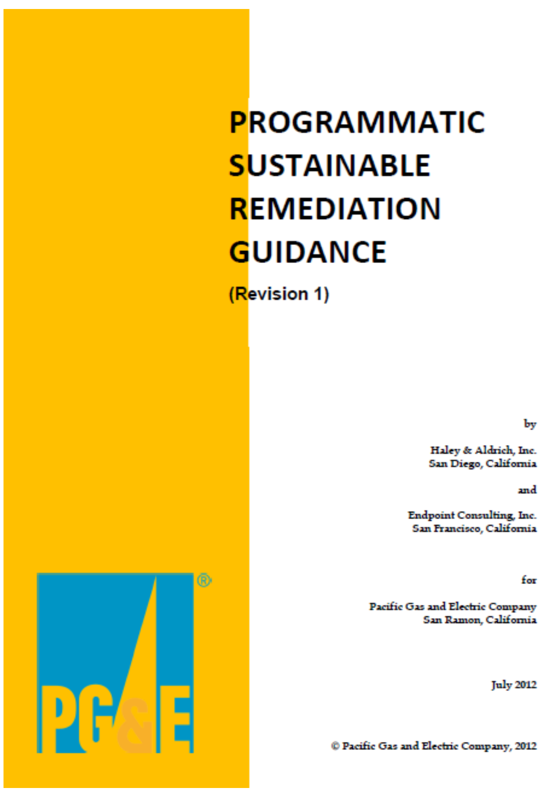
CH2MHILL

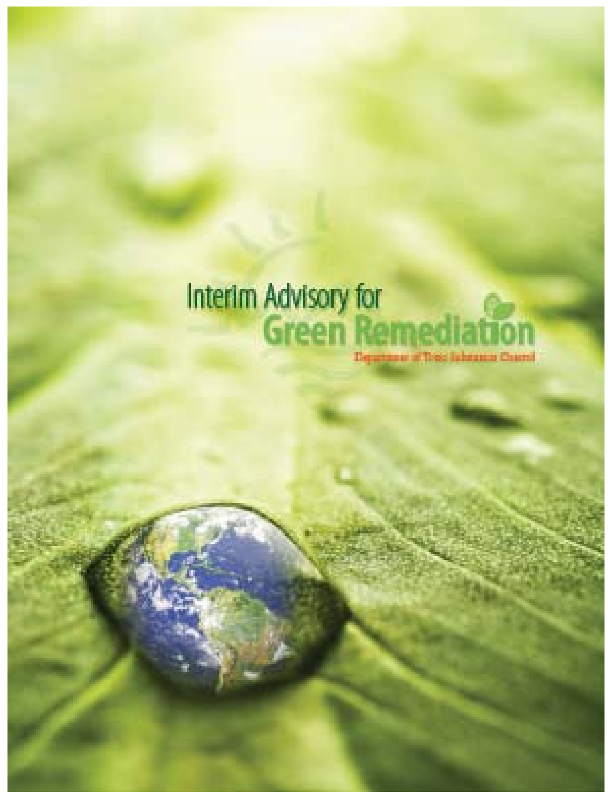
Path: D:\Projects\Topock\MapFiles\2013\CMS\60%Report\AccessRoutes.mxd

SECTION 4

Integration of Sustainability Practices into Remedial Design and Implementation

This section discusses the framework for and the integration of sustainability principles and practices into the remedy design and implementation activities for the Topock project. In July 2011, PG&E published the *Programmatic Sustainable Remediation Guidance* (PG&E 2011b) in consultation with representatives of DTSC to assist in the integration of sustainability principles and practices into PG&E's environmental remediation program. In July 2012, PG&E published Revision 1 of the Guidance (herein referred to as "the Guidance"; PG&E 2012) (pictured below). The Guidance continues to be a dynamic, living document and is aligned with DTSC's *Interim Advisory for Green Remediation* (DTSC 2009; also pictured below).





The Guidance presents a framework which enables the identification/evaluation, benefit quantification, and implementation of sustainable practices into different project activities including remedial design and implementation. The activity-specific steps are:

- Identify applicable sustainability factors (e.g., energy use, materials, greenhouse gas emissions, etc.).
- Identify sustainability best management practices (BMPs) to address each factor (e.g., reducing the number of site mobilizations, utilizing low-emitting technologies, etc.).
- Assess the benefits of the implemented BMPs.
- Designate a resulting activity-specific sustainability rating.

The Green Remediation Evaluation Matrix (GREM) is an Excel spreadsheet that serves as the centralized sustainability data management system throughout the implementation of the project, and will be updated with activity-specific data. This ensures a consistent approach by the project team throughout the life-cycle of the project.

The current activity-specific scope for the Topock project is the design and implementation of the approved groundwater remedy. To date, the PG&E design team has initiated a GREM for this scope, including identifying applicable sustainability factors and BMPs to address each factor (see Table 4.0-1). This GREM will be updated as the design progresses from 60% through final design, and will be evaluated and scored during remedy construction and decommissioning of IM facilities. Operations of the groundwater remedy will be addressed under O&M GREM after the construction is complete and the system is in operation.

The remedy design maintains a focus on reduction in overall remedial timeframe and reduction in O&M requirements. Achieving reduction of the overall project life cycle and O&M requirements will result in reductions to water use, materials use, waste generation, energy use, air emissions generated, health and safety hazards, and potential impacts on biological resources.

Overview of Topock Remedial Design and Implementation GREM

As shown in Table 4.0-1, the sustainability factors considered applicable to the Topock remedial design and implementation activities include:

- **Greenhouse Gas (GHG) Emissions** – These gases trap heat in the atmosphere, causing global warming. GHG emissions are emitted during energy production and transportation. This factor considers the GHG emissions produced as a result of the project activities.
- **Liquid Waste Production** – Liquid waste, if produced by project activities, may cause an impact on the environment if not treated or properly disposed of. This factor focuses on the liquid waste produced as part of project activities.
- **Solid Waste Recycling or Salvaging (Excluding Soil) –** This factor relates to solid waste that is recycled or salvaged as part of project activities.
- **Energy Use** – This factor focuses on the proportion of non-renewable and renewable energy used to perform project activities.
- **Materials** – This factor considers the sustainability aspects of the materials selected to perform project activities.
- **Surface Water and Groundwater Extraction** – This factor encompasses the use of surface water and groundwater resources by the project.
- **Biological Resources** – This factor refers to disturbance to biological resources as part of project activities.
- **Cultural Resources** – This factor considers cultural, archaeological, and historical features of value to stakeholders.
- **Local Economy Boost –** This factor focuses on enhancing the revenue to the local community as the result of the project, e.g., through purchase of materials extracted, manufactured, and/or sold locally, or through the use of local services. The boundary of local community is defined by proximity of the project to available resources. For the Topock remedial design and implementation project, the local community is defined to be within a radius of 50 miles from the PG&E Topock Compressor Station, and includes Kingman area, Needles area, Lake Havasu City Area, and Bullhead City/Mohave Valley Area.
- **Occupational Health and Safety** – This factor considers health and safety risks to persons performing project activities.

For each of the sustainability factors identified above, sustainability BMPs are identified as shown in Table 4.0-1. The BMPs will be updated as the design progresses from 60% to the final design. The BMPs will be scored for each sustainability factor during remedy construction and decommissioning of IM facilities.

As discussed in the Guidance (PG&E 2012), quantitative evaluations will be performed where feasible and when data are readily available. When quantitative analyses are not practical, qualitative evaluations will be performed. Care should be taken to ensure that the level of complexity of the evaluation is appropriate and proportionate to the complexity of the project activities. The evaluation methodology is presented in detail in the Guidance, including appropriate metrics, sustainability evaluation ratings, and result standardization process.

It is important to note that the units of measurement used for the sustainability evaluations are different for each factor considered in the GREM. Standardization of the evaluation results is therefore necessary to combine the sustainability pertaining to each factor. To this end, the Guidance outlines a standardization process where each factor-specific result is grouped into “Low”, “Moderate”, and “High” scores. A “Low” score is the best score. The basis for standardization is provided in the Guidance and is intended as a “living process” that will continue to evolve over time.

TABLE 4.0-1
Green Remediation Evaluation Matrix – Remedy Design and Implementation

	Sustainability Factors	Affected Media	Mechanism/ Effects	Examples of Potential Best Management Practices [1]	Type of Evaluation	Metric	Sustainability Calculation Result	Standardized Result [2]
	Design and Implementation GREM scope includes design and implementation of full scale groundwater and soil remedies. For groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under O&M GREM when the construction is complete and the system is in operation. System 60% and 90% designs maintain a focus on reduction in overall remedial timeframe and reduction in operations and maintenance (O&M) requirements. Achieving overall life cycle reductions and reducing O&M requirements will result in reductions to water use, materials use, waste generation, energy use, air emissions generated, health and safety hazards, and potential impacts on biological resources.							
ENVIRONMENT	**Substance Release/Production**							
ENVIRONMENT	**Greenhouse Gas (GHG) Emissions**	Air	Atmospheric warming	The following are examples of concepts that are being considered/integrated in the full scale remedial design: i) Examples of GHG reduction measures as part of design phase are: a) Used hydraulic modeling to optimize injection/extraction flow rates to minimize flow rates while still achieving target total organic carbon (TOC) distribution. Optimized flow rates will reduce overall pumping requirements along with associated GHG emissions. b) Evaluated use of variable frequency drive (VFD) motors. c) Evaluated use of backwash/clean-in-place piping and automated controls/central system to reduce driving trips for well rehab during implementation phase. ii) Remedial system architectural design considered the following green building elements: a) Doors with insulated tempered glass window openings to admit natural light. b) Windows (louvers) with aluminum framed and a clear anodized finish. Energy efficient insulated tempered glass with a low-E coating. Windows (louvers) allow for natural ventilation and circulation within the building, with minimal energy. c) Use of solar panels. iii) Use of telemetry-based monitoring device at select monitoring wells to minimize footprint. iv) Other key design concepts to minimize GHG: a) Select materials suppliers and waste disposal facilities closest to the site. b) Use of local construction labor and materials suppliers. c) Considering the use of mobile technology to facilitate remote monitoring/diagnostic, and minimize trips to site/reduce carbon footprint.	Quantitative (score when implemented)	Metric tons of carbon dioxide equivalent (CO_2e)/ total volume of Chemical of Concern in relevant media	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
ENVIRONMENT	**Liquid Waste Production**	Water	Water toxicity/ sediment toxicity/ sediment	The following are examples of concepts that are being considered/integrated in the full scale remedial design: i) Reduce brine production by decommissioning IM treatment plant. ii) Condition remedy-produced water and recycle/reuse conditioned water onsite (e.g., re-inject into aquifer) to the maximum extent practicable. iii) Evaluated the effectiveness of backwash and associated produced water generated during Hinkley pilot test and IM-3 injection well maintenance events, and incorporated into basis of design for the remedy-produced water condition system. iv) Evaluating the effectiveness of Aqua Gard technology at IM injection wells, and incorporated into well design for fresh water injection wells. v) Conducting bench-scale testing to evaluate ways to minimize liquid waste generation from pre-treatment of freshwater supply to remove arsenic and fluoride, and management of residual liquid waste.	Quantitative	% Reduction in liquid waste production	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
ENVIRONMENT	**Solid Waste Recycling or Salvaging (Excluding Soil)**	Land	Land use	The following are examples of concepts that are being considered/integrated in the full scale remedial design and in preparation of IM-3 Decommissioning, Removal, and Restoration Work Plan: i) Reuse or recycle IM-3 Treatment Plant Structures, such as the IM-3 Treatment Plant trailer and mobile warehouse units, equipment, and tank systems generated from decommissioning of IM-3 facilities to minimize waste. ii) Salvage uncontaminated materials with potential recycle, reuse, or resale value such as steel, iron, non-ferrous copper, stainless steel, plastic, and concrete. iii) The design incorporates the concept of shared use of existing facilities at TCS (e.g., the use of existing freshwater storage tanks at TCS) and to avoid the need for construction of new facilities. iv) The design incorporates all existing monitoring wells, thereby, minimized the number of new wells to be installed. v) The design assumes the use of the existing HNWR-1 well as freshwater source, thereby, avoided installing a new supply well.	Quantitative	% solid waste recycled or salvaged	This evaluation will be performed during remedy construction and decommissioning of IM facilities	

TABLE 4.0-1
Green Remediation Evaluation Matrix – Remedy Design and Implementation

	Sustainability Factors	Affected Media	Mechanism/ Effects	Examples of Potential Best Management Practices [1]	Type of Evaluation	Metric	Sustainability Calculation Result	Standardized Result [2]
	Design and Implementation GREM scope includes design and implementation of full scale groundwater and soil remedies. For groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under O&M GREM when the construction is complete and the system is in operation. System 60% and 90% designs maintain a focus on reduction in overall remedial timeframe and reduction in operations and maintenance (O&M) requirements. Achieving overall life cycle reductions and reducing O&M requirements will result in reductions to water use, materials use, waste generation, energy use, air emissions generated, health and safety hazards, and potential impacts on biological resources.							
ENVIRONMENT	**Resource Depletion/Gain (Recycling)**							
ENVIRONMENT	**Energy Use**	Subsurface	Consumption	The following are examples of concepts that are being considered/integrated in the full scale remedial design: i) Use energy generated from non-petroleum sources where possible, such as small photovoltaic solar panels at select remote well locations and Central Maintenance Building ii) Use of alternative fuels, e.g. biodiesel iii) Use energy efficient architectural elements iv) Use energy efficient equipment and lighting v) Use EPANET water supply program to design the piping network and minimize energy consumption. vi) Locate conditioned water tanks to allow for gravity flow to injection wells, minimize energy use.	Quantitative	% energy generated by renewable sources	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
ENVIRONMENT	**Materials**	Land	Consumption and reuse	The following are examples of concepts that are being considered/integrated in the full scale remedial design: i) Maximize the purchasing of new materials with recycled content. ii) Interior surfaces of buildings and infrastructures will receive a high-quality finish for appearance and longevity of materials. Building materials selection will consider International Green Building Code and California Health and Safety Codes, Section 18944.	Quantitative	% of materials recycled or salvaged	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
ENVIRONMENT	**Surface Water and Groundwater Extraction**	Water, land	Impoundment/ sequester/reuse	The following are examples of concepts currently being integrated into the full scale remedial design: i) Optimize recirculation flow rates and careful carbon dosing to minimize generation and migration of by-products, while maintaining the required carbon distribution. ii) Most water needs for the IRZ component of the groundwater remedy will be taken from and returned to the target IRZ barrier, thereby maintaining that portion of the aquifer's net water balance, or reused in site processes, to reduce extraction of other waters. iii) Perform hydrologic analysis during design phase to evaluate proposed pumping rates for extraction, the potential cone of depression and the extraction effect on existing wells in proximity. Computer simulations or other appropriate hydrologic analysis will be used to demonstrate that production rates of the existing wells will not be substantially affected by any new freshwater extraction wells as described in mitigation number WATER-1. The implementation of a long-term pump test at HNWR-1 well has been included in the Implementation Plan for Alternative Fresh Water Sources, which is undergoing review by agencies. Once the Implementation Plan is approved, field work will be conducted and data will be used to assess compliance with WATER-1. The following are examples of concepts are being integrated into the management of remedy-produced water: i) Maximize reinjection of treated remedy-produced water to groundwater basin and minimize consumptive use. ii) Monitor injection effects on aquifer and plume characteristics.	Qualitative	Surface water treatment optimization	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
ENVIRONMENT	**Biological Resources**	General environ-ment	Species disappearances/ diversity reduction	The following are examples of activities that are under way and/or being integrated into the full scale remedial design: i) Conduct survey and mapping to document baseline conditions (e.g., mature plants, ethonobotanically sensitive plants, vegetation conditions, wetlands delineation, instream habitat typing, protocol surveys for special status bird species, etc.). Results of surveys and mapping have been used to guide the design to protect, avoid, and minimize potential impact to biological resources. ii) Elements of the project are designed to avoid direct effects on identified sensitive areas. Qualified biologists are coordinating with the design team and have conducted field reviews to ensure footprints of facilities and construction zones are designed to avoid/minimize disturbance of sensitive habitats (BIO-1). Qualified desert tortoise biologist (Gabriel Valdez) has identified potential desert tortoise habitat in the project area based on vegetation surveys, and is coordinating with the design team to ensure that the footprints of project elements and access routes are designed to avoid direct or indirect effects on potential desert tortoise habitat to the extent feasible (BIO-2a). iii) In consultation with the USFWS, develop a Bird Avoidance and Minimization Plan (BAMP) for special status bird species and those species protected under the federal Migratory Bird Treaty Act, including the Yuma clapper rail (BIO-2a). iv) Develop revegetation plans and specifications consistent with EIR mitigation measures AES-1e and AES-2f. v) Mapped the Ordinary High Water Mark (OHWM) and set a minimum setback of 20 feet from the OHWM to prevent substantial vegetation removal along river bank (AES-2a).	Semi-quantitative	Sensitive species	This evaluation will be performed during remedy construction and decommissioning of IM facilities	

TABLE 4.0-1
Green Remediation Evaluation Matrix – Remedy Design and Implementation

	Sustainability Factors	Affected Media	Mechanism/ Effects	Examples of Potential Best Management Practices [1]	Type of Evaluation	Metric	Sustainability Calculation Result	Standardized Result [2]
	Design and Implementation GREM scope includes design and implementation of full scale groundwater and soil remedies. For groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under O&M GREM when the construction is complete and the system is in operation. System 60% and 90% designs maintain a focus on reduction in overall remedial timeframe and reduction in operations and maintenance (O&M) requirements. Achieving overall life cycle reductions and reducing O&M requirements will result in reductions to water use, materials use, waste generation, energy use, air emissions generated, health and safety hazards, and potential impacts on biological resources.							
ENVIRONMENT	**Cultural Resource**	Social	Impact to resources	Examples of activities that are currently being implemented: i) Comply with the requirements of the Programmatic Agreement (PA) and Cultural and Historic Properties Management Plan (CHPMP) to avoid, minimize, or mitigate adverse effects to cultural and historic properties within the APE. ii) Comply with the requirements of the EIR Mitigation Monitoring and Reporting Program (MMRP). Examples of activities already under way or completed include, but not limited to, the following: a - Develop a Cultural Impact Mitigation Program (CIMP) to reduce potential impacts on cultural and historical resources as described in mitigation measure CUL-1a-8. PG&E is working in collaboration with Tribes on several sub-measures of the CIMP. b - Develop a written access plan to preserve Tribal members' access to project area for religious, spiritual, or other cultural purposes as described in mitigation measure CUL-1a-2. c - Convened a multidisciplinary technical review committee (TRC) of scientific and engineering experts as a part of the corrective measures implementation to review project-related documents and advise Tribal leaders per mitigation measure CUL-1. The TRC has been providing various supports on the project under direction of the Tribes. d - Funded two project manager positions from interested Tribes per mitigation measure CUL-1a-11. e - Completed a paleontological survey to refine potential impacts on unique paleontological resources as described in mitigation measure CUL-3. f - Prepare a worker cultural sensitivity education program per mitigation measure CUL-1a-13. Tribal inputs provided in meetings. g - Mapped indigenous plants of traditional cultural significance. Use results of mapping to guide the design to protect, avoid, and encourage the natural regeneration of the identified plants (CUL-1a-5). h - Prioritize using previously disturbed areas for placement of new improvements and re-use existing physical improvements as described in mitigation measure CUL 1a-9. A current version of this map is included in Appendix A2 of this report. i – The following have been incorporated into the 60% design criteria (Appendix C): • Infrastructure such as wells, pipelines, and utilities will be colored consistent with the surrounding natural color palette to not degrade the aesthetic value of the area consistent with mitigation measure AES-2. • All additional phone calls and alarms associated with remediation activities or facilities will not routed through PG&E's existing alarm system utilized at the compressor station. The notification system for remediation-related alerts and/or phone calls will not introduce additional noise to the project area, to the maximum extent feasible. • Light design criteria consistent with EIR mitigation measure CUL-1a-7. j – Completed a geoarchaeological investigation to determine if a potential exists for buried historical and archaeological resources. A summary report is forthcoming. k – Retained a qualified cultural resources consultant to implement the 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. DTSC approved AE as the qualified cultural resources consultant (CUL-1a-3a).	Quantitative	Cultural resources	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
SOCIAL	**Local Economy Boost**							
	Local Economy Boost	Social	Employment/ Income/ Training	Examples of concepts under implementation for Interim Measure include, but not limited to, the following: i) Select local providers for construction and construction support. Local providers assumed to be within a 50 mile radius of the site and includes Kingman area, Needles area, Lake Havasu City Area, and Bullhead City/Mohave Valley Area. ii) Purchase products locally, as feasible, for construction materials. iii) Encourage workers and contractors to consider using local business to the maximum extent possible.	Quantitative	% of project expenditures providing local economy boost	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
	Human Health and Safety							
	Occupational Health and Safety	Social	Health and safety	Examples of concepts/activities that that will be considered for remedial project activities: i) Develop and implement site specific Health and Safety Plan consistent with EIR mitigation measure HAZ-2. ii) Daily site health and safety tailgate meetings prior to commencement of site work. iii) Site safety officer to be onsite to monitor/enforce site safety culture. iv) Use of stop work authority by all site workers. v) Develop project-specific Hazardous Material Business Plan (HMBP), vi) Coordinating with TCS operations on all design aspects within the Compressor Station fenceline to ensure a safe, harmonious, and sustainable design.	Quantitative	Accidents requiring treatment beyond first aid	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
							Remedy Design and Installation-Specific Rating:	

Notes:
[1] Mitigation numbers referenced in this table refer to the mitigation measures in the final project Environmental Impact Report (DTSC 2011d).
[2] The sustainability evaluation for each factor is measured in variable units. Standardization of the evaluation results is therefore necessary to combine the sustainability pertaining to each factor. To this end, the *Programmatic Sustainable Remediation Guidance* (PG&E 2011b) outlines a standardization process where each factor-specific result is grouped into "Low", "Moderate", and "High" scores. A "Low" score is the best score. The basis for standardization is provided in the Guidance and is intended as a "living process" that will continue to evolve over time.

SECTION 5

Institutional Controls, Anticipated Approvals, Permits, and Agreements

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.

ICs in the form of a recorded covenant will not be likely be implemented for the federally administered parcels composing the majority of the Topock site. Rather, the ROD indicated that the ICs adopted by the selected groundwater remedy for the Topock site are specified in the *BLM Lake Havasu Field Office Resource Management Plan* issued in May 2007 (BLM 2007) and in the *1994 Lower Colorado River National Wildlife Refuges Comprehensive Management Plan* (USFWS and BOR 1994). These plans restrict 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. Additionally, there are currently no municipal or private wells in the chromium plume area, to PG&E’s knowledge.

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 the freshwater supply well in Arizona (HNWR-1). 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 are 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.

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 implement the controls according to each specific property where ICs will be required.

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 areas 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., an 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 the BNSF Railroad property (APN 650-151-05 on Figure 5.1-1). As explained in response to a comment from DTSC on the 30% design report (Appendix I, RTC #207), the simulated pumping scenario included a hypothetical extraction well at Park Moabi pumping at 400 gpm, a typical average rate for golf courses in this region (Green 2005). The pumping center was placed at different locations on Park Moabi with pumping rates assigned to model layers 2-4, and plume flow lines were examined. A hypothetical domestic well was also included outside of the plume footprint and placed at different locations to examine the potential for injected recirculation water flow lines to be drawn towards the well. Together, the simulation from pumping of these two hypothetical wells was used to define the area for Category 1 ICs (see Figure 5.1-1).

Also in response to this DTSC comment (Appendix I, RTC #207), additional modeling simulations were performed and additional information was obtained from the Topock Marina on Historic Route 66 regarding potential water use and source:

- An additional simulation of the hypothetical domestic extraction well (mentioned in the paragraph above) was conducted, with additional features including a pool and lawn. The assumed average pumping rate was 1,440 gallons per day, based on water consumption of a quarter-acre lawn and maximum evaporative losses for pools in the Lake Havasu area. The addition of these features makes virtually no difference in the simulation. The closest potential domestic well location would eventually intercept freshwater injection flowlines, regardless of the domestic well pumping rate, but the recirculation water flowlines will not pass through the area outside of the IC boundary as shown on Figure 5.1-1, based on the current remedy configuration.
- Information obtained from the Topock Marina on Historic Route 66 during the first quarter 2013 indicates that they are planning to conduct exploratory drilling on their property in hope of locating a groundwater supply well that can produce about 2000 gallons per minute for use as fire protection water at their future facility. Target timing is 2013.

Additional simulations will be conducted to verify the Category 1 ICs area 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 2014-2016). The locations of planned remedial structures are presented in this intermediate design. Where possible, for planning purposes, future remedial structures (i.e., additional infrastructures to be built after 2016) are also included in the intermediate design in grey out mode. After the remedy locations have been settled on specific parcels, land issues such as survey of alignments, legal description, easements, and encroachments will be determined and processed. PG&E will work with government agencies, property owners, and/or parties with other land use interests, where appropriate, to advance the establishment of IC covenants prior to remedy construction.

For planning purposes, Tables 5.1-1A and 5.1-1B provide an updated listing of potential IC categories associated with federal and non-federal lands, respectively (see Figure 5.1-1 for locations of cited lands/ properties). As discussed previously, ICs in the form of a recorded covenant will not be implemented for the federally administered parcels composing the majority of the Topock site. Rather, the DOI's Record of Decision (ROD; DOI 2010) indicated that the ICs adopted by the selected groundwater remedy for the Topock site are specified in the *BLM Record of Decision and Lake Havasu Field Office Approved Resource Management Plan* issued in May 2007 (BLM 2007) and in the *1994 Lower Colorado River National Wildlife Refuges Comprehensive Management Plan 1994-2014* (USFWS and BOR 1994). These plans restrict surface uses and use of the groundwater on federal lands.

5.2 Identify and Evaluate Appropriate IC Mechanisms

As stated above, the SOB identified the implementation of land use 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 similar mechanisms, as appropriate.

5.3 Anticipated Approvals, Permits, and Agreements

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 their authority under RCRA and CERCLA, respectively.

5.3.1 Access to Federal Lands

Remedial infrastructure are planned on federal lands, including lands administered by BOR (managed by BLM) and HNWR (managed by USFWS). It is PG&E's understanding that the ROD, the Consent Decree, and DOI's approval of the forthcoming Construction/Remedial Action Work Plan constitute permission to implement the selected final groundwater remedy and authorization to access federal property. No other permit applications or approvals for access to federal lands will be required before field implementation. In addition, the process required for compliance with ARARs is addressed in Section 6 of this report, and there is not a separate process for compliance required for access to federal lands.

5.3.2 Access to Non-Federal Lands

Remedial infrastructure are planned on non-federal lands, including lands owned by BNSF Railroad, Kinder Morgan, Metropolitan Water District, Mojave County, and the FMIT. In addition, infrastructures are planned on county roadways or their ROWs (San Bernardino County, Mojave County), and state transportation agencies (California Department of Transportation [Caltrans], Arizona Department of Transportation [ADOT]). Where remedial infrastructures cross or travel along utility easements, a consent to common use agreement or other notification process will be implemented, as appropriate.

Pursuant to CERCLA Section 121(e), activities conducted onsite are exempt from obtaining federal, state, or local permits or complying with other procedural requirements. However, PG&E is still required to comply with the substantive requirements of the identified location- and action-specific ARARs. Below is a list of anticipated approvals/permits/ agreements for which PG&E will either obtain the relevant approval(s)/permit/agreement or otherwise comply with the appropriate substantive requirements:

- Encroachment permits from 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 other ROWs
- Amendments to existing ROWs or leases from California and Arizona State Lands for the crossing of the Colorado River on the Arch Bridge

- Consent to common use agreements or other appropriate notification requirements with utility companies for remedial infrastructures on their lands or within their easements and ROWs
- Access agreement with BNSF for shared use of their maintenance access road in the uplands

Access agreements with private property owners for remedial structures on their lands, where such agreements do not otherwise exist

It should be noted that under the Settlement Agreement between PG&E and the FMIT, PG&E has access to the land owned by the FMIT to implement the selected final groundwater remedy. More specifically, the 2006 Easement Agreement between the FMIT and PG&E covers access as well as activities such as operation and maintenance of facilities. The FMIT's preference to limit such activity to the extent practicable and to have as little remedial infrastructure placed on its property as possible is recognized; this preference has been, and will continue to be, considered during the development of the design, consistent with the provisions of the Easement Agreement and the 2006 Settlement Agreement. For example, in the 60% design, PG&E relocated the freshwater injection well FW-1 south to outside of the FMIT property.

5.3.3 Other Anticipated Approvals, Permits, and Agreements

Implementation of the groundwater remedy also requires compliance with the substantive requirements of other ARARs and PA, CHPMP and EIR mitigation measures. Although no regulatory agency permits are required for activities conducted onsite, pursuant to CERCLA's Section 121(e)(1) permit exemption, PG&E is coordinating with the relevant jurisdictional agencies to meet the various substantive requirements. Section 6 of this 60% BOD presents a summary of actions either taken or being conducted by PG&E in compliance with ARARs and PA, CHPMP and EIR mitigation measures.

Based on discussions with the RWQCB and the SWRCB, it is anticipated that the substantive requirements of Waste Discharge Requirements (WDRs) will be required to be met for injection of fresh water for use in the remedy. PG&E plans to coordinate with the RWQCB regarding substantive requirements applicable to the use of the evaporation ponds at PG&E Topock Compressor Station for disposal of certain remedy-produced water streams (e.g., first flush well rehabilitation water, other minor wastewater streams [see Exhibit 3.4-5]) and potentially wastewater from freshwater pre-injection treatment system).

TABLE 5.1-1A
Framework for Institutional Control – Federally Owned Land
Groundwater Remedy Basis of Design Report - Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

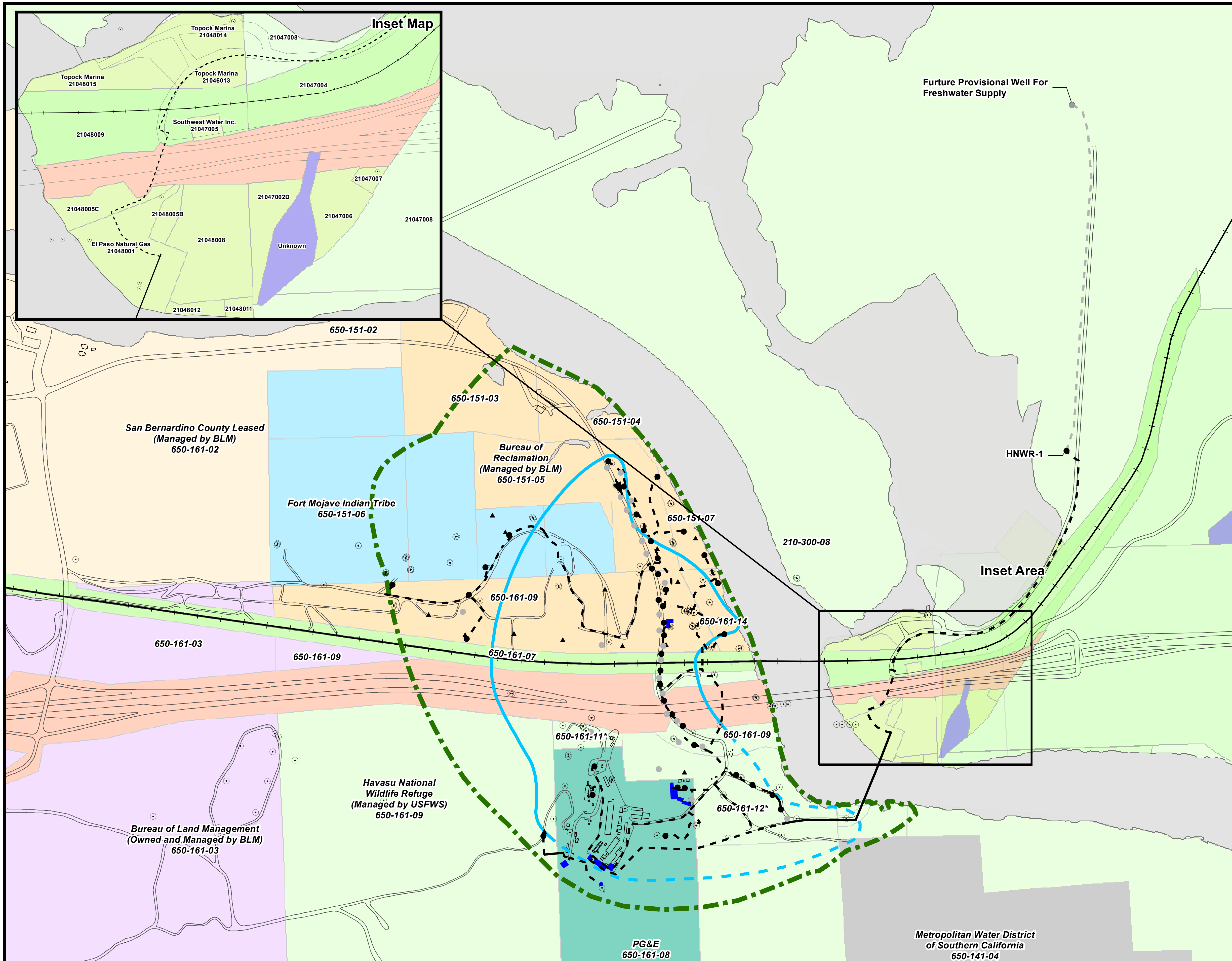
Area	Assessor Parcel No. (APN)	Property Owner	Parties with Other Interests (e.g., existing right of ways, easements, leases, etc.)	Potential Remedial and Investigative Activities	IC Category Category 1 Prohibit installation of new groundwater wells for purposes other than site investigation and remediation activities	IC Category 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	650-151-04	Bureau of Reclamation	Managed by BLM	Construct and O&M pipelines, wells, and/or access roads	X	X
	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
	650-151-07	Bureau of Reclamation	Managed by BLM	Construct and O&M 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
	650-161-09	Bureau of Land Management (managed by HNWR/USFWS)	Caltrans ROW	Construct and O&M In-Situ Remediation Zone (IRZ) along NTH, 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 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 ROW	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 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 5.1-1B
Framework for Institutional Control – Non-Federally Owned Land
Groundwater Remedy Basis of Design Report - Intermediate (60%) 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	IC Category: Category 1 – Prohibit installation of new groundwater wells for purposes other than site investigation and remediation activities	IC Category: 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 access roads	X	X
	650-161-07	Burlington Northern Santa Fe RR Co (CA side)		Construct and O&M pipelines, monitoring wells, and share use of railroad maintenance access road; soil investigation	X	X
	650-161-08	PG&E	Various utility easements	Construct and O&M remedy facilities, pipelines, wells, and access roads; soil investigation	X	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						X
	Colorado River	CA State Lands Commission		Crossing Colorado River on the Arched Bridge		X
	Colorado River	AZ State Lands Department		Crossing Colorado River on the Arched Bridge		X
	210-480-05C	Private Property Owner		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X
	210-480-01	Kinder Morgan		Construct and O&M freshwater pipeline, conduits (e.g., communication), wells and/or access roads		X

TABLE 5.1-1B
Framework for Institutional Control – Non-Federally Owned Land
Groundwater Remedy Basis of Design Report - Intermediate (60%) 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	IC Category: Category 1 Prohibit installation of new groundwater wells for purposes other than site investigation and remediation activities	IC Category: Category 2 Restrict future development and surface uses of the land to allow construction, operation, and maintenance of groundwater remedial structures
	TBD	TBD	ADOT (I-40)	Construct and O&M freshwater pipeline and conduits (e.g., communication)		X
	Mohave County Road 10 and Frontage Road adjacent to I-40	Mohave County		Construct and O&M freshwater pipeline, conduits (e.g., communication)		X
	BNSF Fee Land	BNSF Northern Santa Fe RR Co (AZ side)		Construct and O&M freshwater pipeline, conduits (e.g., communication)		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	Kinder Morgan and PG&E		Install freshwater pipeline and conduits (e.g., communication)		X



LEGEND

- Existing Monitoring Well
- Approximate Area for Category 1 Institutional Control

Property Owner

- BNSF Railroad
- Bureau of Land Management (owned and managed by BLM)
- Bureau of Reclamation (managed by BLM)
- Caltrans Leased From Underlying Federal Owner
- Fort Mojave Indian Tribe Owner in Fee, With PG&E Easement and Access for Remediation
- Havasu National Wildlife Refuge
- Metropolitan Water District of Southern California
- PG&E
- Privately Owned
- San Bernardino County Leased (managed by BLM)

Remedy Features

- Remediation Wells (Excludes Monitoring Wells)
- Future Provisional Wells
- Remedy Monitoring Well
- Aboveground Pipe
- Underground Pipe/Conduit
- Future Provisional/Contingent Water Pipe
- Proposed New Remedy Structure
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2011 sampling events. Dashed where based on limited data.

Note:
1. * = PG&E has a possessory interest on these parcels (650-161-11,650-161-12) for the operation of a compressor station and associated pipelines.
2. Area for which to apply Category 2 restrictions will be determined after the remedy facility infrastructure is settled and will be documented through land documents (including legal description, etc.). PG&E will work with the government agencies, property owners, and/or parties with other land use interests, where appropriate, on land documents.
3. PG&E is currently evaluating the need for and/or scope of an IC at and around the HNWR-1 well.

0 300 600 1,200 Feet

N

FIGURE 5.1-1
AREA FOR CATEGORY 1 INSTITUTIONAL CONTROLS

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: D:\Projects\Topock\MapFiles\2013\CMS\60%Report\GWUseRestrictions.mxd

SECTION 6

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, including the PA and the CHPMP, at the intermediate (60%) design stage.

6.1 Summary of Compliance with EIR Mitigation Measures

There are 154 subparts to the mitigation measures from the EIR that address twelve resource areas including aesthetic, biological resources, air quality, cultural resources, geology and soils, hazardous materials, hydrology and water quality, land use and planning, noise, transportation, utilities and service systems, and water supply. A summary of actions taken or to be taken in compliance with the EIR mitigation measures is presented in Table 6.1-1.

Communications and outreach are key elements in all phases of project implementation. The EIR MMRP (DTSC 2011c) 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 6.1-2.

6.2 Summary of Compliance with Identified ARARs[3]

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 6.2-1. In addition, a summary of actions taken or that will be taken to comply with applicable stipulations in the PA (BLM 2011) related to the groundwater remedy is presented in Table 6.2-2, and a summary of actions taken or that will be taken to comply with applicable requirements in the CHPMP (BLM 2012) is presented in Table 6.2-3.

[3] The public health goal (PHG) for hexavalent chromium is not an ARAR or "to be considered" (TBC) standard in the DOI ROD. In response to DOI's comment #211 on the 30% design, however, PG&E notes that: "On July 27, 2011, the Office of Environmental Health Hazard Assessment (OEHHA) established a public health goal (PHG) of 0.02 μg/L for hexavalent chromium. The OEHHA fact sheet describes the PHG as follows: "A PHG is not a regulatory standard. It is only one step in the process of developing an enforceable standard that is set by the California Department of Public Health (CDPH) for drinking water that public water systems must meet" (OEHHA 2011).The CDPH announced that the PHG "will contribute to CDPH's development of a primary drinking water standard (maximum contaminant level, MCL) that is specific for chromium-6 [hexavalent chromium]…. chromium-6 is currently regulated under the 50-micrograms per liter (μg/L) MCL for total chromium in California"(CDPH 2012).

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% 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 Mature Plants Survey Report (CH2M HILL 2012e) was completed on January 17, 2012, and is included in Appendix A4 of this BOD report. The report contains surveys results and associated maps, which have been used to guide the design. An overview of the report and the survey results were discussed with interested Tribes on January 26, 2012. Figure 2.4-8 presents the mature plant survey information for Key Views 5 and 11. PG&E biologist (Melanie Day) and CH2M HILL biologist (Marjorie Eisert) participated in a field review of planned remedial facilities with the design team on April 23-24, 2012. A field review was also conducted on June 20 by PG&E biologist (Virginia Strohl). The purpose of these field reviews along with in office reviews was to ensure the footprints of planned facilities including potential access routes are designed to avoid disturbance of sensitive habitats to the extent feasible.	The survey methodology tech memo was completed on October 31, 2011, and provided to interested Tribes on November 8, 2011. The Mature Plants Survey Report (CH2M HILL 2012e) was completed on January 17, 2012.
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 for Riparian Areas	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	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 for Riparian Areas	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	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.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of this BOD Report for the 60% design. The detailed specification for colors are included Appendix E of this report.	
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 for Riparian Areas	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)	Date Completed
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.	Figure 2.4-6 illustrates that the locations of the riverbank extraction wells and associated piping met the 20-feet setback requirement.	The mapping methodology technical memorandum and a map with the 20-feet setback from the OHWM were submitted on November 18, 2011.
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 Mature Plants Survey Report (CH2M HILL 2012e) was completed on January 17, 2012, and is included in Appendix A4 of this BOD report. The report contains surveys results and associated maps, which have been used to guide the design. An overview of the report and the survey results were discussed with interested Tribes on January 26, 2012. Figure 2.4-8 presents the mature plant survey information for Key Views 5 and 11. PG&E biologist (Melanie Day) and CH2M HILL biologist (Marjorie Eisert) participated in a field review of planned remedial facilities with the design team on April 23-24, 2012. A field review was also conducted on June 20 by PG&E biologist (Virginia Strohl). The purpose of these field reviews along with in office reviews was to ensure the footprints of planned facilities including potential access routes are designed to avoid disturbance of sensitive habitats to the extent feasible.	The survey methodology tech memo was completed on October 31, 2011, and provided to interested Tribes on November 8, 2011. The Mature Plants Survey Report was completed on January 17, 2012.
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 for Riparian Areas	A revegetation plan for the riparian vegetation along the river will be prepared and submitted with the final design.	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 for Riparian Areas	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	This requirement will be incorporated into the revegetation plan, and therefore, will be satisfied by implementation of AES-1b/2c.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)	Date Completed
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.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of this BOD Report for the 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.	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.	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	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan which will be submitted as part of the 90% design; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrent with the 90% design and the Corrective Measure Construction/ Remedial Action Work Plan. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	
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	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan which will be submitted as part of the 90% design; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrent with the 90% design and the Corrective Measure Construction/ Remedial Action Work Plan. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	

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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	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan which will be submitted as part of the 90% design; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrent with the 90% design and the Corrective Measure Construction/ Remedial Action Work Plan. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	
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	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan which will be submitted as part of the 90% design; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrent with the 90% design and the Corrective Measure Construction/ Remedial Action Work Plan. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	
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	This requirement will be incorporated into the forthcoming Corrective Measure Construction/ Remedial Action Work Plan which will be submitted as part of the 90% design; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrent with the 90% design and the Corrective Measure Construction/ Remedial Action Work Plan. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	
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.	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 Construction/Remedial Action Work Plan is planned for submittal in late 2013, concurrent with the 90% design.	

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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.	Figure 2.4-5 shows the overlaps between planned remedy infrastructure and the USACE jurisdictional waters/wetlands. As shown in Figure 2.4-5, complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells in washes (e.g., a wash in the Upland, Bat Cave Wash). On February 12, 2013, PG&E consulted with Mr. Gerardo Salas of USACE Los Angeles District in Los Angeles regarding the application of the CERCLA 121(e)(1) permit exemption to the Topock remediation project. PG&E will continue to coordinate with USACE on this matter, including on the substantive requirements of CWA Section 404.	

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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.	Revegetation Plan for Riparian Areas including USACE/CDFW Jurisdictional Areas	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).	Figure 2.4-5 shows the overlaps between remedy infrastructure and the CDFW jurisdictional waters/wetlands. As shown in Figure 2.4-5, complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells, and associated pipes and components in washes (e.g., a wash in the Upland, Bat Cave Wash). CDFG is now the California Department of Fish and Wildlife, and thus is referred to as CDFW in this report. On December 11, 2012, PG&E consulted with CDFW District Regional Manager and his staff at the Blythe, California office regarding the substantive requirements of the CDFW Section 1602 and the application of the CERCLA 121(e)(1) permit exemption to the Topock remediation project. On February 21, 2013, CDFW staff from the Blythe office conducted a field review of the project. On March 6, 2013, the CDFW issued a letter to PG&E confirming that CERCLA 121(e)(1) applies to response actions conducted onsite at Topock, specifically soil and groundwater investigation activities and remedial actions at the site (CDFW 2013). As a result, no Lake or Stream Bed Alteration Agreement is required by CDFW. However, PG&E must still comply with substantive elements CDFW would require in such an Agreement for the duration of the project. In this case, the substantive elements are the avoidance and minimization measures (AMMs) attached to the March 6, 2013 letter (this letter can be viewed or downloaded from the DTSC Topock website at www.dtsc-topock.com), and any additional measures PG&E’s biologist determines to be necessary.	On March 6, 2013, CDFW issued a letter confirming that CERCLA 121(e)(1) permit exemption applies to response actions conducted onsite as part of the Topock remediation project, and specified the substantive requirements in the form of AMMs that PG&E must comply with for the duration of the project.

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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.	The Yuma clapper rail/California black rail surveys consist of six focused surveys between March 14 and May 19, 2012.The southwestern willow flycatcher (SWFL) surveys were conducted May 21 through 25 and June 4 through 8; June 18 through 22; and June 26 through 30,2012. The 2012 SWFL survey report was submitted to BLM and USFWS on January 31, 2013 (CH2M HILL 2013c). The results of the Yuma clapper rail/ California black rail survey will be summarized in a forthcoming report. An Avoidance and Minimization Plan for special status birds is under preparation, in consultation with the USFWS.	

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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 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.	On September 25, 2012, the USFWS authorized two biologists, Melanie Day and Gabriel Valdes, to conduct activities described in this mitigation measure, pursuant to the PG&E Topock groundwater remediation project. Specifically, these two authorized biologists may survey, provide work area and vehicles inspection, and direct (pre)construction activities to avoid impacts on desert tortoise or their potential habitat, and to provide worker's awareness training for the groundwater remediation project. Gabriel Valdes identified the potential desert tortoise habitat shown in Figure 2.4-10. Through coordination with the biologists (Gabriel Valdes and Melanie Day), the footprints of remediation wells, monitoring wells, piping, electrical transformers, access routes and pathways have been designed to avoid direct and indirect effects on potential desert tortoise habitat. PG&E, USFWS, and DOI continue to coordinate on the PBA for the final groundwater remedy. The 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.	
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.	The IM-3 Decommissioning Work Plan will describe the general procedures for restoration of the land and habitats. The Avoidance and Minimization Plan and Habitat Restoration Plan associated with decommissioning activities will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore these Plans will be prepared in the future, prior to decommissioning (note that PG&E will prepare a separate Habitat Restoration Plan in compliance with the Consent Decree; this Plan will be developed in coordination with the FWS Havasu Wildlife Refuge Manager and submitted with the Construction/Remedial Action Work Plan).	

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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.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). No further action is required. The intermediate (60%) 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.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). No further action is required. The intermediate (60%) 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.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). As part of the preparation of the technical memorandum, an instream habitat survey was conducted on April 4, 2012 to determine the preferred locations for spawning and rearing of the razorback sucker and bonytail chub. Survey results were presented in a technical memorandum entitled *Instream Habitat Typing Survey, Topock Compressor Station, Colorado River* (CH2M HILL 2012f). The report was provided to DTSC on May 25, 2012, and is included in Appendix A6 of this BOD report.	The Instream Habitat Typing Survey Technical Memorandum (CH2M HILL 2012f) was completed on May 25, 2012.

TABLE 6.1-1
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Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Action (60% Design Report Compliance Status)	Date Completed
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.	In response to comments on the 30% design submittals, PG&E prepared a technical memorandum to present additional details on three freshwater sources (groundwater from California, groundwater from Arizona, and Colorado River water). No further action is required. The intermediate (60%) 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).	Corrective Measure Implementation Work Plan (CMI) and Cultural Impact Mitigation Program (CIMP)	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.	Work on the Cultural Impact Mitigation Program (CIMP) commenced in May 2011, and the CIMP will be submitted with the 90% design (due late 2013).	The Revised Groundwater CMI/RD Work Plan (CH2M HILL 2011f) 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.	PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed, in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources.	

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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).	PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan, for submittal with the final design (target 2013). Communication logs with Tribes are submitted to DTSC quarterly, as part of the quarterly EIR mitigation measures compliance reports (see Table 6.1-2)	
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).	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; DTSC 2011c) 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.	On January 27, 2012, PG&E nominated Applied Earthworks, Inc. (AE) as the qualified cultural resource consultant for the groundwater remedy project and requested DTSC's consideration and approval of AE. On March 2, 2012, DTSC accepted PG&E's nomination and approved AE as the qualified cultural resource consultant for the groundwater remedy project. In 2012, the Annual Cultural Monitoring event was conducted November 5 through 7, 2012.	DTSC accepted PG&E's nomination and approved AE as the qualified cultural resource consultant for the groundwater remedy project on March 2, 2012.
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).	Work on the site security plan has begun. The site security plan is planned for submittal as part of the 90% design (target late 2013).	

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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.	PG&E is currently in the process of implementing this mitigation measure and has discussed with Interested Tribes at the monthly meetings on November 22, 2011, December 22, 2011, January 26, 2012, and March 22, 2012. To date, tribal inputs have been received for this measure. PG&E is coordinating with BLM and San Bernardino County on constructing an information kiosk within Park Moabi and posting signage to communicate restrictions to off-road vehicle usage in part of the project area and inform visitors of the work being done at the site.	
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.	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.	
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.	In March 2012, PG&E expanded the TRC scope to include review of documents related to the soil investigation at locations outside the Compressor Station. As directed by this measure, an annual activity report was submitted to DTSC on June 29, 2012. In addition, TRC activities are summarized and included in the quarterly EIR mitigation measures compliance reports.	The TRC was convened on July 1, 2011. An annual activity report was submitted on June 29, 2012.

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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.	A continuation of the Fall 2011 floristic survey was conducted from 3/12/12 to 3/20/12. Additional floristic survey was conducted from 3/12 through 3/14, 2013. On March 29, 2013 PG&E submitted two reports related to plant surveys: a) The first report titled “Topock Groundwater Remediation Project Floristic Survey Report” summarizes the floristic survey results from 2011 and 2012; this report is included in Appendix A5 of this BOD report. Results from 2013 are planned to be included in the next design deliverable associated with the freshwater source details. b) The second report titled “Topock Groundwater Remediation Project Ethnobotany Survey Report” summarizes the survey results for ethnobotanically sensitive plants from 2011 and 2012; this report is included in Appendix A7 of this BOD report. Results from 2013 are planned to be included in the next design deliverable associated with the freshwater source details. In addition, PG&E is working with interested Tribes on the Plant transplantation/monitoring plan required under this measure, as part of the CIMP.	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.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this BOD Report for the intermediate (60%) design.	
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.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of this BOD Report for the intermediate (60%) design. PG&E discussed this measure with interested Tribes in the monthly meetings on April 26, 2012, July 27, 2012, October 25, 2012, and November 9, 2012.	

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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.	Work on the CIMP is ongoing. PG&E has been working collaboratively with interested Tribes on various sub-measures under the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Outreach efforts have occurred and are ongoing. Protocols for continued communication are being developed as part of the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012 and December 4, 2012. As required by DTSC, a log of communications with interested Tribes has been maintained and included in the quarterly EIR mitigation measure compliance reports since January 2012. The last quarterly report was submitted to DTSC on January 31, 2013. Table 6.1-2 of this report contains a log of Tribal communications since the start of Q1 2013 through March 19, 2013.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012 and December 4, 2012, A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012 August 23, 2012, September 19, 2012, September 27, 2012, and January 15, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	

TABLE 6.1-1
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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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meetings on February 23, 2012, March 22, 2012, April 26, 2012, May 24, 2012, and January 15, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with Interested Tribes at the monthly meeting on January 15, 2013. PG&E has begun work on a habitat restoration plan and will collaborate with Tribes on its effort. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	

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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.	Discussions regarding protocols for the repatriation of soils have been and are ongoing since early 2011. Agencies and Tribal members reviewed and provided inputs on the draft *Management Protocol for Handling and Disposition of Displaced Site Material*, as well as participated in conference calls (January 9, 2012, April 10, 2012, June 15, 2012, and August 2012) to discuss comments. A revised protocol along with responses to comments (RTCs) was sent to Agencies and Tribes for review on August 28, 2012. FMIT sent a comment letter on the revised protocol and RTCs on September 7, 2012. DTSC responded to FMIT on September 18, 2012. Tribes and Agencies met on October 16, 2012 to further discuss RTC process. Subsequent to this meeting, DTSC issued directives for implementation of an updated RTC process. On January 14, 2013, the revised protocol was reissued along with updated RTCs (that reflected the updated RTC process) as part of the Final Soil RCRA Facility Investigation/Remedial Investigation Work Plan (CH2M HILL 2013b). The revised protocol is also included in Appendix B of the Soil Management Plan (Volume 4 of the Draft O&M Manual), and will again be included in the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval. This measure was discussed with interested Tribes at the monthly meeting on February 19, 2013.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2011, October 25, 2012, November 9, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	

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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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with Interested Tribes at the monthly meeting on September 27, 2012, October 10, 2012, November 9, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012, September 27, 2012, October 10, 2012, November 9, 2012, and February 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012, December 18, 2012, and February 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012, December 18, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	

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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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, August 23, 2012, September 19, 2012, and March 19, 2013. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012, September 27, 2012, October 10, 2012, and November 9, 2012. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	
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.	Work on the CIMP is ongoing. The CIMP outline was discussed with interested Tribes on 3/23/12. PG&E has and will continue to discuss with and solicit inputs from interested Tribes on various mitigation measures under the CIMP. This measure was discussed with interested Tribes at the monthly meeting on June 28, 2012 and December 4, 2012. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	

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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 ground-truth 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.	The design has been and is carried out in a manner that gives: (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. 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 intermediate (60%) design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The freshwater supply for the remedy will be the existing HNWR-1 well. • The freshwater supply storage will be the existing water storage tanks at the Compressor Station. • The remedy-produced water treatment plant and the freshwater pre-injection treatment system will be located entirely within the footprint of Compressor Station. • The central maintenance facility for the remedy will be located entirely on PG&E property, at the Transwestern Bench. By centralizing maintenance functions into one location, this reduces the footprint of remedy structure outside of PG&E property.	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.	The design has been and is carried out in a manner that avoids any direct impacts on Loci A, B, and C of the Topock Maze. PG&E Remediation Resources Specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities do not create direct physical impact on the Topock Maze, as it is manifested archaeologically. There are no remedy facilities inside 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.	As of the submittal of the 60% design, PG&E has funded a second project manager position for the Cocopah Indian Tribe. The first funded position was for the Chemuevi Indian Tribe.	
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.	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.	

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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.	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 Remediation Resources Specialist, and Interested Tribal members who attend the meetings. In compliance with this measure, PG&E and Tribes are collaborating on a training/education manual to educate workers. This measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, August 23, 2012 and September 19, 2012.	
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.	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. PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	
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.	PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.	

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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.	This measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, Geoarchaeological investigations were conducted on June 5-8, 2012 by Dr. Roland Brady of Geological Services and Pat Maloney of Applied Earthworks, both qualified cultural resources consultants. Participants from Interested Tribes include Wirlene Fischer-Holt (CRIT), Dr. Leo Leonhart (Consultant to the FMIT), and Dr. Margaret Eggers (TRC). A geoarchaeological investigation report is forthcoming.	
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.	This measure was discussed with Interested Tribes at the monthly meeting on October 25, 2012 and November 9, 2012.	

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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.	Consistent with CUL-1a-3, PG&E has retained AE, a consulting firm with qualified cultural resources consultants, to observe ground-disturbing activities and provide training as required. This measure was discussed with Interested Tribes at the monthly meeting on October 25, 2012 and November 9, 2012.	
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.	The requirements of this mitigation measure will be met by implementation of CUL-1b/c-2 and CUL-1b/c-3. This measure was discussed with interested Tribes at the monthly meeting on May 24, 2012,	
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.	This measure was discussed with interested Tribes at the monthly meeting on January 26, 2012,A paleontological investigation was conducted on July 25, 2012. The outcome of the survey was provided in a report completed in December 2012; this report is currently being revised to incorporate comments received.	

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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.	PG&E has retained AE and prior to construction AE will prepare training material for the identification of human remains, provide training and oversee ground-disturbing activities as required by this mitigation measure. 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.	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.	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.	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.	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.	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.	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.	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.	A grading and erosion control plan will be prepared and included in the Construction/ Remedial Action Work Plan, which will be submitted as part of the final design for DTSC review and approval.	

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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 BMP Plan prior to construction activities, that will be included in the Construction/Remedial Action Work Plan.	PG&E will prepare a BMP Plan prior to construction activities that will be included in the Construction/Remedial Action Work Plan, to be submitted concurrent with the 90% design.	
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.	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.	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.	This measure will be implemented as directed. The BMPs will be identified in the Construction/ Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the 90% design, as well as the Closure Plan for Decommissioning of Remedy Facilities and Restoration, which will be submitted prior to decommissioning.	

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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.	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.	This measure will be implemented as directed. The forthcoming Habitat Restoration Plan, to be 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.	This measure will be implemented as directed. Storage and handling of hazardous materials will be discussed in the Hazardous Materials Business Plan (HMBP), the outline for which is presented in Appendix F of the O&M Plan, with the complete HMBP to be submitted as part of the 90% design.	
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.	This measure will be implemented as directed. Secondary containment for hazardous materials is described in the design criteria and drawings which are presented in Appendices C and D, respectively, of this BOD Report for the 60% design. Storage and handling of hazardous materials will be discussed in the HMBP, the outline for which is presented in Appendix F of the O&M Plan (Volume 1), with the complete HMBP to be submitted as part of the 90% design.	
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.	This measure will be implemented as directed. Storage and handling of hazardous materials and spill response procedures will be discussed in the HMBP, the outline for which is presented in Appendix F of the O&M Plan (Volume 1), with the complete HMBP to be submitted as part of the 90% design.	

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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.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction will be described in the BMP Plan, which will be submitted at the 90% design stage as part of Corrective Measure Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration.	
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 for implementation at fueling areas on-site during construction.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction will be described in the BMP Plan, which will be submitted at the 90% design stage as part of Corrective Measure Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration.	
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.	This measure will be implemented as directed. Fueling areas and maintenance areas will be supplied with proper secondary containment and spill response equipment. BMPs/SOPs for fueling during construction will be described in the BMP Plan, which will be submitted at the 90% design stage as part of Corrective Measure Construction/Remedial Action Work Plan and Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration.	

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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.	This mitigation measure will be implemented as directed. A health and safety plan will be developed for O&M activities and will be submitted at the 90% design stage. Similarly, a health and safety plan will be developed for construction activities and will be submitted with the Construction/Remedial Action Work Plan at the 90% design stage. 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.	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 speeds will be limited 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.	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.	

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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.	This measure will be implemented as directed. Project-specific Health and Safety Plans for construction and O&M activities will be prepared and submitted to DTSC at the 90% design stage. A Soil Management Plan (SMP) is included in Volume 4 of the O&M Manual, which is Appendix L to this BOD report. The SMP includes procedures and protocols for the management and disposal of potentially contaminated soil displaced during drilling, construction, O&M of the groundwater remedy, and the decommissioning and removal of the IM-3 system.	
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.	This measure will be implemented as directed. Project-specific Health and Safety Plans for construction and O&M activities will be prepared and submitted to DTSC at the 90% design stage.	
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.	This measure will be implemented as directed. Project-specific Health and Safety Plans for construction and O&M activities will be prepared and submitted to DTSC at the 90% design stage, 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.	This measure will be implemented as directed. A Soil Management Plan is included in Volume 4 of the O&M Manual, which is Appendix L to this BOD report. The Plan includes 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.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
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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 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	BMP Plan	This measure will be implemented as directed. PG&E will prepare a BMP Plan prior to construction activities which will be included in the Construction/Remedial Action Work Plan.	This measure will be implemented as directed. PG&E will prepare a BMP Plan prior to construction activities (at the 90% design stage) which will be included in the Construction/Remedial Action Work Plan. On December 27, 2011, the Superior Court issued a judgment in response to litigation, and the State Water Board will be amending Order 2009-0009-DWQ (as modified by Order No. 2010-00014-DWQ)in accordance with the related peremptory writ of mandate. As a result, the Numeric Effluent Limits (NELs) are no longer in effect. In addition, further amendments to the permit are possible.	

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		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.				
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.	This measure will be implemented as directed. The Contingency Plan (Volume 3) of the O&M Manual, which is included in the 60% design, includes BMPs to avoid or reduce impacts from the operations and maintenance phases. The Sampling and Monitoring Plan (Volume 2) of the O&M Manual includes a monitoring program in compliance with applicable water quality standards, and identified ARARs. The O&M SWPPP (Appendix E of O&M Plan) will include a storm water monitoring program in compliance with the General Permit. The outline for the O&M SWPPP is included in the Draft O&M Manual at the 60% design stage; the complete SWPPP will be provided at the 90% design stage.	

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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	This measure will be implemented as directed. The O&M SWPPP outline is included as Appendix E of the O&M Plan. The complete SWPPP will be submitted at the 90% design stage. The SWPPP will be developed in compliance with the Industrial Storm Water General Permit Order 97-03-DWQ (General Industrial Permit), or the relevant applicable requirements.	

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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.	This measure will be implemented as directed. The O&M SWPPP and BMP Plan, which will be submitted at the 90% design stage, will include a monitoring and reporting program to assess the effectiveness of BMPs and to modify BMPs and revise the SWPPP, if necessary. On December 27, 2011, the Superior Court issued a judgment in response to litigation, and the State Water Board will be amending Order 2009-0009-DWQ (as modified by Order No. 2010-00014-DWQ)in accordance with the related peremptory writ of mandate. As a result, the Numeric Effluent Limits (NELs) are no longer in effect. In addition, further amendments to the permit are possible.	
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.	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.	This measure will be met through actions to be taken under HYDRO-1.	

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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.	The EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Based on the EIR discussion, PG&E assumes that vibration-sensitive land uses are residential and mobile home parks. Based on this definition, none of the proposed remediation or new monitoring wells presented in the 60% design is 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.	
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.	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.	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.	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.	

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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.	This measure will be implemented as directed. PG&E interprets the acceptable non-transportation noise level standards cited in the mitigation measure to be San Bernardino County Development Code 83.01.080; specifically Table 83-2 specifies noise standards for stationary noise sources for residential land use to be 55 A-weighted decibels (dBA) from 7 am-10 pm and 45 dBA from 10 pm-7 am, other Commercial land use to be 60 (dBA) all day, and Industrial land use to be 70 (dBA) all day. In addition, Section (g) of the County Code 83.01.080 lists the noise sources that are exempted from the regulations which include a) motor vehicles not under the control of the commercial or industrial use, b) emergency equipment/vehicles/devices, and c) temporary construction, maintenance, repair, or demolition activities between 7 am and 7 pm, except Sundays and Federal holidays. The use of berms, stockpiles, dumpsters, and/or bins to shield the nearest noise-sensitive receptor adjacent to construction activities will be implemented as needed. 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.	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).	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.	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.	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.	

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Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?	Action (30% Design Report Compliance Status)	Action (60% 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.	A plan for conducting a long-term constant-rate extraction test at HNWR-1 well is included in the *Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL 2012g). Upon receipt of agencies' approval, PG&E will implement the plan. Data collected will be used to evaluate compliance with this measure.	

TABLE 6.1-2
Log of Outreach/Communication with Tribes
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

ID	Date/Time	Party Initiated Contact	Party Received Contact	Summary of Outreach/Communications
January 1, 2013 through March 19, 2013				
1	March 13, 2013	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone, Leo Leonhart, Linda Otero, Luke Johnson, Russell Ray, Shan Lewis, Timothy Williams, Courtney Coyle & Christine Medley), Cocopah (Jill McCormick, Sherry Cordova, Kendra Morton), Hualapai (Bennett Jackson, Philbert Watahomigie, Loretta Jackson, Sherry Counts, Rudy Clark & Dawn Hubbs); Chemehuevi (Ron Escobar, Tito Smith, Thomas Pradetto & Steven Escobar); CRIT (Wayne Patch, Wilene Fisher-Holt, Doug Bonamici, Howard Magill, Valerie Welsh-Tahbo, Amelia Flores, Johnson Fisher, Josephina Rivera, Rebecca Loudbear and Rosanna Mitchell); (Fort Yuma-Quechan) Bill Hirt, Chase Choate, John Bathke; (Cahuilla) Roland Ferrer; (TRC) Margaret Eggers	Sent via email an invitation to the Project Initiation Meeting for Topock MW-38 Well Repair and Old Well/Pipe Reconnaissance. This will take place on April 1, 2013 at 1:00 PM at the PG&E Topock Compressor Station Conference Room. An agenda was sent along with the email.
2	March 8, 2013	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone, Leo Leonhart), Cocopah (Jill McCormick), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Thomas Pradetto & Steven Escobar); CRIT (Wilene Fisher-Holt, Doug Bonamici, Howard Magill and Rosanna Mitchell), Margaret Eggers (TRC)	Sent via email the agenda for the March TMU call/meeting (March 19, 2013). This meeting will be at the CH2M HILL office in Henderson at 2:30PM. Call-in and Webex information was sent for those who could not attend in person. Further texts on the four MMRP mitigation measures (CUL-1a-8, CUL-1a-8i, CUL-1a-8j, CUL-1a-8m, CUL-1a-8n) were included for discussion.
3	February 25, 2013	PG&E (Curt Russell)	FMIT (Nora McDowell-Antone, Linda Otero, Courtney Ann Coyle, Leo Leonhart), Cocopah (Jill McCormick), Fort Yuma-Quechan (John Bathke), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Thomas Pradetto, Tito, and Steven Escobar); CRIT (Wilene Fisher-Holt & Doug Bonamici)	Sent email to inform schedule of field activities for March 2013. The schedule lists activities outside of ongoing IM-3 operation and maintenance such as groundwater, performance, and compliance monitoring, along with IM maintenance activities, field activities, and in-situ pilot tests.
4	February 19, 2013	February 19 Topock Monthly Update (TMU) Meeting	N/A	Meeting participants included FMIT, Hualapai, Chemehuevi, CRIT, TRC, California Department of Toxic Substances Control (DTSC), PG&E, ARCADIS, and CH2M HILL
5	February 11, 2013	PG&E (Curt Russell)	FMIT (Nora McDowell-Antone, Linda Otero, Courtney Ann Coyle), Cocopah (Jill McCormick), Hualapai (Loretta Jackson & Dawn Hubbs)	An email of responses to the questions that FMIT Nora McDowell-Antone had on the Revised Alternative Freshwater Source Implementation Plan. There were six total comments on the Tech Memo in which PG&E summarized responses for each individual question.

TABLE 6.1-2
Log of Outreach/Communication with Tribes
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PG&E Topock Compressor Station, Needles, California

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6	February 8, 2013	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone, Leo Leonhart), Cocopah (Jill McCormick), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Thomas Pradetto & Steven Escobar);), Fort Yuma-Quechan (John Bathke), CRIT (Wilene Fisher-Holt, Doug Bonamici, Howard Magill and Rosanna Mitchell), Margaret Eggers (TRC)	Sent via email the revised agenda for the February TMU call/meeting (February 19, 2013). This meeting will be at the CH2M Hill office in Henderson at 2:30PM. Call-in and Webex information was sent for those who could not attend in person. The revised agenda substituted CUL-1a-8l for CUL-1a-8i since this MMRP mitigation measure was ready for review. Further texts on this measure along with a few others (CUL-1a-8, CUL-1a-8d, CUL-1a-8h, CUL-1a-8k, & CUL-1a-8l) were included for discussion.
7	February 7, 2013	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone, Linda Otero, Courtney Ann Coyle & Leo Leonhart), Cocopah (Jill McCormick), Fort Yuma-Quechan (John Bathke), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Tito, Thomas Pradetto & Steven Escobar); CRIT (Wilene Fisher-Holt, Doug Bonamici	Notes from the monthly update call in January were attached. Participants from the January 15, 2013 meeting were FMIT, Hualapai, TRC, DTSC, PG&E, ARCADIS, and CH2M HILL. Also, the agenda for the February TMU call (February 19, 2013). Further information on the mitigation measures (CUL-1a-8; CUL-1a-8d, CUL-1a-8h, CUL-1a-8i, & CUL-1a-8k) were included for discussion.
8	January 27, 2013	PG&E (Curt Russell)	FMIT (Nora McDowell-Antone, Linda Otero, Courtney Ann Coyle, Leo Leonhart), Cocopah (Jill McCormick), Fort Yuma-Quechan (John Bathke), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Thomas Pradetto, Tito, and Steven Escobar); CRIT (Wilene Fisher-Holt & Doug Bonamici)	Sent email to inform schedule of field activities for February 2013. The schedule lists activities outside of ongoing IM-3 operation and maintenance such as groundwater, performance, and compliance monitoring, along with IM maintenance activities, field activities, and in-situ pilot tests.
9	January 15, 2013	January 15 Topock Monthly Update (TMU) Meeting	N/A	Meeting participants included FMIT, Hualapai, Chemehuevi, CRIT, TRC, California Department of Toxic Substances Control (DTSC), PG&E, ARCADIS, and CH2M HILL
10	January 11, 2013	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone, Leo Leonhart), Cocopah (Jill McCormick), Fort Yuma-Quechan (John Bathke), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Thomas Pradetto & Steven Escobar); CRIT (Wilene Fisher-Holt, Doug Bonamici, Howard Magill and Rosanna Mitchell), Margaret Eggers (TRC)	Sent an attached copy of the Paleontological Resources Management Plan: mitigation measure CUL-3, December 2012.

TABLE 6.1-2
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ID	Date/Time	Party Initiated Contact	Party Received Contact	Summary of Outreach/Communications
11	January 7, 2013	PG&E (Glenn Caruso)	FMIT (Nora McDowell-Antone, Leo Leonhart), Cocopah (Jill McCormick & Kendra Morton), Hualapai (Loretta Jackson & Dawn Hubbs); Fort Yuma-Quechan (John Bathke); Chemehuevi (Ron Escobar, Thomas Pradetto & Steven Escobar); CRIT (Wilene Fisher-Holt, Doug Bonamici, Howard Magill)	Sent via email the agenda for the January TMU call/meeting (January 15, 2013). This meeting will be at the CH2M HILL office in Henderson at 12:00 PM. Call-in and Webex information was sent for those who could not attend in person. Further texts on the two mitigation measures (CUL-1a-8, CUL-1a-e) were sent. In addition, the CIMP v. CHPMP Comparison for CUL-1a-8(a), CUL-1a-8(c), CUL-1a-8(d), and CUL-1a-8(e) and the Mitigation Measures Status and Tracking form were included for discussion.
12	January 1, 2013	PG&E (Curt Russell)	FMIT (Nora McDowell-Antone, Linda Otero, Courtney Ann Coyle, Leo Leonhart), Cocopah (Jill McCormick), Fort Yuma-Quechan (John Bathke), Hualapai (Loretta Jackson & Dawn Hubbs); Chemehuevi (Ron Escobar, Thomas Pradetto, Tito, and Steven Escobar); CRIT (Wilene Fisher-Holt & Doug Bonamici),	Sent email to inform schedule of field activities for January 2013. The schedule lists activities outside of ongoing IM-3 operation and maintenance such as groundwater, performance, and compliance monitoring, along with IM maintenance activities, field activities, and in-situ pilot tests.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% 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.	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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
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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)	Action (60% Design Report Compliance Status)
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.	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. Concentrations of Cr(VI) and in-situ by-products (e.g., arsenic, manganese) may fluctuate within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 μg/L, which is typical of water quality in the vicinity of Topock, Arizona, and will be removed to below MCL prior to injection. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation. 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.	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 prevent any and all discharges to the Colorado River from the groundwater contamination. The remedy is designed to prevent migration of contaminants to the Colorado River that would result in an exceedance of applicable water quality standards.

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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.	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. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**,** and will be removed to below MCL prior to injection**.** Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation. 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.	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. Concentrations of in-situ by-products (arsenic, manganese [secondary MCL of 50 µg/L]) may fluctuate within the treatment area during remedy implementation 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. Additionally, there are currently no municipal or private wells in the chromium plume area, to PG&E's knowledge.

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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.	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.	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.
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.	The intermediate (60%) design includes facilities in the jurisdictional waters of the US (see Figure 2.4-5).PG&E will work with the USACE to ensure compliance with the substantive requirements of Section 404 per CERCLA Section 121(e)(1). A wetlands delineation was completed in March 2012 and to be revised in April 2013, results will be summarized in a forthcoming report for DTSC review.
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.	No further action required. The remedy as presented in the 60% design does not result in point source discharges to waters of the United States that will require an NPDES permit.

TABLE 6.2-1
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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 a BMP Plan prior to construction activities, that will be included in the Construction/Remedial Action Work Plan.	PG&E will prepare a BMP Plan to address construction activities which will be included in the Construction/Remedial Action Work Plan and the IM-3 Decommissioning Work Plan, that will be submitted as part of the 90% design. In addition, PG&E will prepare an industrial or O&M SWPPP that will include a storm water monitoring program in compliance with the General Permit. The outline for the O&M SWPPP is included in Appendix E of the O&M Plan (Volume 1) at the 60% design stage; the complete industrial SWPPP will be provided at the 90% design stage.
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.	No further action required. The remedy, as presented in the 60% 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.	No further action required. The remedy, as presented in the 60% design does not include activities subject to NESHAPs.

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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)	Action (60% Design Report Compliance Status)
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* (CHPMP) 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.	The remedy, as presented in the intermediate (60%) design, does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan (BLM 2011b) was completed for Tribal access to lands under federal management within the Topock site for traditional religious, cultural, or spiritual purposes during implementation of the Remedy. PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan, for submittal with the final design (target 2013). BLM also developed the CHPMP to avoid, minimize and mitigate potential affects to historic properties, including the Topock TCP during implementation of the Remedy. BLM issued the final CHPMP on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequent to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will continue to be developed throughout the design to address mitigation measures. The intermediate (60%) design was submitted on April 5, 2013. PG&E will prepare and submit 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.
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.	Preparation of the PBA for the final groundwater remedy and coordination with USFWS and DOI are ongoing. 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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
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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.	Avoidance and minimization measures will be included in the Construction/Remedial Action Work Plan, which will be submitted as part of the 90% design, to the extent necessary to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg. Regarding decommissioning activities, the Avoidance and Minimization Plan and Habitat Restoration Plan will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore these Plans will be prepared in the future, prior to decommissioning. The IM-3 Decommissioning Work Plan will describe the general procedures for restoration of the land and habitats.
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	The 60% design assumes that freshwater supply comes from the existing well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. If any new wells are constructed in Arizona they 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.	No further action is required. The 60% 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.	This remediation project is a CERCLA remedial action. The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. 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.

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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).	The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. 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).	The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. 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).
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).	The 60% design assumes that freshwater supply comes from the existing irrigation well (HNWR-1) on the Refuge in Arizona, and does not include any new monitoring wells in Arizona. If the Refuge irrigation well is not used in the final design, placement of new freshwater supply wells will be needed. 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.	No further action is required. The intermediate (60%) design does not involve treatment of groundwater in Arizona.

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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.	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 management is described in Section 6 of the O&M Manual, which is included in this Basis of Design Report for the 60% design as Appendix L. The Construction/Remedial Action Work Plan will be submitted as part of the 90% design. The Plan for Decommissioning of the IM-3 Facility will also be submitted as part of the 90% design. 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.	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.	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 management, including waste analysis, is described in Section 6 of the O&M Manual, which is included in this BOD Report for the 60% design as Appendix L. The Soil Management Plan is also included in the O&M Manual (Volume 4).

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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.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/ Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.
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..	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/ Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. 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.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/ Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. 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.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/ Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Hazardous waste generated onsite will meet the recordkeeping requirements of 22 CCR §66262.40, §66262.41.

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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.	The O&M Manual, which is included in this BOD Report for the 60% design as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.
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.	The O&M Manual, which is included in this BOD Report for the 60% design as Appendix L, includes a Sampling and Monitoring Plan in Volume 2 to ensure that the regulated unit achieves compliance with the water quality protection standard, and a Contingency Plan in Volume 3 to address circumstances that may adversely affect the operation of the remedy.
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.	PG&E will prepare a Decommissioning Plan for Remedy Facility and Site Restoration that will be submitted prior to decommissioning. Achievement of RAOs will be considered clean closure and that will remove any post-closure care obligations.
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.	Waste management is described in Section 6 of the O&M Manual, which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. Containers used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.171-§66262.179.

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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.	At the 60% design stage, there is no transfer, storage and/or treatment of hazardous waste in tank systems.
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.	A Soil Management Plan is included in Volume 4 of the O&M Manual as part of the 60% design. In conformance with EIR mitigation measures HAZ-2 and HAZ-2f, the Soil Management Plan describes 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 long term storage of soil requiring construction of a waste pile meeting Chapter 14, Article 12 requirements for soil exhibiting RCRA hazardous waste characteristics will occur. If necessary to facilitate characterization or staging for offsite transportation, RCRA and non-RCRA hazardous waste soil will be temporarily accumulated in a staging pile that meets the design standards specified in California Health and Safety Code Section 25123.3 for up to 90 days prior to transportation to a permitted offsite disposal facility.
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.	No further action is required. The 60% design does not include construction of a landfill.

TABLE 6.2-1
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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.	No further action is required. The 60% 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.
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.	Waste management is described in Section 6 of the O&M Plan (Volume 1), which is included in this BOD Report for the 60% design as Appendix L. Waste management will also be described in the Construction/Remedial Action Work Plan and the Plan for Decommissioning of the IM-3 Facility that will be submitted as part of the 90% design. 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

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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.	The Contingency Plan (Volume 3) of the O&M Manual includes contingency planning for potential failure modes (including large releases), assess and mitigate risks, and prioritize risk management in order to prevent problems before they arise. The O&M Plan (Volume 1) of the O&M Manual covers routine O&M activities which includes testing and maintenance of communication and alarm. Project-specific HMBP and a Construction/Remedial Action Work Plan will address procedures for emergencies. The outline for the HMBP is presented in Appendix F of the O&M Plan, which is included in the 60% design. The complete HMBP and Construction/ Remedial Action Work Plan will be included in the 90% design.
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.	PG&E will prepare a project-specific HMBP; an O&M Manual (including a sampling and monitoring plan); and a Construction/Remedial Action Work Plan. The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. The outline for the HMBP is presented in Appendix F of the O&M Plan, which is included in the 60% design. The complete HMBP and Construction/Remedial Action Work Plan will be included in the 90% design. Although the 60% design does not include regulated units, these plans present a monitoring and response program that is functionally equivalent and will provide a level of protection to water quality equivalent to the cited requirement.
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.	The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. PG&E will prepare Progress Reports that presents the results and analysis of monitoring data.

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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	PG&E will prepare an O&M Manual and Progress Reports. The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. Although the 60% design does not include regulated units, the programs described in these documents provide a level of protection equivalent to a detection monitoring program that will provide reliable indication of a release.
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.	PG&E will prepare an O&M Plan and Progress Reports. Reports. The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in this BOD Report for the 60% design. Although the 60% design does not include regulated units, the programs described in these documents provide 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.	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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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.	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 covenants (institutional controls) are described in Section 5.0.	The final groundwater remedy includes restrictions on use of the groundwater for potable use. The land use covenants (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.	The remedy includes water and monitoring wells, and will adhere to the standards specified in this ARAR. Note that the general approach for well decommissioning is currently being developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes. Protocols for well decommissioning will be based on this general approach and be presented in Appendix B of the O&M Plan (Volume 1 of the O&M Manual), at the 90% design stage. Well construction and decommissioning standards will also be described 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.	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 of 32 µg/L (based on the regional background concentration) has been established at the conclusion of remedy implementation. Concentrations of Cr(VI) and in-situ byproducts (e.g., arsenic, manganese) may fluctuate above baseline levels within the treatment area during remedy implementation. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**,** will be pre-treated to below MCL prior to injection. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions, and will return to pre-remedy baseline levels after the end of active remediation. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. 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.

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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.	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. 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. The remedy is also designed and will be implemented to control the generation and migration of in-situ by-products (arsenic, manganese). The MCL for arsenic is 10 µg/L and the secondary MCL for manganese is 50 µg/L. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project’s Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L (which is typical of water quality in the vicinity of Topock, Arizona) will be pre-treated to below MCL prior to injection. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. The O&M Manual is Appendix L of this BOD Report for the 60% design. PG&E will prepare Progress Reports, and a Corrective Measure/Remedial Action Completion Report.

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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.	The O&M Manual is Appendix L of this BOD Report for the 60% design. PG&E will prepare 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. In addition, as part of the remedy fresh water from a well in Arizona will be injected west of the plume, within the project's Area of Potential Effects. The naturally occurring arsenic concentration in water from the well exceeds the MCL of 10 µg/L, which is typical of water quality in the vicinity of Topock, Arizona**,** will be pre-treated to below MCL prior to injection. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation will attenuate under site conditions, are localized, and will return to pre-remedy baseline levels after the end of active remediation. Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site. 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 92-49 that require restoration of background water quality.	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 92-49 that require restoration of background water quality.

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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)	Action (60% Design Report Compliance Status)
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[3] 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.	The 60% design was submitted to DOI on April 5, 2013, and includes proposed facilities on BLM land. Engineering drawings are included as Appendix D to this 60% design report and an O&M Manual is included as Appendix L. PG&E will submit a Construction/Remedial Action Work Plan as part of the 90% design, a Decommissioning Plan prior to decommissioning, and progress reports 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[3] 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. [2]	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.	The 60% design was submitted to DOI on April 5, 2013, and includes proposed facilities on HNWR land. Engineering drawings are included as Appendix D to this 60% design report and an O&M Manual is included as Appendix L. PG&E will submit a Construction/Remedial Action Work Plan as part of the 90% design, a Decommissioning Plan, prior to decommissioning, and progress reports for review by DOI. PG&E understands that DOI will coordinate its review of these submittals with USFWS.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)
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.	Figure 2.4-5 of this BOD Report for the 60% design shows the overlaps between remedy infrastructure and the USACE and CDFW jurisdictional waters/wetlands. As shown in Figure 2.4-5, PG&E determined in the 60% Design that complete avoidance of washes is not feasible due to the need to install remediation and monitoring wells, and associated pipes and components in washes (e.g., a wash in the Upland, Bat Cave Wash). For activities to be conducted in CDFW jurisdictional washes, PG&E will comply with the avoidance and minimization measures specified in the CDFW letter dated March 6, 2013 (CDFW 2013), and any additional measures PG&E's biologist determines to be necessary. PG&E will work with USACE and USFWS to determine and comply with the substantive requirements, per CERCLA 121(e), of Section 404 and the Fish and Wildlife Coordination Act, respectively.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)
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.	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, was issued on January 20, 2012. The CHPMP can be modified and updated, as needed, to address new information and ongoing activities related to the project. Therefore, subsequent to the issuance of the CHPMP, BLM continues to hold periodic working meetings on the CHPMP. It should be noted that treatment measures are included in the CHPMP and a treatment plan will continue to be developed throughout the design to address mitigation measures. The Tribal Access Plan for lands under federal management was completed on 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. BLM published the first Annual Report on November 25, 2011, and the second Annual Report on January 29, 2013. The PA requires that such reports will be prepared and submitted by December 1 each year for the first five years after execution of the PA and every two years thereafter. Documents led by PG&E include design submittals; a Construction/Remedial Action Work Plan; a Plan for decommissioning, removal, and restoration of the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The intermediate (60%) design submittal was submitted on April 5, 2013. The other documents will be prepared and submitted.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)
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.	Requirements in the PA and the 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 the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration. The intermediate (60%) design submittal was submitted on April 5, 2013. The other documents will be prepared and submitted.
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.	Requirements in the PA and the CHPMP will be adhered to.. PG&E will submit a Construction/Remedial Action Work Plan as part of the 90% design. The 60% design was submitted on April 5, 2013.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)
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.	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.	Requirements of the PA and the 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.	BLM led the preparation of the Tribal Access Plan for lands under federal management, and the Plan was completed on November 26, 2011. Note that the EIR-required Access Plan is under preparation

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)
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.	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 of this BOD Report for the 60% design. 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, and Panel 5675 of 6700 for Mohave County, Arizona and Unincorporated Areas, Revised November 18, 2009 (Map Number 04015C5675G). The base flood elevation shown on the current FIRM is 464 at River Mile (RM) 234 of the Colorado River. A review of the Mohave County Flood Insurance Study (FIS) shows that this elevation is specific to the California side of the River only, and is different from information found in the newer FIS for Mohave County, AZ. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. This design uses the more conservative elevation of 464 feet as the base flood elevation for the project on the California side of the Colorado River. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88. The effective FIS for Mohave County lists a regulatory base flood elevation of 465.3 feet NAVD. This is used as the base flood elevation for the project on the Arizona side of the Colorado River. The vertical datum for all flood elevations shown on the Mohave County FIRM is NAVD88. In this 60% design, certain infrastructure (piping) cannot be located outside of 100-year floodplain as defined by the above baseline flood elevation. PG&E will work with San Bernardino County and Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.
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.	Requirements from the PA and the 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 as part of the 90% design.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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)	Action (60% Design Report Compliance Status)
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.	Requirements from the PA and the CHPMP will be adhered to during implementation of the remedy.
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.	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 of the BOD report for the 60% design. The 100-year floodplain is defined in the 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 RM 234 of the Colorado River. The effective FIS for San Bernardino County lists a regulatory base flood elevation of 463.90 feet. The vertical datum for all flood elevations shown on the San Bernardino County FIRM is NAVD88.This design uses the more conservative elevation of 464 feet as the base flood elevation. In this 60% design, certain infrastructure (piping) cannot be located outside of 100-year floodplain as defined by the above baseline flood elevation. PG&E will work with San Bernardino County and Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.

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.
[3] The “action” notation in Location-specific ARARs #5 and 7 refers to the DOI Record of Decision (DOI 2010), surnamed by the Bureaus (BLM, BOR, USFWS) and Bureau of Indian Affairs.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	60% Design Report Compliance Status
1	Stipulation I(A)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to select and implement, or cause to be implemented, an alternative or combination of alternatives to remediate the groundwater and soil contamination in a manner that fulfills the requirements of CERCLA and the CERCLA Records of Decision (RODs) and protects the Colorado River, human populations, and the natural environment to the maximum extent practicable.	Implementation of Selected Groundwater Remedy	PG&E is implementing the groundwater remedy selected by DOI and DTSC.
2	Stipulation I(B)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to Subject to I(A) above, carry out, and require others under their jurisdiction to carry out, all investigative, testing and remediation activities, including all supporting operations and maintenance activities, in ways that avoid, minimize, or mitigate adverse effects to cultural and historic properties within the APE, to the maximum extent practicable.	Implementation of Selected Groundwater Remedy	PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with the ongoing in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.
3	Stipulation I(C)	The BLM, USFWS, USBR and PG&E shall consult with the Tribes that attach cultural significance to the TCP within the APE to develop a plan to ensure Tribal access to areas within the APE for religious, cultural, or spiritual purposes. Access shall be consistent with applicable laws, regulations and agreements governing property within the APE and may not impede the Topock Remediation Project, may not create health and safety concerns, and shall exclude the Topock Compressor Station and related facilities.	Development of Access Plan (Tribal Access)	The Tribal Access Plan for lands under federal management was completed on November 26, 2011. PG&E has initiated work on an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan, for submittal with the final design (target 2013).
4	Stipulation I(D)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to ensure that PG&E shall to the extent practicable restore the areas affected by the Topock Remediation Project within the APE, including, but not limited to, the site of the existing treatment plant and related facilities but excluding the Topock Compressor Station and related facilities, to the conditions existing prior to the construction of the PG&E investigation and remediation related appurtenances and facilities.	Planning for Restoration	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP, which will be submitted with the 90% Design.
4	Stipulation I(E)	The Federal Agencies, in consultation with the Tribes, SHPOs, ACHP, PG&E, and other interested parties, agree to consult with other Signatories, Tribes and Invited Signatories, following the guidelines in Appendix B of this PA, regarding actions proposed in this Undertaking, including establishment of any rights of way, time critical or emergency actions.	Groundwater Remedy Design and Implementation	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.
5	Stipulation II(B)	At each phase (workplan or design document) of implementation of the Undertaking, an evaluation will occur to determine if the APE should be amended. This evaluation will coincide with the development of the workplan or design document for the specific phase of the Undertaking. Where alternatives under consideration consist of corridors or large land areas, or where access to properties is restricted, the agency official may use a phased process to conduct identification and evaluation efforts (36 CFR §800.4(b)(2)). Prior to implementation of each phase (work plan or design document) of the Undertaking, BLM will determine, in consultation with the AZ SHPO, CA SHPO, Tribes, and PG&E, what, if any, changes are required in the APE. If BLM determines that the APE must be revised, BLM will redefine the APE taking the input from those parties into account. Should such revision to the APE be needed, BLM will amend the CHPMP to include any changes to the APE.	Groundwater Remedy Design and Implementation	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol, including on the APE.
6	Stipulation III(B)(1), III(B)(2)(a) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, existing monitoring wells and related facilities shall be used to the maximum extent practicable.	Implementation of Selected Groundwater Remedy	In this intermediate (60%) design, all existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	60% Design Report Compliance Status
7	Stipulation III(B)(2)(b) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, the need for and placement of any new facilities or activities will be determined in consultation with the Tribes and the Consulting Parties following the guidelines in Appendix B.	Implementation of Selected Groundwater Remedy	This 60% design presents planned facilities and activities for the implementation of the groundwater remedy. BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.
8	Stipulation III(B)(2)(c) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, that new facilities or activities be placed in areas already disturbed by previous grading or other mechanized activities to the maximum extent practicable, consistent with protecting human health and the environment and achieving cleanup in a timely manner.	Implementation of Selected Groundwater Remedy	The design has been and is carried out in a manner that gives: (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. A disturbed area map was prepared in compliance with an EIR mitigation measure (CUL-1a-9), to facilitate placement of infrastructure; a current version of the map is included in Appendix A2 of this 60% BOD. In addition, 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 intermediate (60%) design proposes the following: • All existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells. • The freshwater supply for the remedy will be the existing HNWR-1 well. • The freshwater supply storage will be the existing water storage tanks at the Compressor Station. • The remedy-produced water treatment plant and freshwater pre-injection treatment system will be located entirely within the footprint of Compressor Station. • The central maintenance facility for the remedy will be located entirely on PG&E property, at the Transwestern Bench. By centralizing maintenance functions into one location, this reduces the footprint of remedy structure outside of PG&E property.
9	Stipulation III(B)(2)(e) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, the performance of all field activities in support of the remedy shall be executed in such a way as to avoid and/or minimize adverse effects to cultural and historic properties to the maximum extent practicable.	Implementation of Field Activities in Support of the Groundwater Remedy	The planning of field activities is executed under the guidance of PG&E remediation resources specialist (Glenn Caruso). The implementation of field activities is performed in accordance with approved work plans and under the monitoring of Archaeological Monitor(s). Tribal Monitors are invited to observe ground-disturbing field activities.
10	Stipulation III(B)(2)(f) - Remediation of GW contamination	Should Alt E be selected, the Federal Agencies will ensure that, consistent with the general principals in Stipulation I, subject to Stipulation I(A), direct, indirect and cumulative adverse effects shall be considered and mitigated.	Implementation of Selected Groundwater Remedy	Adverse effects are being considered and mitigated through the implementation of the measures included in the PA, the CHPMP and the EIR.
11	Stipulation III(B)(3)(a) - Remediation of GW contamination – Final Design	Consultation between the Signatories, Tribes and Invited Signatories shall be initiated prior to final design and implementation of that alternative.	Design and Implementation of Selected Groundwater Remedy	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol.
12	Stipulation III(B)(3)(b) - Remediation of GW contamination – Final Design	Every effort should be made to avoid and minimize adverse effects in accordance with the general principles set forth in Stipulation I.	Implementation of Selected Groundwater Remedy	PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with the ongoing in office reviews is to ensure that the footprints of planned facilities are designed in ways to avoid, minimize, or mitigate impacts on historical and archaeological resources to the maximum extent feasible.
13	Stipulation III(B)(3)(c) - Remediation of GW contamination	Whatever the selected alternative, the Federal Agencies will consult with all Signatories, Tribes, and Invited Signatories during the design, implementation, and monitoring activities to determine how best to restore the areas affected by the Topock Remediation Project. These areas will include, but not be limited to, the site of the existing treatment plant and related facilities but will exclude the Topock Compressor Station and related facilities. The Federal Agencies will ensure that environmental restoration to the conditions existing prior to the construction of the Project, is planned and conducted to the extent practicable.	Implementation of Selected Groundwater Remedy	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP, which will be submitted with the 90% Design. Additionally, a Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning, and BLM will consult the Tribes on this Plan.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	60% Design Report Compliance Status
14	Stipulation V(A)	All facilities and appurtenances related to the Topock Remediation Project are to be removed as soon as practicable upon attainment of cleanup standards and a determination by DOI that removal of such facilities is protective of human health and the environment. All such removal will be planned in consultation with the Signatories, Tribes, and Invited Signatories, following the guidelines in Appendix B [Consultation Protocol).	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. Additionally, a Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning, and BLM will consult the Tribes on this Plan.
15	Stipulation V(B)	The removal of such facilities shall be monitored following the monitoring guidelines in Appendix C.	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.
16	Stipulation V(C)	The removal of such facilities shall take place along existing graded roads to the maximum extent practicable.	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities.
17	Stipulation V(D)	Prior to decommissioning of any remediation facility, the Federal Agencies will consult with all Signatories, Tribes, and Invited Signatories during the development of the closure plan to determine how to best restore the areas affected by the Topock Remediation Project, including but not limited to, the site of the existing treatment plant and related facilities, but excluding the Topock Compressor Station and related facilities, to ensure that environmental restoration of conditions existing prior to the construction of the Project, is achieved to the extent practicable.	Planning for decommissioning	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning, and BLM will consult the Tribes on this Plan.
18	Stipulation V(E)	PG&E will draft a plan for decommissioning, removal and restoration of the IM-3 facility prior to implementation of the groundwater remedy, in consultation with all Signatories, Tribes and Invited Signatories.	Groundwater Remedy Design	This stipulation will be adhered to during design. The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration will be included as an appendix to the CIMP, which will be submitted with the 90% Design. The Plan will be drafted in consultation with all Signatories, Tribes and Invited Signatories.
19	Stipulation IX(A)-(D)	A. If the Undertaking affects a previously unidentified cultural and/or historic resource, including human remains and/or associated funerary objects or graves, or affect such resources in a way not previously anticipated, or have greater adverse effect than previously anticipated, all work in the vicinity of the discovery shall cease. No further action will be taken until the BLM, in consultation with Tribal and Archaeological Monitors and PG&E in the field, has determined the nature of the discovery and delineated an area not to exceed 50 meters from the approximate center point of the discovery (or a smaller or larger areas if warranted by specific circumstances) in which no further work is to take place until treatment of the discovery is resolved. At such point BLM will notify all Signatories, Tribes, and Invited Signatories of the nature and general location of the discovery. The BLM will implement appropriate measures, including stabilization or covering, to protect any discovery (human remains, funerary objects, sacred objects, or objects of cultural patrimony) from further disturbance in accordance with the principles set forth in Stipulation I. Ongoing work not within 50 meters (or a smaller area if determined appropriate by parties in the field) of the discovery may continue. If human remains and/or associated funerary objects compose all or part of the discovery, then BLM shall ensure the stipulations of the POA included in the CHPMP, as described in Stipulation VII (H) hereof, will be completed. Also, if human remains and/or funerary objects are encountered, all activities shall follow the procedures and direction provided in NAGPRA and California Public Resources Code sections 5097.98 and 5097.991. For Arizona, such activities shall follow the procedures and direction provided in NAGPRA and applicable state laws, including the Arizona Antiquities Act of 1927 (ARS § 41-841 to 41-846), Burial Protection Law of 1990 (ARS §41-865), and ARS §41-844 of 1990.	Field Implementation of Selected Groundwater Remedy	This stipulation will be adhered to during the field implementation of the Freshwater Implementation Plan. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	60% Design Report Compliance Status
20	Stipulation IX(A)-(D) (continued)	B. If the Tribes, PG&E, and BLM can resolve treatment of the discovery in a manner that does not cause adverse effects to significant cultural and historic properties, BLM shall document the resolution, the activities within the work area may proceed and the AZ SHPO and the CA SHPO shall be notified of the discovery and resolution. The Tribes, PG&E, and BLM will use their best efforts to resolve treatment as quickly as possible. C. If there is failure to resolve treatment of the discovery in consultation with the Tribes and PG&E, BLM shall then consult with the AZ SHPO or the CA SHPO to develop a treatment plan that takes into account the effects of the Undertaking on the discovery. Within fifteen (15) days of notification of discovery, BLM shall provide the consulted SHPO(s), via email, a recommendation for resolving the discovery situation that takes into account the potential effects of the Undertaking on the discovery. D. If the CA SHPO or AZ SHPO (as appropriate, depending on the location of the discovery) does not object to BLM's recommendation(s) within fifteen (15) days, BLM will implement the recommendation(s). If the consulted SHPO objects to the recommendation, BLM will utilize the dispute resolution process in Stipulation XV of this PA to resolve any objection.	Field Implementation of Selected Groundwater Remedy	This stipulation will be adhered to during the field implementation of the selected groundwater remedy.
21	Appendix C Monitoring Protocol	Cultural sensitivity training will be required of all staff, workers and contractors engaged in activities in the Topock Remediation Project APE to familiarize them with the sacred nature of the areas so that they will perform their job in a respectful manner. This training will also be given to new personnel before they are allowed to do fieldwork within the APE. This training will be conducted by PG&E with participation by Tribes and Tribal Monitors, Archaeological Monitors, Federal Agency staff, and PG&E supervising staff, as appropriate. Consistent with PG&E's stated policy, PG&E will not tolerate any disrespectful behavior in the field and will remove any staff, workers or contractors who do not comply with this section.	Implementation of Selected Groundwater Remedy	Site orientation and the training on cultural/historical resources sensitivity will be provided at the project initiation meeting, to be held at the Topock Compressor Station. Site orientation will stress that all site activities will be conducted in a respectful manner. Sensitivity training will be provided by PG&E Site Operations Manager, PG&E Remediation Resources Specialist, and PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate. In addition, PG&E and Tribes are collaborating on a similar measure under the CIMP, and to produce a training/education manual to educate workers. This CIMP measure was discussed with interested Tribes at the monthly meeting on April 26, 2012, August 23, 2012 and September 19, 2012.
22	Appendix C Monitoring Protocol	Prior to execution of the PA for the Undertaking, PG&E sometimes invited the Tribes to be present on site during construction to monitor and observe non-maintenance grading, trenching, or other excavation for any facilities, new roads, or other project components related to the Undertaking which may have had the potential to adversely impact cultural and historic resources. The Tribal and Archaeological Monitors shall both be invited to monitor such field work.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project
23	Appendix C Monitoring Protocol	This Protocol specifies ways in which the Tribes, BLM, and PG&E may ensure that: 1. Tribes, BLM, and PG&E, each are kept well informed of Undertaking activities and outcomes; 2. Tribal and Archaeological Monitors have the opportunity to alert PG&E's site supervisor (or designee) to potentially sensitive areas or issues that Monitors may be aware of or may become aware of while fieldwork is in progress; 3. PG&E's site supervisor (or designee) notifies BLM of potentially complicated situations. These situations may include discovery of a new cultural or historical resource, damage to a previously recorded cultural or historical resource, or unanticipated effects identified; 4. Tribal concerns regarding work activities are addressed while fieldwork is in progress.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	60% Design Report Compliance Status
24	Appendix C Monitoring Protocol (Work Schedule)	Tribal and Archaeological Monitors will be provided with anticipated schedules for Topock Remediation Project work that requires monitoring as early as possible but at least three (3) business days in advance of the initiation of the identified project work, whenever possible. Recognizing that changes to the work schedule may be inevitable, any change in the work schedule will be provided to the Tribal and Archaeological Monitors as soon as possible after the change becomes part of the work schedule. If there is a question regarding need for a monitor, the questioning party shall consult the BLM Project or Field Manager who will make the final determination of need.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. The PG&E Site Operations Manager or his designee will provide the work schedule and inform the monitors of schedule changes as soon as practicable.
25	Appendix C Monitoring Protocol (Discoveries)	If the Undertaking will affect previously unidentified resources, or affect a previously recorded cultural or historical resource in a way not previously anticipated, or have greater or different effects than previously anticipated, all work having potential for adverse affect shall cease within a fifty (50)-meter radius (or a smaller or larger area if determined appropriate by the BLM, the Monitors, and PG&E in the field) of the point of discovery. The Archaeological and Tribal Monitors will work with BLM and PG&E to ensure that the PA requirements of Stipulation VII (CHPMP) and Stipulation IX (Discoveries) are met.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.
26	Appendix C Monitoring Protocol (Human Remains)	If the Undertaking affects previously unidentified human remains and/or associated funerary objects or graves, or affects such resources in a way not previously anticipated, or has greater adverse effect than previously anticipated, all work in the vicinity of the discovery shall cease. No further action will be taken until the BLM, in consultation with Tribal and Archeological Monitors and PG&E in the field, has determined the nature of the discovery and delineated an area not to exceed 50 meters from the approximate center point of the discovery (or a smaller or larger area if warranted) in which no further work is to take place until treatment of the discovery is resolved.	Implementation of Field Activities	This stipulation will be adhered to during field implementation. Tribal monitors will be invited to monitor ground-disturbing field activities. Archaeological monitoring will also be conducted during ground disturbing portions of the project. Applied Earthworks, a professional cultural resources consulting firm, was retained by PG&E with DTSC approval. Applied Earthworks will observe ground-disturbing activities and will have the authority to temporarily divert or halt any activities in the event that previously unidentified potentially significant cultural resources are discovered.
27	Appendix C Monitoring Protocol (Safety)	Tribal and Archeological Monitors will be required to meet with PG&E's site supervisor prior to initiating monitoring activity and will be required to obtain any applicable training required under 29 CFR 1910.120 and 40 CFR 300.150. The PG&E site supervisor will identify the safety and logistical guidelines that are appropriate for the monitoring activity. Tribal and Archaeological Monitors are invited to attend the safety meetings at the start of each workday or new work task. If the Monitors do not attend this meeting, they will be instructed about the safety concerns of the day by a PG&E representative. Tribal and Archaeological Monitors will be expected to wear all personal protective equipment specified by PG&E's site supervisor and required of other similarly situated field workers. Tribal and Archaeological Monitors will be expected to actively participate to enhance the safety of themselves and the other workers onsite by communicating with PG&E's site supervisor if any safety concerns are identified. Due to safety considerations at the Project site, Tribal and Archaeological Monitors will also be prohibited from conducting any monitoring within designated construction exclusion zones, unless otherwise authorized by PG&E. Such zones are to be clearly delineated to the Tribal and Archaeological Monitors by PG&E's site supervisor. In these situations, other efforts to provide alternative methods for accommodating Monitors including, but not limited to, high-powered binoculars, spotting scopes, or other vision enhancement tools or alternative viewing platforms will occur.	Implementation of Field Activities	During the project initiation meeting or at similar venues (as appropriate), the PG&E Site Operations Manager or his designee will identify the safety and logistical guidelines that are appropriate for the monitoring activity. Tribal and Archaeological Monitors will be invited to attend the safety meetings at the start of each work day or new work task. If they do not attend, they will be instructed of the safety concerns of the day by PG&E.

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	60% Design Report Compliance Status
1	Section 6.2	Measures and principles to avoid, minimize, or resolve adverse effects include the following: • Existing monitoring wells and related facilities shall be used to the maximum extent practicable. • The need for and placement of any new facilities or activities will be determined in consultation with the Tribes and the Consulting Parties following the Guidelines in Appendix B. • New facilities or activities will be placed in areas already disturbed by previous grading and other mechanized activities to the extent practicable, consistent with human health and the environment and achieving cleanup in a timely manner. • The performance of all field activities in support of the remedy shall be executed in such a way as to avoid and/or minimize adverse effects to cultural and historic properties to the maximum extent practicable. • Subject to Stipulation I(A) above, direct, indirect and cumulative impacts shall be considered and mitigated.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c), (e) and (f) in Table 6.1-2.
2	Section 6.2.3	Refers to the requirement in the PA Stipulation V(E) and PG&E's 2006 Settlement Agreement with the Fort Mojave Indian Tribe that a plan will be prepared for the decommissioning, removal and restoration of the IM-3 facility prior to implementation of the groundwater remedy, in consultation with all Signatories, Tribes and Invited Signatories. Additionally, PG&E will remove all other remediation facilities and appurtenances related to the Topock Remediation Project as soon as practicable following the attainment of cleanup standards and a determination by DOI that the removal of these facilities is protective of human health and the environment.	See responses to PA Stipulations V(A)-(E) in Table 6.1-2.
3	Section 6.3	"Environmental Restoration" refers to the restoration obligations in the Programmatic Agreement and the Consent Decree, including that PG&E draft a plan for decommissioning, removal, and restoration of the IM-3 facility and a Remedy Decommissioning Plan that will address post-remedy restoration of the site.	See responses to PA Stipulations I(D), III(B)(3)(c), and V(D)-(E) in Table 6.1-2.
4	Section 6.6.3	"Avoidance Measures/Management Thresholds" provides that: "The primary means for achieving avoidance will be through careful planning and placement of project facilities and installation of temporary barrier fences around significant cultural and historic properties. Metal fence posts and orange mesh all-weather fabric will be used, unless other appropriate materials are identified as preferable, for temporary fencing and will be regularly inspected and maintained. Permanent post-and double cable fencing may be required in high traffic areas. An archaeologist and/or Tribal representative(s) will clearly delineate the sensitive areas to be avoided by construction and supervise fence installation. Project personnel will be notified that fenced locations are to be completely avoided."	See EIR MMRP (DTSC 2011c) mitigation measure CUL-1a. PG&E remediation resources specialist (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 23-24 and June 20, 2012. The purpose of these field reviews along with in office reviews is to ensure that the footprints of planned facilities are designed, in ways that avoid, minimize, and mitigate significant adverse effects to historically significant cultural and historic resources.
5	Section 6.6.4	Construction Monitoring Monitoring of all earth-disturbing Project activities will be in accordance with Appendix C of the PA (Tribal and Archaeological Monitoring Protocol). Qualified archaeological and Tribal monitors will be notified in advance and invited to be on site during earth-disturbing construction activities (grading, trenching, boring, drilling, or other excavation) for new injection, extraction or monitoring wells, new pipelines, new treatment facilities, new access roads, new staging areas, other new transportation facilities, or other new Project components. Due to safety considerations at the Project site, Tribal and archaeological monitors will comply with all safety requirements.	See responses to PA Appendix C, Monitoring Protocol in Table 6.1-2. See also mitigation measure CUL-1a-8(l).
6	Section 6.6.5	Periodic Site Monitoring Sound management of the archaeological and historical properties requires that any progressive degradation of sites be identified. Additionally, it is recognized that a mechanism is needed to identify any accidental damage that may occur. To accomplish these goals, PG&E will develop a proposal describing a program of periodic site monitoring and condition assessment. BLM, following consultation with the Tribes and other appropriate parties, will approve any monitoring program before implementation by PG&E. The program will include all historic properties within the APE. Any previously unknown properties that may be encountered during the Project also will be included in the monitoring program unless such properties are evaluated as ineligible. During its initial phase, periodic monitoring and condition assessment will consist of annual field visits to monitor site conditions and disturbances	As part of the 2004 Cultural Resources Management Plan, Applied Earthworks conducted quarterly monitoring the first year and since then (2005 – 2012) annual monitoring and condition assessment.
7	Section 6.8	"Protocols for Tribal and Archaeological Monitoring" states that monitoring for the Project will be performed in accordance with the PA's Appendix C (Tribal and Archaeological Monitoring Protocol).	See responses to PA Appendix C, Monitoring Protocol in Table 6.1-2. See also mitigation measure CUL-1a-8(l).

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	60% Design Report Compliance Status
8	Section 6.9	If the Undertaking extends beyond the APE, BLM will determine, in consultation with the PA Signatories, Tribes, and Invited Signatories, what (if any) changes are required in the APE. If BLM determines that the APE must be revised, BLM will redefine the APE, taking into account the advice of the other Consulting Parties. Should such revision to the APE be needed, BLM will amend the CHPMP to include any changes to the APE (BLM et al. 2010:8).	See response to PA Stipulation II(B) in Table 6.1-2.
9	Section 7.1	1. Physical avoidance of the Topock Maze and associated prehistoric sites. 2. To the maximum extent practicable, PG&E will avoid all archaeological sites within the APE and protect all historic properties regardless of their NRHP status. The primary means for accomplishing avoidance will be through careful planning and placement of proposed access routes and drilling sites and by the installation of barrier fences around significant historic properties. A pre-project archaeological survey field verification will be conducted prior to any ground-disturbing activities. Consistent with other phases of work conducted at the Topock Remediation Project site, agency representatives and other stakeholders (including representatives of Native American Indian tribes involved with the Project) will be invited to the site for a project initiation meeting to discuss various cultural sensitivities associated with the Project. 3. Ensure that PG&E shall, to the extent practicable, restore the areas affected by the Topock Remediation Project within the APE, including but not limited to the site of the existing treatment plant and related facilities but excluding the Topock Compressor Station and related facilities, to the conditions existing prior to the construction of the PG&E investigation and remediation related appurtenances and facilities per PA Stipulation I.D. 4. Remediation activities that propose the removal or introduction of vegetation on public lands shall be undertaken after coordination with Tribes to assess if culturally significant native plant species are being impacted and if there could be potential visual impacts to the Topock TCP. 5. Existing monitoring wells and related facilities shall be used to the extent practicable per PA Stipulation III.B.2(a). 6. The need for and placement of any new facilities or activities will be determined in consultation with the Tribes and the Consulting Parties following the Guidelines in Appendix B and per PA Stipulation III.B.2(b). 7. New facilities or activities will be placed in areas already disturbed by previous grading and other mechanized activities to the extent practicable, consistent with human health and the environment and achieving cleanup in a timely manner per PA Stipulation III.B.2(c). 8. Clay deposits are an important resource identified by the Hualapai in their creation, and may be important as well to other Tribes. Accordingly, BLM, PG&E, and those Tribes that ascribe importance to clay deposits shall meet to identify the clay deposits that are considered a resource and develop a protocol to be followed if such clay deposits are encountered.	See responses to PA Stipulations I(B), I(D), III(B)(1), III(B)(2)(a)-(c) and (e), III(B)(3)(c), and V(D) in Table 6.1-2. See also mitigation measures CUL-1a-8(i), AES-1, and AES-2. Regarding Item 4, PG&E does not plan to remove or introduce vegetation on public lands in connection with the remedy; instead, only some trimming of vegetation may be required which will be focused on non-native species (e.g., tamarisk). The trimming of native species (e.g., palo verde and mesquite) will be avoided or minimized to the extent practicable. Regarding Item 8, BLM met with the Hualapai Tribe and PG&E in late 2012 and discussed the Clay Monitoring Protocol. The Hualapai representative indicated that the Hualapai would make the initial draft of this protocol and then send it out for BLM and PG&E to review.
10	Section 7.2	Accommodation of Tribal Activities and Ceremonies Involving the Topock Maze/TCP The BLM will continue to work with the Tribes to identify tribal activities and ceremonies that are associated with the Topock TCP. When such activities and ceremonies are identified, BLM will consult with the Tribes and PG&E to develop treatment measures to accommodate them. Treatment measures may address scheduling of Undertaking work to accommodate ceremonial activities and to mitigate audible and visual impacts.	See response to mitigation measure CUL-1a-8k in Table 6.1-1.
11	Section 7.3	Treatment of other cultural, historical, and archaeological properties within the APE "The only properties identified within the APE that are not contributing properties to the Topock TCP are the properties from the historic period (i.e., Route 66, the AT&SF Railroad Grade, and National Old Trails Road). None of these properties has been impacted, to date, by this Undertaking. These properties shall be avoided, to the extent practicable, in the implementation of the Undertaking. These properties are periodically monitored for condition assessment to assure that they are being protected."	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c) and (e) in Table 6.1-2.
12	Section 8.1	Discoveries - Steps to be taken if previously unrecorded properties are found	PG&E will follow the procedures specified in Appendix C of the CHPMP (Discovery Plan). See also response to PA Stipulation IX(A)-(D) in Table 6.1-2 and mitigation measure CUL-1a-8(b) and -8(o).
13	Section 8.2	Discoveries - Treatment of any human remains, funerary objections, ceremonial objects and items of cultural patrimony	PG&E will follow the procedures specified in Appendix D of the CHPMP (Plan of Action). See also response to PA Stipulation IX(A)-(D) in Table 6.1-2 and mitigation measure CUL-1a-8(b) and -8(o).

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	60% Design Report Compliance Status
14	Section 8.3	Consultation Procedures Related to Unanticipated Discoveries The BLM will notify all Signatories of the PA, Tribes and Invited Signatories of the nature and general location of any discovery. If the Tribes, PG&E and BLM can resolve treatment of the discovery in a manner that does not cause adverse effects to significant cultural and historic properties, BLM shall document the resolution, the activities within the work area may proceed and the AZ SHPO and the CA SHPO shall be notified of the discovery and resolution. The Tribes, PG&E and BLM will use their best efforts to resolve treatment as quickly as possible. If there is failure to resolve treatment of the discovery in consultation with the Tribes and PG&E, BLM shall then consult with the AZ SHPO or the CA SHPO to develop a treatment plan that takes into account the effects of the Undertaking on the discovery. Within fifteen (15) days of notification of discovery, BLM shall provide the consulted SHPO(s), via email, a recommendation for resolving the discovery situation that takes into account the potential effects of the Undertaking on the discovery. If the CA SHPO or AZ SHPO (as appropriate, depending on the location of the discovery) does not object to BLM's recommendation(s) within fifteen (15) days, BLM will implement the recommendation(s). If the consulted SHPO objects to the recommendation, BLM will utilize the dispute resolution process in Stipulation XV of the PA to resolve any objection.	See response to PA Stipulation IX(A)-(D) in Table 6.1-2. See also mitigation measures CUL-1a-8(b) and -8(o).

SECTION 7

Project Delivery Strategy/Updated Schedule

The CD (DOI 2013) requires a discussion of the project delivery strategy at the intermediate (60%) design stage. Because explicit details regarding this requirement were not provided in the 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 7.1)
- Review requirements (see Section 7.2)
- Phasing alternatives (see Section 7.3)
- Procurement and contracting strategy (see Section 7.5)
- Contractor, labor, and equipment availability concerns (see Section 7.5)
- Design/updated project schedule (see Section 7.5)
- 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 7.2).

In addition to the USEPA Guidance on project delivery strategy discussed above, the forthcoming Construction/ Remedial Action Work Plan will further detail the delivery strategy by detailing the plans and schedules for construction and implementation of the remedy as set forth in the remedial design plans and specifications. Specifically the Construction/Remedial Action Work Plan will include:

- Health and safety plan
- Schedule for the completion of the remedial action tasks
- Schedule for submitting other remedial action-required plans
- Groundwater monitoring plan
- Contractor Construction Quality Assurance Project Plan (CCQAPP)
- Method for implementing the CCQAPP/O&M Plan/Contingency Plan
- Methods for satisfying permit requirements
- Tentative formulation of remedial action team
- Decontamination procedures and disposal of materials
- Requirements for project closure

The procedures and criteria for approval of decommissioning of IM-3 are also presented herein (see Section 7.4) in response to comment on the 30% design from the FMIT (HA-29) and at the direction of DTSC. Each of these items is discussed below. At this intermediate (60%) 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.

7.1 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 intermediate (60%) 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.

7.2 Submittals and Review Requirements

Exhibit 7.2-1 presents the review requirements for the intermediate (60%) and pre-final (90%)/final (100%) submittals. Tables 7.2-1 and 7.2-2 map the requirements of the 1996 CACA and 2013 CD, respectively, to the design documents and other future documents. Table 7.2-3 provides the content and packaging of key documents.

7.3 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 final 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.

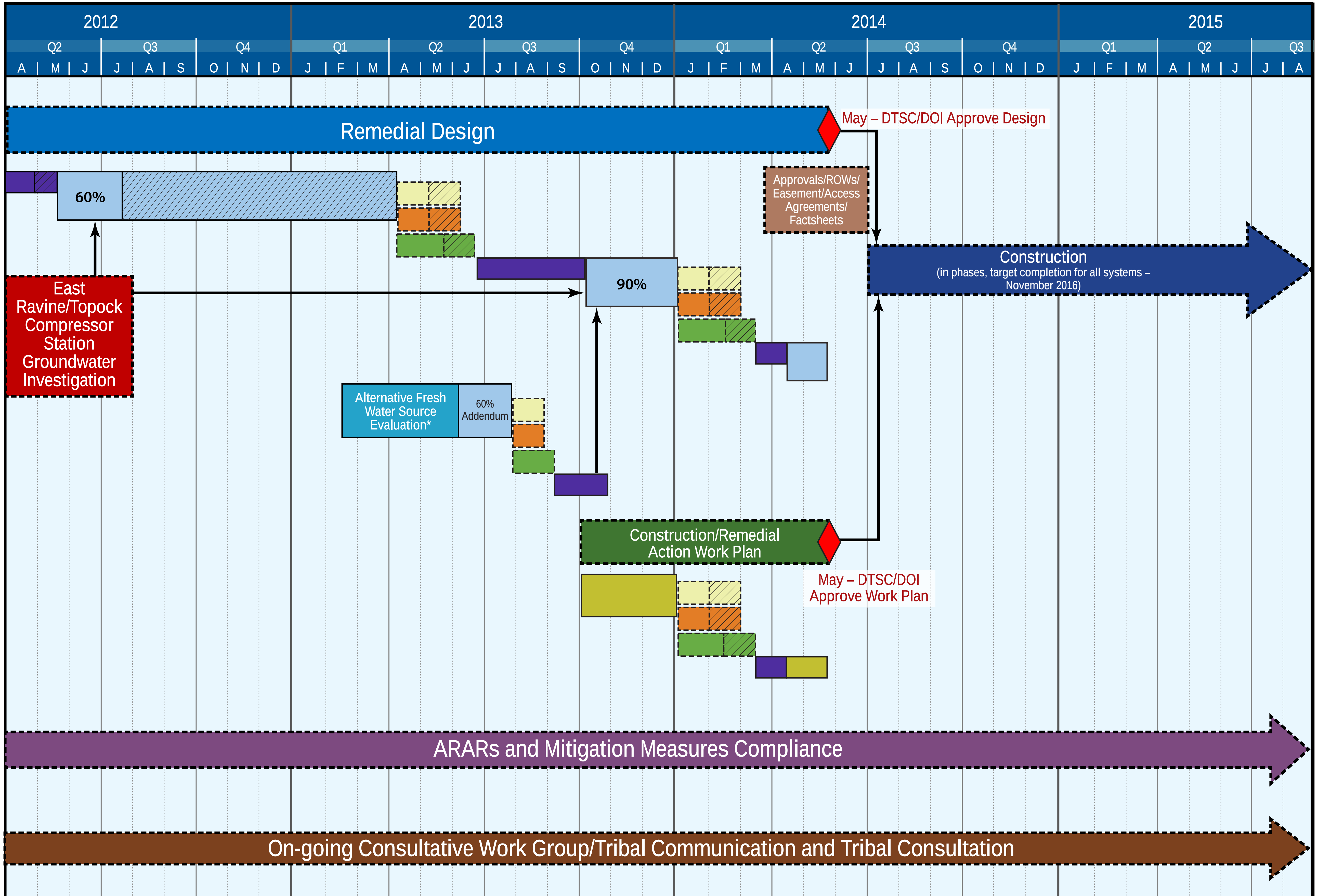
7.3.1 Criteria Used to Evaluate the Transition Alternatives

The following criteria were used in the 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 Inner Recirculation Loop Injection Wells
   c. Minimize chromium going to upland groundwater

Groundwater Remedy Design, Construction, and Initial Start-Up Schedule

PG&E Topock Compressor Station | Needles, California
April 2013



LEGEND

- Draft/Final Work Plan
- Consultative Work Group/Technical Work Group Review
- Preliminary/ Intermediate/ Pre-Final/ Final Design
- Tribal Consultation
- Agencies Review
- Comment Resolution
- Extended Period

Note:
* The timing and duration of implementation is estimated and will be redefined after DTSC and DOI approval of the Revised Implementation Plan for Evaluation of Alternative Freshwater Sources.

EXHIBIT 7.2-1
GROUNDWATER REMEDY DESIGN, CONSTRUCTION, AND START-UP SCHEDULE
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL.

3. IRZ and Inner Recirculation Loop 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 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

7.3.2 Evaluation of Proposed Transition Plan

The results of this evaluation have led 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 7.3.1. 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 Inner Recirculation Loop 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.

The groundwater flow and solute transport model was used to further evaluate the final groundwater remedy startup schedule and sequence following the IM shut-down. Two 1-year and two 2-year start-up schedules were simulated, as listed below.

- Scenario 1A (1 year)
  - Month 0 - 6: NTH IRZ ON
  - Month 6 - 9: NTH IRZ OFF and Freshwater Injection[4] ON
  - Month 9 - 12: NTH IRZ OFF and Freshwater Injection, TCS Recirculation Loop, and Inner Recirculation Loop ON
- Scenario 2A (1 year)
  - Month 0-6: NTH IRZ ON
  - Month 6-9: NTH IRZ OFF and Inner Recirculation Loop[5] ON
  - Month 9-12: NTH IRZ OFF and Freshwater Injection, TCS Recirculation Loop, and Inner Recirculation Loop ON
- Scenario 1B (2 years)
  - Month 0-12: NTH IRZ ON
  - Month 12-18: NTH IRZ OFF and Freshwater Injection[5] ON
  - Month 18-24: NTH IRZ OFF and Freshwater Injection, TCS Recirculation Loop, and Inner Recirculation Loop ON
- Scenario 2B (2 years)
  - Month 0-12: NTH IRZ ON
  - Month 12-18: NTH IRZ OFF and Inner Recirculation Loop[5] ON
  - Month 18-24: NTH IRZ OFF and Freshwater Injection, TCS Recirculation Loop, and Inner Recirculation Loop ON

The primary difference between these start-up schedules, other than duration, is the order in which the different remediation wells are brought online.

Simulated Cr(VI) transport for Scenarios 1A and 2A are shown in Figure 7.3-1 (Model Layer 2) and Figure 7.3-2 (Model Layer 4). The model results indicate that both of the proposed 1-year start-up schedules are protective of the Colorado River—i.e., the Cr(VI) plume does not migrate a significant distance in the floodplain during start-up and the portion of the plume located downgradient of the NTH IRZ does not migrate past the capture zone of the River Bank Extraction Wells. Additionally, the Cr(VI) plume migrates towards capture by the River Bank extraction wells slightly faster when the freshwater injection is turned on in month 6 (Scenario 1A) instead of month 9 (Scenario 2A).

Simulated Cr(VI) transport for Scenarios 1B and 2B are shown in Figures 7.3-3 (Model Layer 2) and 7.3-4 (Model Layer 4). Similar to the 1-year scenario model results, the main difference between the two 2-year scenarios is that the Cr(VI) plume migrates towards capture by the River Bank extraction wells slightly faster when the freshwater injection is implemented sooner (i.e., in month 12 as opposed to month 18). Both start-up schedules are protective of the Colorado River.

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[4] The intermediate (60% design) nominal scenario assumes IRL-1 and IRL-2 (northern Inner Recirculation Loop Injection Wells) will receive carbon-amended River Bank Extraction Well water if hexavalent chromium concentrations in the River Bank Extraction Wells exceed the clean-up goal; and IRL-3 and IRL-4 (southern Inner Recirculation Loop Injection Wells) will receive freshwater. Thus, the startup scenarios include IRL-3 and IRL-4 with the Freshwater Injection ON; and Inner Recirculation Loop ON includes only IRL-1 and IRL-2. Injection wells IRL-1 through IRL-4 will be constructed for flexibility to inject either/both freshwater or/and River Bank Extraction Well water during the lifetime of the remedy. FW-1 (not depicted in the figures) is located west of the area shown.

[5] See footnote 4.

Based on these results, a shorter, 1-year start-up schedule is preferred to reduce the total remedial timeframe; however, the 2-year start-up schedule demonstrates that a longer start-up period can be accommodated while still being protective of the Colorado River.

Additional discussion regarding the final groundwater remedy startup simulations is provided in Appendix B, Development of Groundwater Flow, Geochemical, and Solute Transport Models.

7.3.3 Implementation of Transition Plan

The proposed plan relies on rapid termination of IM operation and a step-wise start-up of the final groundwater remedy (see Exhibit 7.3-1). The transition plan, which would be similar to Scenarios 1A/1B presented above, would generally proceed as follows:

- As soon as the NTH IRZ wells, River Bank Extraction Wells, Freshwater Injection Wells, East Ravine Extraction Wells, and Transwestern Bench extraction wells 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 to allow for incremental start-up of the injection wells, water level measurements, flow balancing, and system adjustments, as necessary.
- Once the NTH IRZ is established, the carbon substrate injections will be turned off and the freshwater injection system[6] 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 to allow for incremental start-up of the injection wells, water level measurements, flow balancing, and system adjustments, as necessary.
- Subsequently, the Inner Recirculation Loop will next be initiated (i.e., start-up of River Bank Extraction Wells and Inner Recirculation Loop Injection Wells). This step could take 3 to 6 months to allow for incremental start-up of the extraction and injection wells, flow balancing, and system adjustments, as necessary. In addition, if groundwater captured by the River Bank Extraction Wells requires carbon amendment before re-injection (see Section 3.2.2), refinement and operation of the carbon substrate amendment system components will also be required.
- Simultaneously to the start-up of the Inner Recirculation Loop, the start-up of the TCS Recirculation Loop (i.e., the East Ravine extraction wells, Transwestern Bench extraction wells, and TCS injection wells) will be initiated. This step could take 3 to 6 months to allow for incremental start-up of the injection wells, water level measurements, flow balancing, and system adjustments, as necessary.

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. As demonstrated by the modeling effort described in Section 7.3.2, the proposed plan is protective of water quality in the Colorado River.

[6] See footnote 4

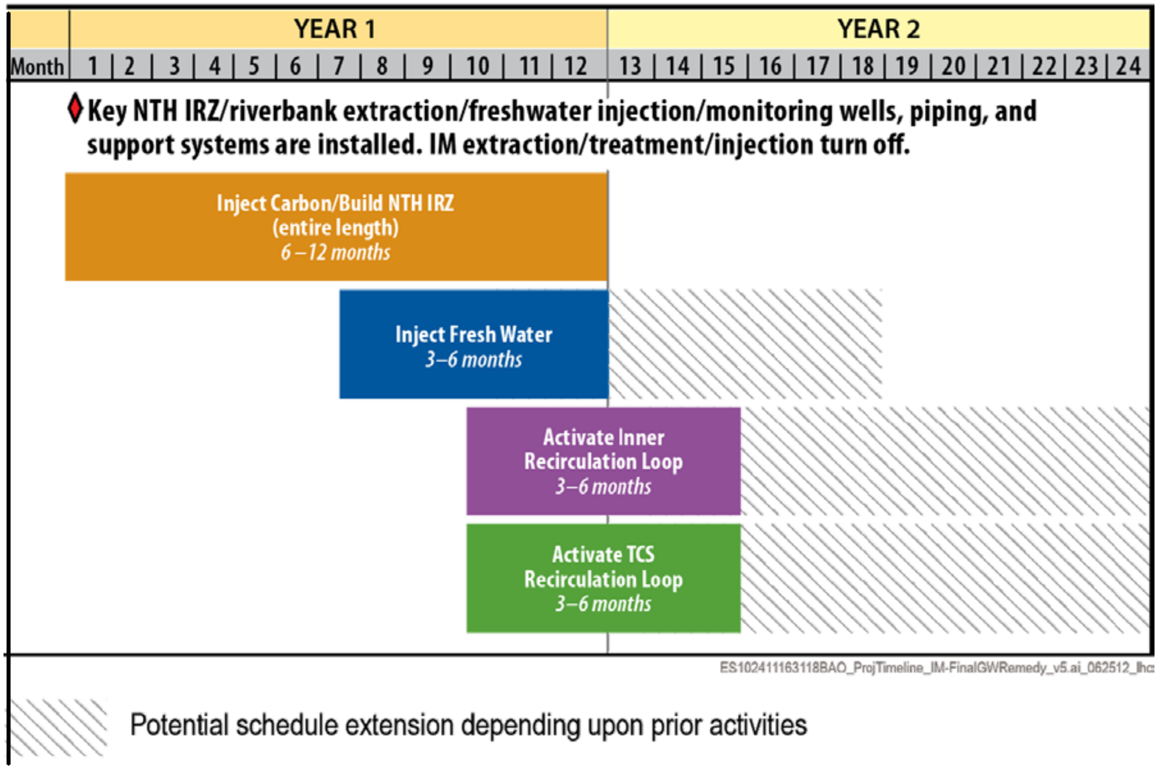


EXHIBIT 7.3-1

PROJECT TIMELINE FOR IMPLEMENTATION OF PROPOSED TRANSITION PLAN

Groundwater Remedy Revised Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

7.4 Criteria for Approval of IM-3 Decommissioning

In response to the FMIT's comment on the 30% design (HA-GC2 and HA-29) and as directed by DTSC, the following procedures and criteria for DTSC's determination that the remedy is maintaining plume control and that IM-3 decommissioning can be approved are presented below for review by project stakeholders and Tribes during the design phases and approval by DTSC as part of the Construction/Remedial Action Work Plan.

Plume Control Criteria

The Plume Control Criteria that will be considered include, but are not limited to, the following factors:

1. Delivery and circulation of reagent within the NTH IRZ treatment zone has successfully established a reducing zone adequate to limit Cr(VI) plume migration;
2. Successful demonstration of hydraulic movement within the EIR project area, as defined in the EIR and as shown in EIR Exhibit 3-2, consistent with the approved remedy design resulting from operation of hydraulic extraction along the river with reinjection in the Upland area and fresh water injection in the Upland area;
3. Verified monitoring data have established that the Cr(VI) plume is generally stable within its baseline footprint, where the baseline footprint is the area of groundwater at the time of remedy start-up delineated by concentrations of Cr(VI) in excess of 32 µg/L;
4. Verified monitoring data demonstrate control of remedy by-products (such as manganese and arsenic resulting from dosing and groundwater movement) within the limits projected in the approved remedy design; and

5. Successful Cr(VI) and by-product migration control will be projected using the groundwater flow and transport model used for remedial design only after a demonstration of consistency of model projections of the groundwater flow with transport model and field data.

The IM-3 system shall be turned off when the groundwater remedy equipment and facilities are in place and ready to begin start-up. The remedy equipment and facilities may include the NTH IRZ wells, the River Bank Extraction Wells, the freshwater wells, monitoring wells, the East Ravine/TCS wells, and the pipelines, controls, and electrical and mechanical systems needed to operate these wells. DTSC will issue to PG&E a written approval of the decommissioning of IM-3 directing PG&E to implement the DTSC and DOI-approved IM-3 decommissioning plan no later than 30 days after the following three items have occurred:

a) DTSC determines that the groundwater remedy is achieving plume control;

b) DTSC determines that the groundwater remedy is Operating Properly and Successfully (OPS) (unless DTSC determines, at its lawful discretion, that such decommissioning can occur prior to DTSC's OPS determination); and

c) After DOI concurs with the decommissioning of IM-3, DTSC shall issue to PG&E a written approval of the decommissioning of IM-3 directing PG&E to implement the DTSC- and DOI-approved IM-3 Decommissioning Work Plan.

PG&E will then begin decommissioning and removal of the IM-3 facilities as soon as is reasonably practicable after DTSC issues its written approval to proceed.

7.5 Procurement Methods/Contracting Strategy/ Updated Project Schedule

For this project, PG&E plans to use pre-qualified contractors, where appropriate and available, including 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 procurement requirements and protocols including PG&E's Supplier Diversity Program. At this intermediate (60%) design stage, PG&E has not identified any labor, contractor, or equipment availability concerns.

The updated project schedule is presented in Exhibit 7.5-1. A summary of the schedule updates at this intermediate (60%) design stage is listed below (note that for brevity and focus, the project schedule included in this 60% BOD was simplified to focus on the remedial design, construction, and startup activities):

- Intermediate Remedial Design (Lines 29 through 43) – This schedule shows the 60% design submittal on April 5, 2013 per DTSC's direction (DTSC 2012). In addition, the 60% design addendum will also be submitted within 45 days after completion of the freshwater details per DTSC's direction. The exact timing of the 60% design addendum is dependent on DTSC and DOI approval of the Implementation Plan.
- ROWs/Easements/Landowner Agreements/Approvals (Lines 119-121) – No change. More details/ update will be provided at the pre-final (90%) design stage after remedial facilities locations are confirmed.
- Community Outreach (Lines 122 through 135) – Updates were provided to reflect progress made since 30% design and current plan at the intermediate (60%) design stage.
- Construction (Lines 136-151) – Added monthly progress reports during construction. A high level breakdown of the key construction steps and a gross estimation of the duration for each step is provided to assist with conceptualizing the field execution portion of the project. At this 60% design stage, PG&E anticipates that the well installation/development/testing to be the bracketing construction activity, i.e. this step governs the critical path for field implementation pending final resource loading assumptions. From a high level scheduling stand point, PG&E anticipates that all other construction steps (e.g., new pipeline installation, carbon amendment facilities, supporting facilities) will fit within the time window of the well installation/development/testing activity. PG&E will work on the scheduling details between the 60% and 90% design including resource loading and optimization.

A detailed construction schedule (including work breakdown structure [WBS]) will be developed as part of the 90% design submittal and 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.

- Start-up (Transition from IM to final groundwater remedy) (Lines 157-164) – Added the timeline for implementation of the proposed IM to final groundwater remedy transition presented in Section 7.3.3. Added quarterly progress reports during start-up period.

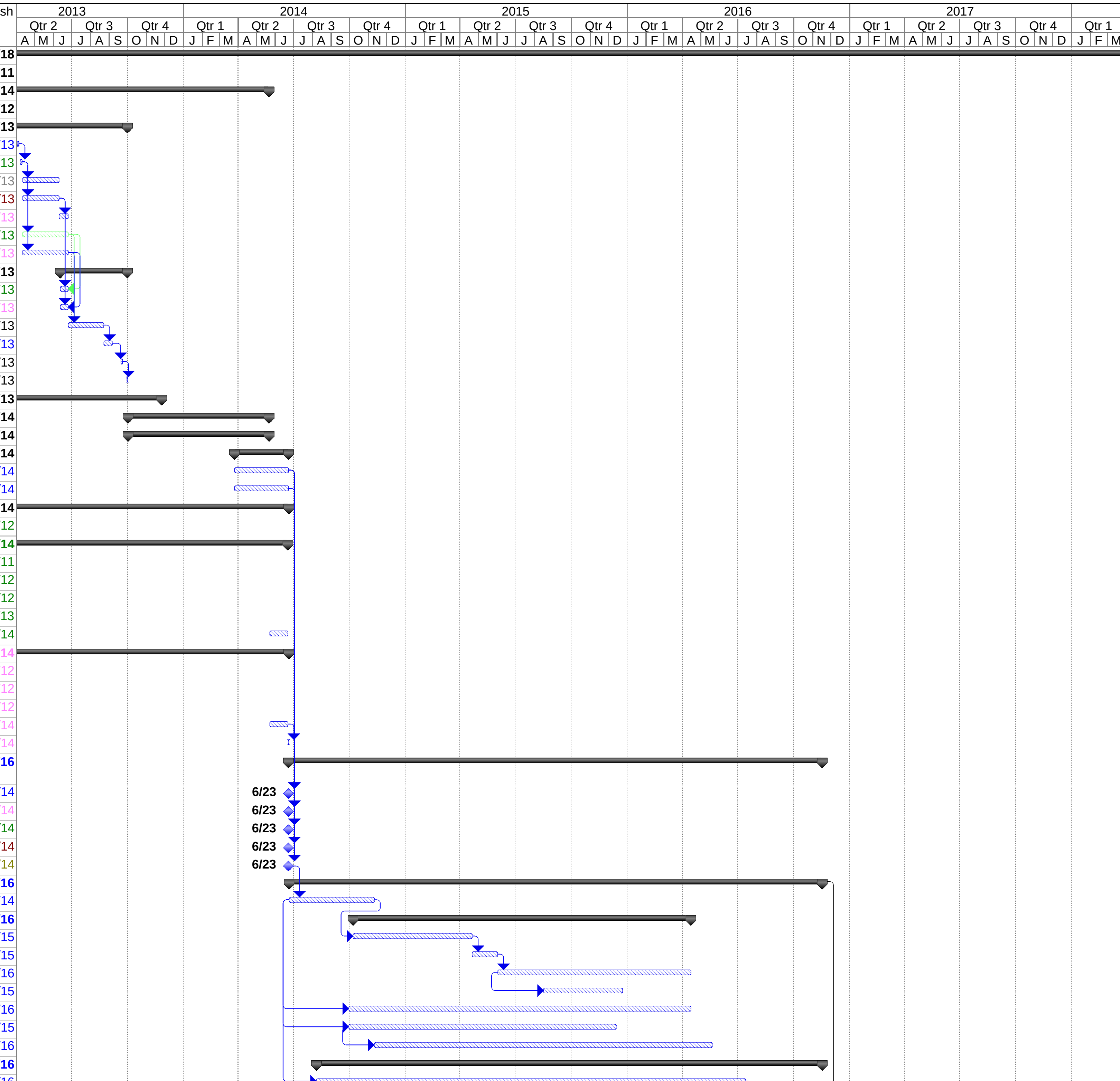
7.6 Construction Yard/Temporary Staging Areas During Construction

In general, construction activities will include the mobilization of equipment (drill rigs, excavators, backhoes, cranes, etc.), supplies (pipes, valves, transformers, etc.), and site workers/contractors (inspectors, supervisors, superintendents, construction workers, etc.) to and from the project site. In addition, there will be site visitors including federal and state agency personnel, Tribal members monitors, and interested stakeholders at a minimum. All of these extra resources and personnel will need to be properly accommodated throughout the duration of the construction phase, which could take two years.

To that end, PG&E has identified potential locations within the project area as possible temporary staging locations for construction activities including a construction yard. It is envisioned that the construction yard will include at a minimum: multiple trailers serving as a work place for personnel, a central check-in/out location for site visitors, a place for daily briefings/project meetings, etc., and staging area for equipment and materials as well as other construction related functions. Figure 7.6-1 shows a preliminary map of all temporary equipment staging areas and the yard, a subset of which PG&E would plan to use for the remedy. These temporary staging areas and the construction yard are located in areas that are already developed or disturbed, consistent with EIR, PA and CHPMP mitigation measures. Between the 60% and 90% design, PG&E will be contacting Moabi Regional Park to further discuss the possibility of PG&E's use of land leased by the Park for a construction yard and will include additional details in the 90% design.

EXHIBIT 7.5-1
TOPOCK REMEDIATION PROJECT SCHEDULE

ID	Task Name	Duration	Forecasted Start	Forecasted Finish
1	**DESIGN, PERMITTING, AND CONSTRUCTION OF GROUNDWATER REMEDY**	**1893.5 days**	**Mon 1/31/11**	**Wed 5/2/18**
2	**Corrective Measure Implementation/Remedial Design (CMI/RD) Workplan**	**199 days**	**Mon 1/31/11**	**Thu 11/3/11**
16	**Remedial Design (Preliminary, Intermediate, and Pre-Final/Final)**	**698.5 days**	**Tue 9/20/11**	**Thu 5/22/14**
17	**Preliminary Design**	**174 days**	**Tue 9/20/11**	**Thu 5/17/12**
29	**Intermediate Design**	**357.5 days**	**Fri 5/18/12**	**Tue 10/1/13**
30	Prepare/submit Intermediate Design Package	11 mons	Fri 5/18/12	Fri 4/5/13
31	DTSC forward to CWG/TWG	3 days	Mon 4/8/13	Wed 4/10/13
32	CWG/TWG review/comment on Intermediate Design Package	60 edays	Thu 4/11/13	Mon 6/10/13
33	Tribes Consultation	60 edays	Thu 4/11/13	Mon 6/10/13
34	BLM process after close of comment period	15 edays	Mon 6/10/13	Tue 6/25/13
35	DTSC review/comment on Intermediate Design Package	75 edays	Thu 4/11/13	Tue 6/25/13
36	DOI review/comment on Intermediate Design Package	75 edays	Thu 4/11/13	Tue 6/25/13
37	**Response to Comments (RTCs)/Comments Resolution**	**78.5 days**	**Thu 6/13/13**	**Tue 10/1/13**
38	DTSC meet with Tribes to discuss comments (timing is approximate, subject to availability)	9 days	Thu 6/13/13	Tue 6/25/13
39	DOI meet with Tribes to discuss comments (timing is approximate, subject to availability)	9 days	Thu 6/13/13	Tue 6/25/13
40	Agencies and PG&E resolve comments (duration is approximate, will verify after receipt of commer	8.5 wks	Wed 6/26/13	Fri 8/23/13
41	Submit RTCs to Agencies, Tribes and Stakeholders (duration is approximate, will verify after Agenc	2 wks	Fri 8/23/13	Fri 9/6/13
42	Meeting to discuss RTCs (2 weeks after submit RTCs)	1 day	Fri 9/20/13	Mon 9/23/13
43	Comment resolution complete (1 week after RTC meeting)	1 day	Mon 9/30/13	Tue 10/1/13
44	**Intermediate Design Addendum**	**268 days**	**Fri 11/16/12**	**Tue 11/26/13**
95	**Pre-Final/Final Design (include plan for decommissioning, removal, and restoration of IM3 facility)**	**166 days**	**Wed 10/2/13**	**Thu 5/22/14**
107	**Construction/Remedial Action Work Plan**	**166 days**	**Wed 10/2/13**	**Thu 5/22/14**
119	**ROWs/Easements/Landowner Agreements/Approvals/Compliance**	**63 days**	**Wed 3/26/14**	**Mon 6/23/14**
120	Other Approvals and Compliance	3 mons	Wed 3/26/14	Mon 6/23/14
121	Landowner Agreements/Leasing/ROW Agreements	3 mons	Wed 3/26/14	Mon 6/23/14
122	**Community Outreach**	**708 days**	**Fri 10/7/11**	**Mon 6/23/14**
123	Prepare/Issue Project Update Factsheet	4 mons	Fri 10/7/11	Tue 1/31/12
124	**Community Outreach Activities (State)**	**707 days**	**Fri 10/7/11**	**Sun 6/22/14**
125	Update mailing list	2.95 mons	Fri 10/7/11	Fri 12/30/11
126	Conduct Community Survey	1.62 mons	Tue 1/31/12	Fri 3/16/12
127	Conduct Community Interview	2 mons	Wed 4/25/12	Thu 6/21/12
128	Prepare/Issue Community Outreach Plan	7.1 mons	Mon 3/19/12	Wed 1/16/13
129	Prepare/Issue factsheet for Corrective Measures Implementation	30 edays	Fri 5/23/14	Sun 6/22/14
130	**Outreach/Public Participation Activities (Federal)**	**625 days**	**Tue 1/31/12**	**Mon 6/23/14**
131	Conduct Community Survey	1.62 mons	Tue 1/31/12	Fri 3/16/12
132	Conduct Community Interview	2 mons	Wed 4/25/12	Thu 6/21/12
133	Update Community Involvement Plan	2.43 mons	Fri 6/22/12	Sat 9/1/12
134	Prepare/issue factsheet for Remedy Implementation	30 edays	Fri 5/23/14	Sun 6/22/14
135	Open house	1 day	Mon 6/23/14	Mon 6/23/14
136	**Remedy Construction/Shakedown (the duration and sequencing shown is preliminary and will be revisited/ optimized at 90% design stage with resource loading)**	**628 days**	**Mon 6/23/14**	**Thu 11/17/16**
137	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 6/23/14	Mon 6/23/14
138	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 6/23/14	Mon 6/23/14
139	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 6/23/14	Mon 6/23/14
140	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 6/23/14	Mon 6/23/14
141	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 6/23/14	Mon 6/23/14
142	**Construction Activities**	**627 days**	**Tue 6/24/14**	**Thu 11/17/16**
143	Field Preparation (including new well survey)	100 days	Tue 6/24/14	Tue 11/11/14
144	**Well Installation/Development/Testing**	**398 days**	**Tue 10/7/14**	**Fri 4/15/16**
145	Pilot Boring Data Collection	140 days	Tue 10/7/14	Tue 4/21/15
146	Refine Well Design and Installation Program	30 days	Tue 4/21/15	Tue 6/2/15
147	Remediation Wells Installation/Development/Testing	228 days	Tue 6/2/15	Fri 4/15/16
148	Monitoring Wells Installation/Development	94 days	Mon 8/17/15	Thu 12/24/15
149	Install New Pipeline	403 days	Tue 9/30/14	Fri 4/15/16
150	Carbon Amendment/Supporting Facilities	314 days	Tue 9/30/14	Mon 12/14/15
151	Commissioning/Shakedown	398 days	Tue 11/11/14	Fri 5/20/16
152	**Reporting**	**594 days**	**Fri 8/8/14**	**Thu 11/17/16**
153	Prepare/submit monthly construction progress reports	24 mons	Fri 8/8/14	Thu 7/14/16



Project: PG&E Topock Remediation Project
Date: Wed 4/3/13

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.

TABLE 7.2-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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	CMI/RD Work Plan	Revised CMI/RD Work Plan submitted on November 2, 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	Preliminary Design submitted on November 18, 2011 Intermediate – April 5, 2013 Intermediate Addendum – July 2013 Final – December 2013 Revised Final – May 2014
	• Waste management practices	O&M Plan, Construction/ Remedial Action Work Plan	See O&M Plan, Construction Work Plan
	• Site safety and security provisions	Intermediate and Final Design Submittals	Intermediate – April 5, 2013 Intermediate Addendum – July 2013 Final – December 2013

TABLE 7.2-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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 Design submitted on November 18, 2011 Intermediate – April 5, 2013 Intermediate Addendum – July 2013
	• 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 – December 2013 Revised Final – May 2014
Operations and Maintenance Plan	• Project management • System description • Personnel training • Start-up 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 O&M Manual submitted on April 5, 2013 Final – December 2013 Revised Final – May2014

TABLE 7.2-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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 – December 2013 Final – May 2014
	• 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 7.2-1
Cross Reference of 1996 CACA Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	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	CMI/RD Work Plan	Revised CMI/RD Work Plan submitted on November 2, 2011
	• Construction Quality Assurance Plan	Construction/Remedial Action Work Plan (see Table 7.2-3 for content)	Draft – December 2013 Final – May 2014
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	November 2011

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Future Documents will contain or satisfy this requirements	Target Submittal Schedule
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 • Draft construction schedule • Geotechnical analysis In addition, the following items may be required: • Equipment lists • Site preparation and fieldwork standards • Responses to preliminary design review comments	Intermediate Design Submittals (see Table 7.2-3 for content)	April 5, 2013 July 2012 (Intermediate Addendum)
Pre-Final (90%) and Final Design (100%)	• Final Basis of Design • Final plans and specifications • Operations and Maintenance Plan • Contractor Construction Quality Assurance Project Plan (CCQAPP) • Field Sampling Plan • Contingency Plan • IM-3 Decommissioning Plan • RA schedule • Refined cost estimates • Construction schedule In addition, the following items may be required: • Site preparation and fieldwork standards • Equipment lists • Responses to intermediate design review comments • Responses to pre-final design review comments	Final Design Submittals (see Table 7.2-3 for content)	Final – December 2013 Revised Final – May 2014
Operations and Maintenance Plan	• See CD, Appendix C (Scope of Work)	Operations and Maintenance Plan (see Table 7.2-3 for content)	Draft O&M Manual submitted on April 5, 2013 Final – December 2013 Revised Final – May 2014
Field Sampling Plan	• See CD, Appendix C (Scope of Work)	Operations and Maintenance Plan, Construction/Remedial Action Work Plan	See submittal schedule for corresponding plans

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Future Documents will contain or satisfy this requirements	Target Submittal Schedule
Contingency Plan	• See CD, Appendix C (Scope of Work)	Operations and Maintenance Plan, Construction/Remedial Action Work Plan	See submittal schedule for corresponding plans
Health and Safety Plan	• See CD, Appendix C (Scope of Work)	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 CD, Appendix C (Scope of Work)	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 • Sampling and monitoring during construction • Methods for implementing CCQAPP/O&M Plan/Construction Contingency Plan • Protocols for documenting ARARs compliance Identification of the remedial action team • CCQAPP • Disposal of materials • Requirements for project closeout • Site Management Plan • IM-3 Decommissioning Plan • Project Management Plan • Habitat Restoration Plan • Decontamination Plan • Data management • Collection and maintenance of information In addition, the following items may be required: • Communication procedures and protocols	Construction/Remedial Action Work Plan, Health and Safety Plan	Draft – December 2013 Final – May 2014

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	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.	Progress reports	Submittal schedule will be established in the Construction/RA Work Plan
RA Construction Completion Report	• Purpose • Synopsis of the final remedial action, design criteria, and certification that the remedial action 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 indicate how initial operation of the final groundwater remedy compares to the design criteria • Summary of any significant deviations (e.g., technical field changes, cost variances, revised assumption)from the ROD or approved works plans made during construction • Summary of significant activities that occurred during construction • Summary of any inspection findings • As-built drawings • A schedule indicating when the treatment system will begin full scale operations	Corrective Measure/Remedial Action Construction Completion Report	Submittal schedule will be established in the Construction/RA Work Plan

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Future Documents
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Future Documents will contain or satisfy this requirements	Target Submittal Schedule
Five-Year Review Process - Studies/Investigations as requested by DOI	• See CD, Appendix C (Scope of Work)	As requested by DOI	
RA Completion Report	• Purpose • Synopsis • Remedial completion criteria, including a description of the process and criteria for determining when corrective measures, maintenance, and monitoring may cease. • Demonstration that the RAOs 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/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
Remedy Decommissioning Plan	• Procedures for the removal and decommissioning of the groundwater remedy system and associated infrastructure • Post-remedy restoration	Remedy Decommissioning Plan	Submittal schedule will be established in the Construction/RA Work Plan

Note:
CD = Remedial Action/Remedial Design Consent Decree between PG&E and the United States (DOI 2013).

TABLE 7.2-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

A. Submittals Required by 1996 CACA/2013 CD/Settlement Agreement (see Exhibit 7.2-1 and Tables 7.2-1/7.2-2 for submittal schedule)

Preliminary Design Package (For Review/Comment Only)	**Intermediate Design Package (For Review/Comment Only)**	**Pre-Final/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 - Geotechnical Analysis - 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 - Geotechnical Analysis - Additional design data mapped, surveyed, or collected post CMS/FS - Equipment list - Long-lead procurement considerations - Updated schedule and cost estimates - O&M Plan and support appendices - Construction Quality Assurance Project Plan - Field Sampling Plan - Contingency Plan - IM-3 Decommissioning Plan • **Final Plans** - Site plans - Engineering/architectural drawings - Excavation/earthwork drawings - Construction/installation drawings - PFDs - P&IDs • **Final Specifications** - Detailed specifications

TABLE 7.2-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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, including well rehabilitation methods and chemicals use, 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 7.2-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Intermediate (60%) 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]

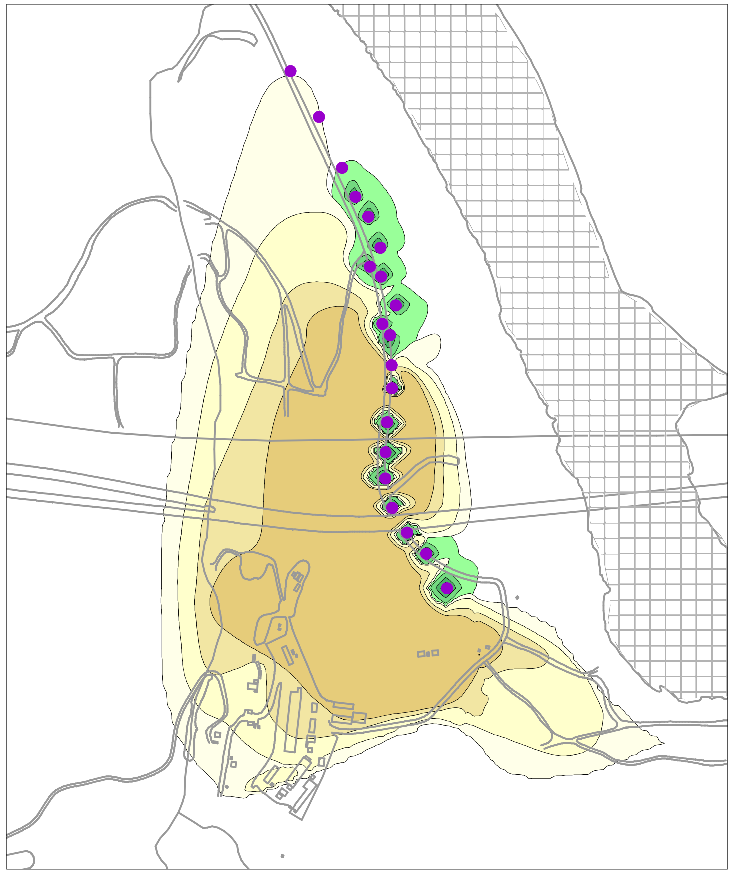
B. Submittals to meet substantive requirements of ARARs (not otherwise included in the above documents) (see Exhibit 7.2-1 and Tables 7.2-1/7.2-2 for submittal schedule)		
Key ARARs Compliance Submittals Concurrent with Preliminary Design Package	**Key ARARs Compliance Submittals Concurrent with Intermediate Design Package**	**Key ARARs Compliance Submittals Concurrent with Final Design Package/ Final Construction/Remedial Action Work Plan**
	• Soil Management Plan (ARAR #86)	• 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) • 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 (ARAR #41) • Delineation of waters and wetlands field survey addendum (ARAR #27, 32, 63)

TABLE 7.2-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

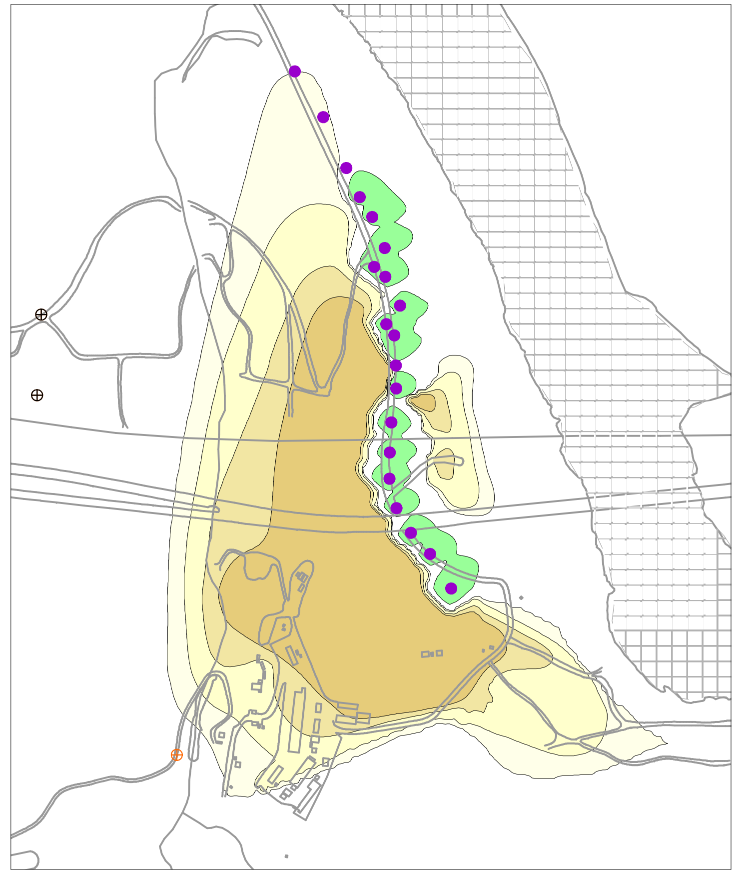
C. Submittals to meet EIR MMRP requirements (see Exhibit 7.2-1 and Tables 7.2-1/7.2-2 for submittal schedule)		
EIR Compliance Submittals Concurrent with Preliminary Design	**EIR Compliance Submittals Concurrent with Intermediate Design Package/ Draft O&M Plan**	**EIR Compliance Submittals Concurrent with Final Design Package/Final O&M Plan/Final Construction/Remedial Action Work Plan**
• Aerial map of disturbed areas (CUL-1a-9) • Map of ordinary high water mark (AES-2a)	• Aerial map of disturbed areas (CUL-1a-9) • Map of ordinary high water mark (AES-2a) • Map of mature plant species (AES-1a/AES-2) • Map of indigenous species listed in Appendix PLA of the EIR (CUL-1a-5) • Soil Management Plan (HAZ-2c)	• 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)** • Site Security Plan (CUL-1a-3b) • Access Plan (CUL-1a-2) • Storm Water Pollution Prevention Plan (SWPPP)/BMP plans and Monitoring & Reporting (HYDRO-1) • 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)** • Revegetation plan for riparian areas including USACE/CDFW jurisdictional areas(BIO-1) **(Agreeable to USACE, DFG, BLM, USFWS)** • Revegetation plan for riparian areas (AES-1b/1c/1e, AES-2c/d/f) • Delineation of waters and wetlands field survey addendum (BIO-1) • Hydrologic analysis (WATER-1) • Fueling SOPs for Onsite Fueling Areas (HAZ-1b-b) • 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)**

Note:
[1] For definition of Institutional Controls, see Section 5 of this Basis of Design Report.

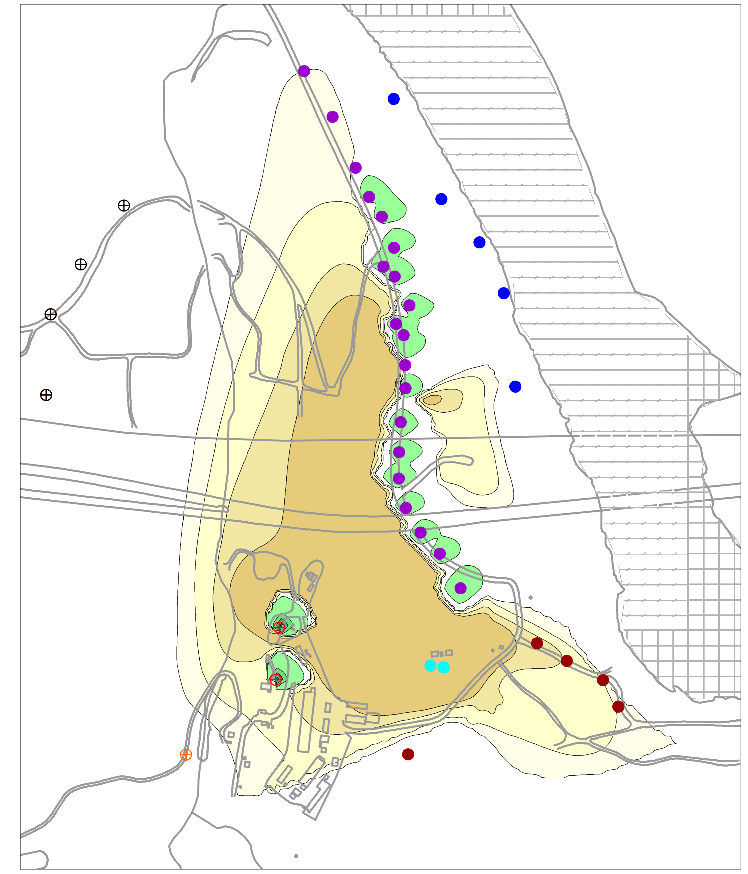
1A



Transition Month 6
NTH IRZ ON



Transition Month 9
FW ON



Transition Month 12
FW, TCS Recirculation Loop, & IRL ON

LEGEND

- NTH IRZ WELLS
- RIVERBANK EXTRACTION WELLS
- IRL INJECTION WELLS
- FRESHWATER INJECTION WELLS
- TCS INJECTION WELLS
- TRANSWESTERN BENCH EXTRACTION WELLS
- EAST RAVINE EXTRACTION WELLS

N

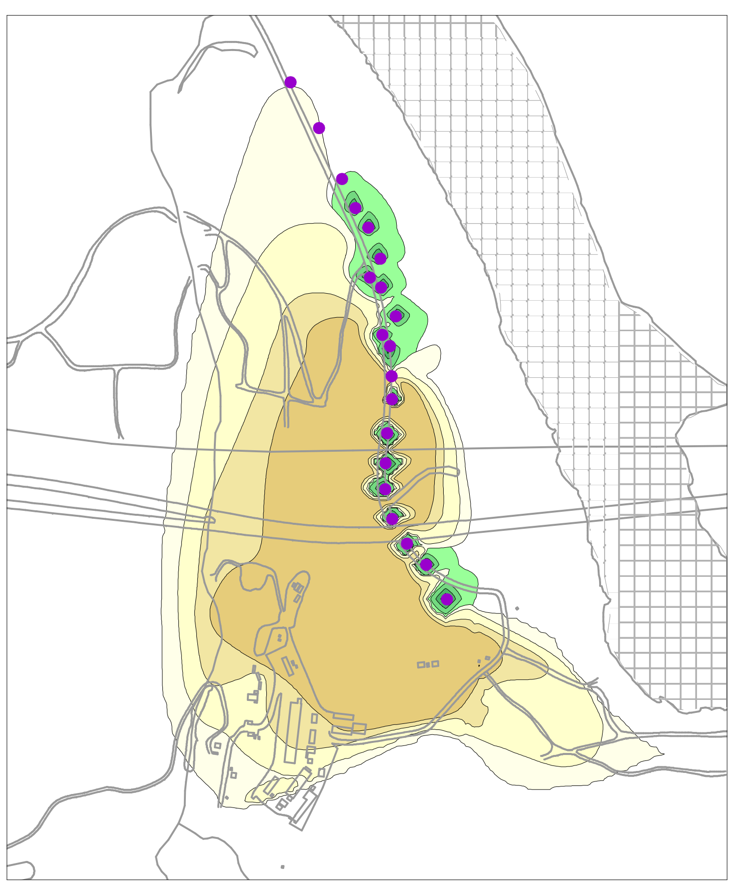
*Note: The intermediate nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive carbon-amended River Bank extraction well water if hexavalent chromium concentrations in the River Bank extraction wells exceed the clean-up goal; and IRL-3 and IRL-4 (southern wells) will receive freshwater. Therefore, the startup scenarios include IRL-3 and IRL-4 with the FW ON; IRL ON includes only IRL-1 and IRL-2. Injection wells IRL-1 through IRL-4 will be constructed for flexibility to inject either/both freshwater or/and River Bank extraction well water during the lifetime of the remedy. FW-1 (not shown) is located west of the area shown.

SCALE IN FEET
0 1,000 2,000

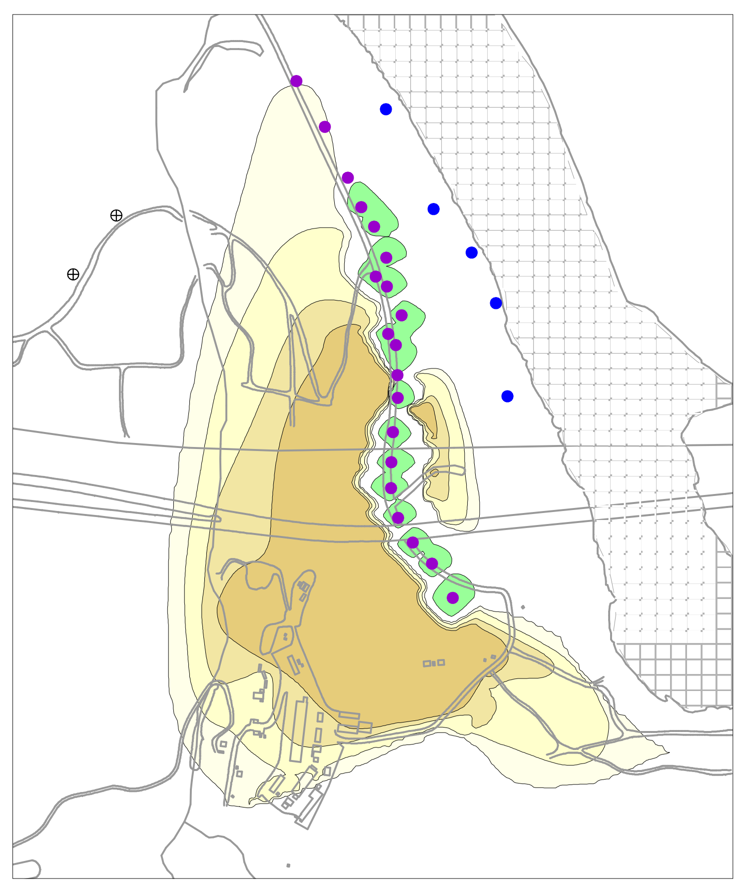
SCENARIO 1A START UP SCHEDULE

Months 0-6: NTH IRZ ON
Months 6-9: NTH IRZ OFF and FW ON
Months 9-12: NTH IRZ OFF and FW, TCS Recirculation Loop, & IRL ON

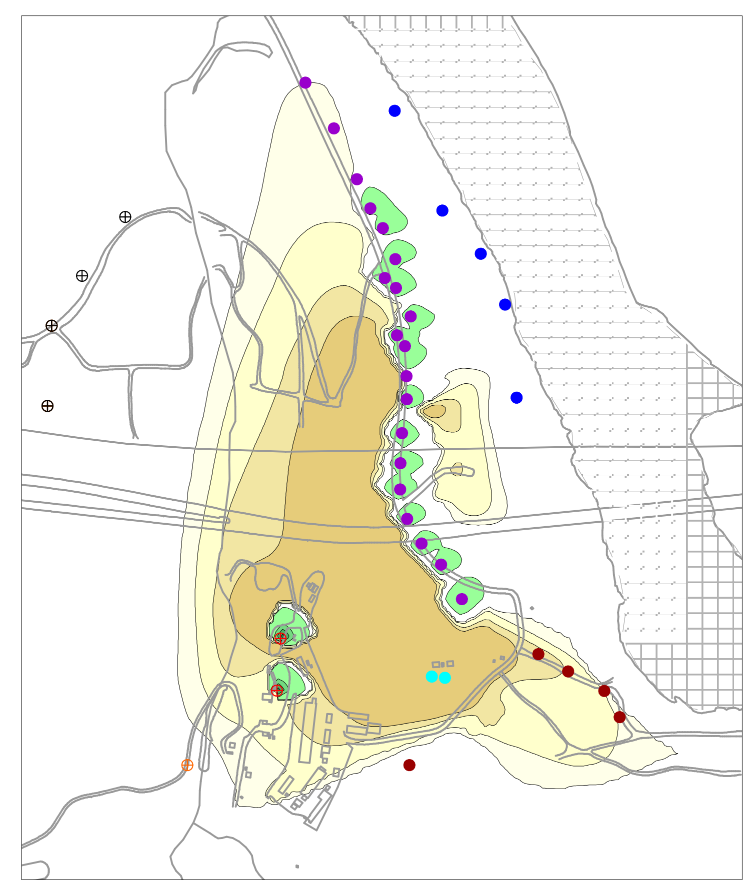
2A



Transition Month 6
NTH IRZ ON



Transition Month 9
IRL ON



Transition Month 12
IRL, FW, & TCS Recirculation Loop ON

SCENARIO 2A START UP SCHEDULE

Months 0-6: NTH IRZ ON
Months 6-9: NTH IRZ OFF and IRL ON
Months 9-12: NTH IRZ OFF and FW, TCS Recirculation Loop, & IRL ON

Hexavalent Chromium Concentration (ppb)
32 100 500 1,000 5,000 10,000 15,000

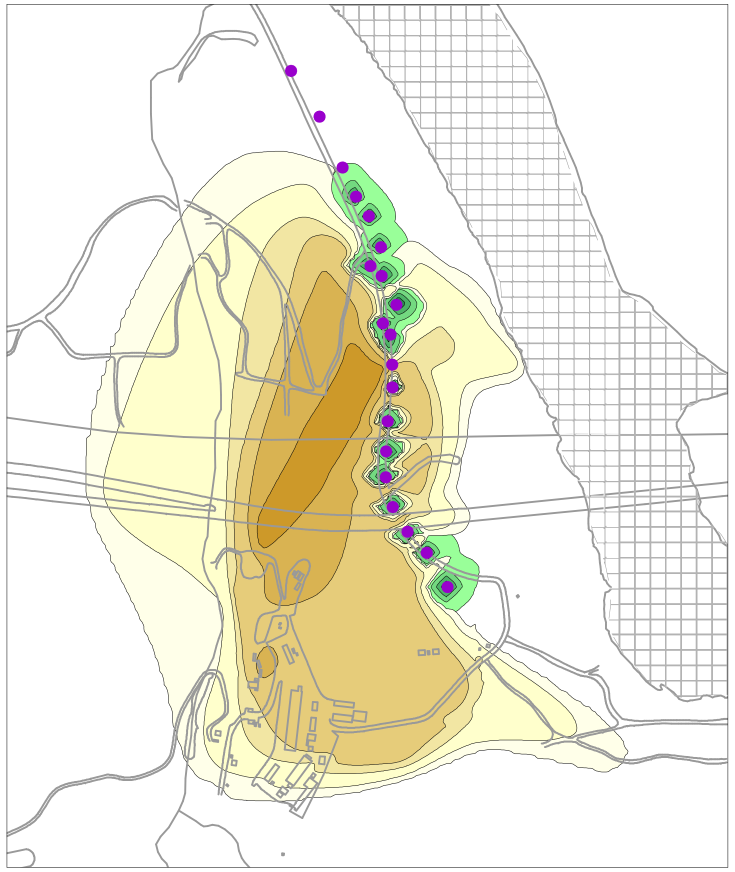
Total Organic Carbon Concentration (ppm)
1 25 50 75 100

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

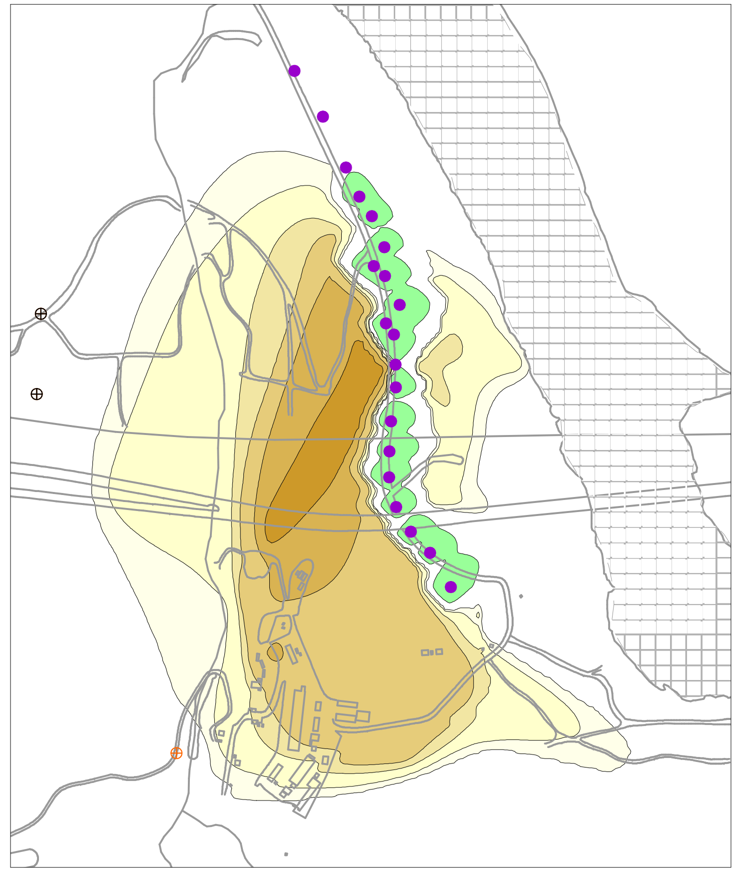
SIMULATED HEXAVALENT CHROMIUM TRANSPORT IN MODEL LAYER 2 FOR 1 YEAR START UP SCENARIOS

ARCADIS

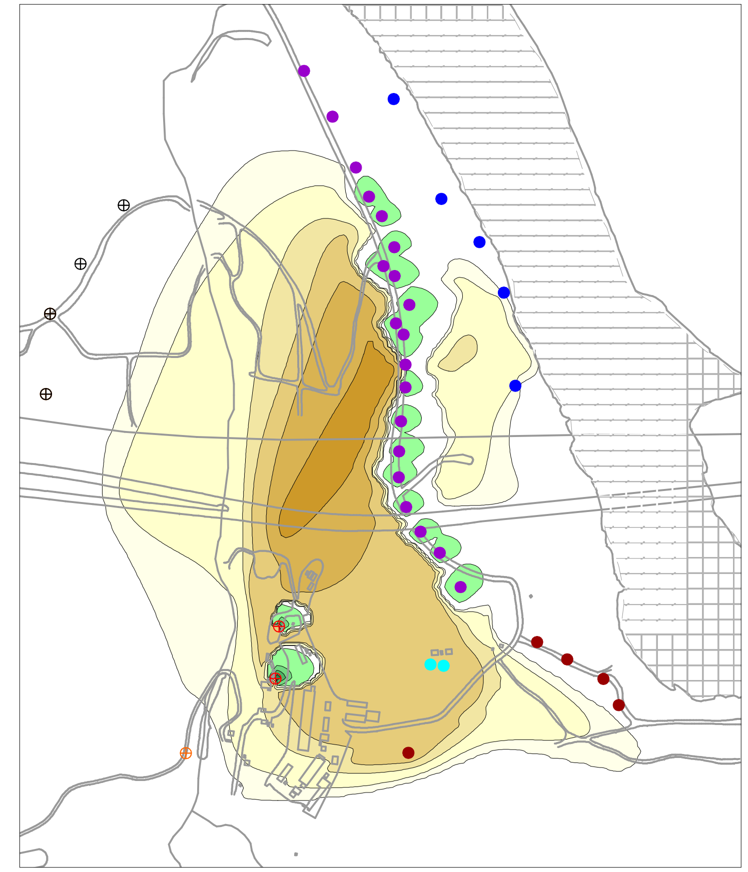
FIGURE
7.3-1



Transition Month 6
NTH IRZ ON



Transition Month 9
FW ON



Transition Month 12
FW, TCS Recirculation Loop, & IRL ON

1A

LEGEND

- NTH IRZ WELLS
- RIVERBANK EXTRACTION WELLS
- IRL INJECTION WELLS
- FRESHWATER INJECTION WELLS
- TCS INJECTION WELLS
- TRANSWESTERN BENCH EXTRACTION WELLS
- EAST RAVINE EXTRACTION WELLS

N

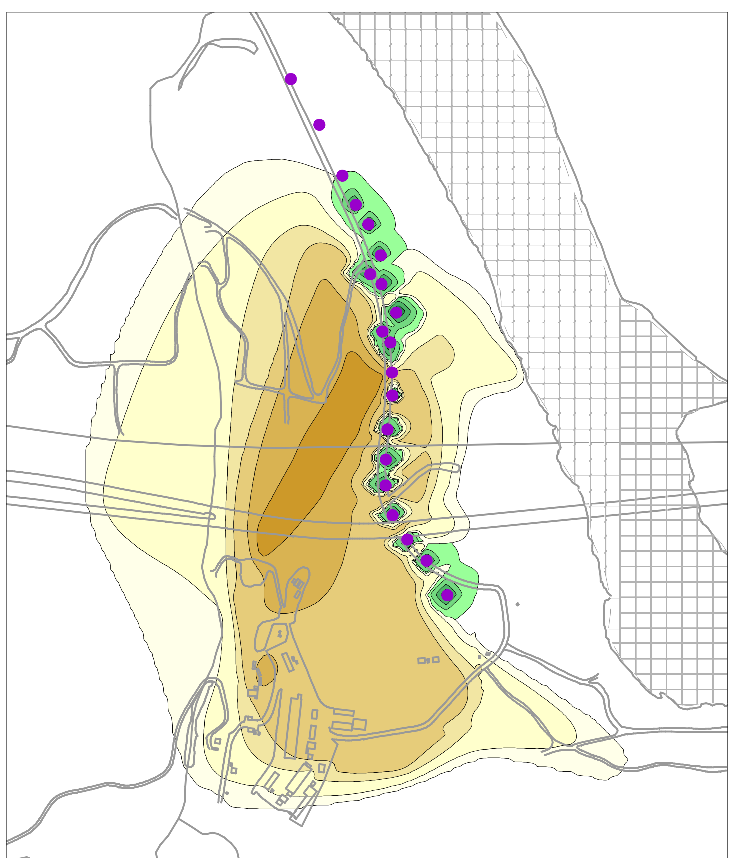
*Note: The intermediate nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive carbon-amended River Bank extraction well water if hexavalent chromium concentrations in the River Bank extraction wells exceed the clean-up goal; and IRL-3 and IRL-4 (southern wells) will receive freshwater. Therefore, the startup scenarios include IRL-3 and IRL-4 with the FW ON; IRL ON includes only IRL-1 and IRL-2. Injection wells IRL-1 through IRL-4 will be constructed for flexibility to inject either/both freshwater or/and River Bank extraction well water during the lifetime of the remedy. FW-1 (not shown) is located west of the area shown.

SCALE IN FEET

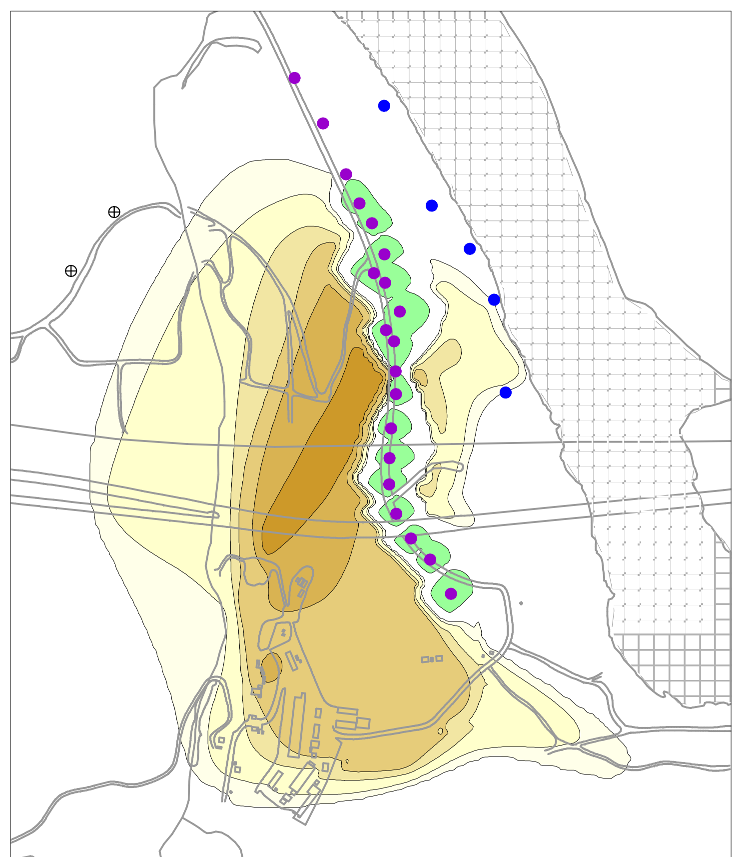
0 1,000 2,000

SCENARIO 1A START UP SCHEDULE

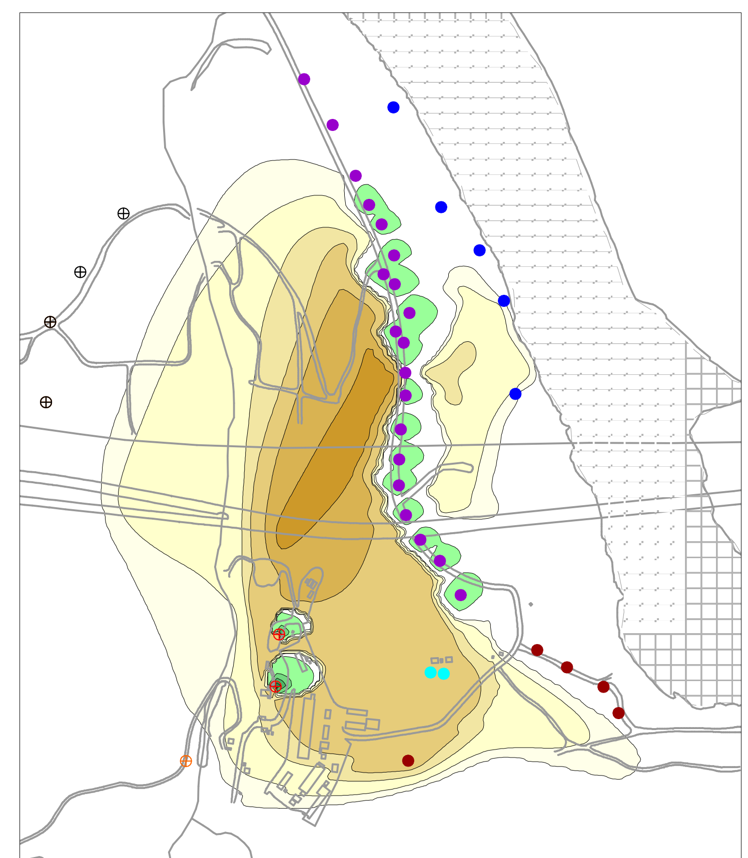
Months 0-6: NTH IRZ ON
Months 6-9: NTH IRZ OFF and FW ON
Months 9-12: NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON



Transition Month 6
NTH IRZ ON



Transition Month 9
IRL ON



Transition Month 12
IRL, FW, & TCS Recirculation Loop ON

2A

SCENARIO 2A START UP SCHEDULE

Months 0-6: NTH IRZ ON
Months 6-9: NTH IRZ OFF and IRL ON
Months 9-12: NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON

Hexavalent Chromium Concentration (ppb)

32 100 500 1,000 5,000 10,000 15,000

Total Organic Carbon Concentration (ppm)

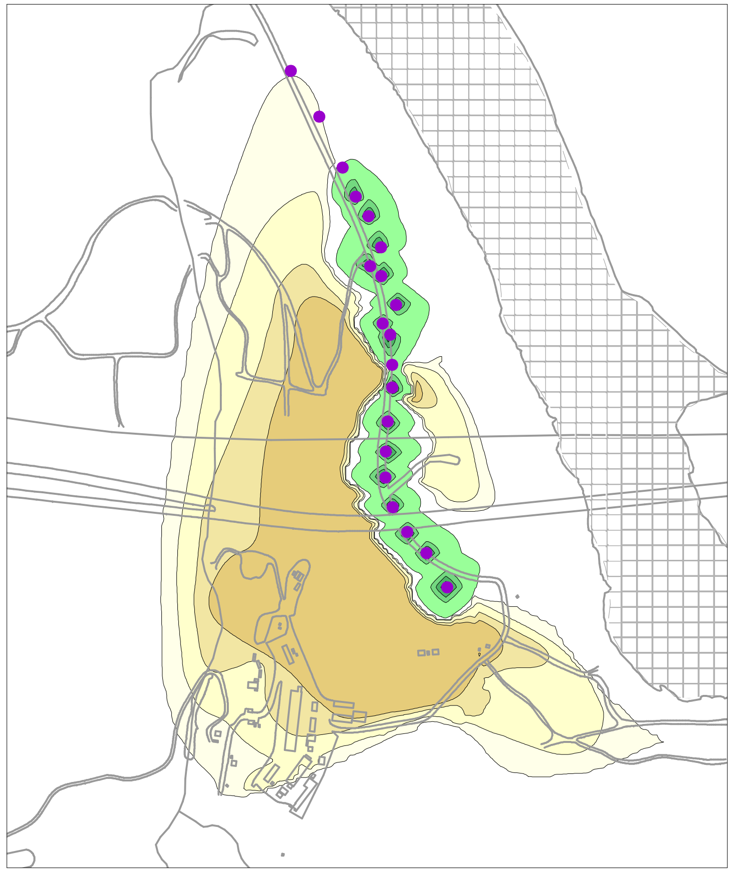
1 25 50 75 100

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

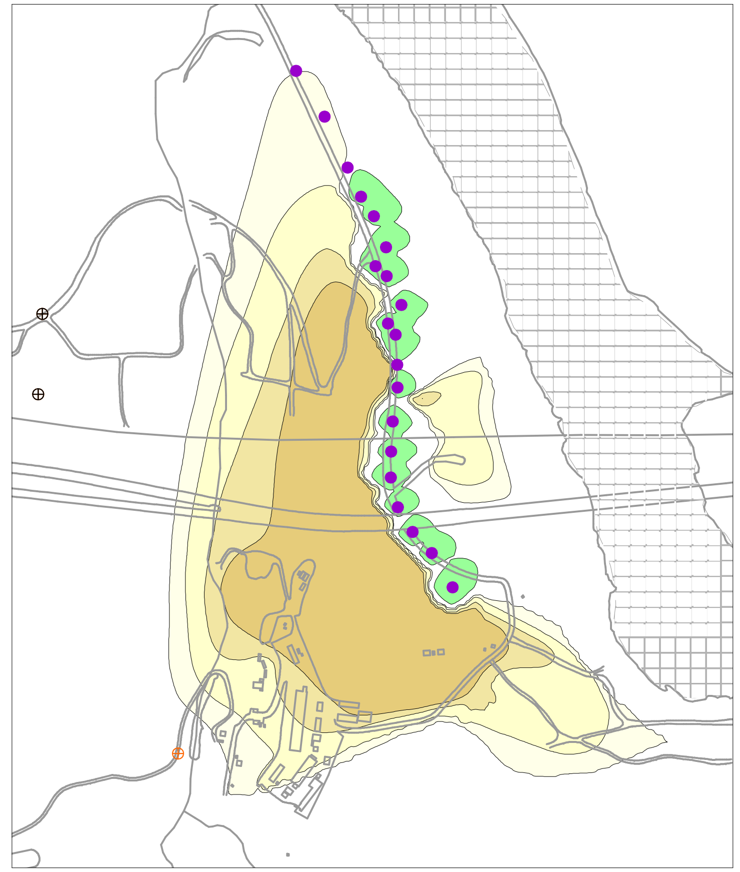
SIMULATED HEXAVALENT CHROMIUM TRANSPORT IN MODEL LAYER 4 FOR 1 YEAR START UP SCENARIOS

ARCADIS

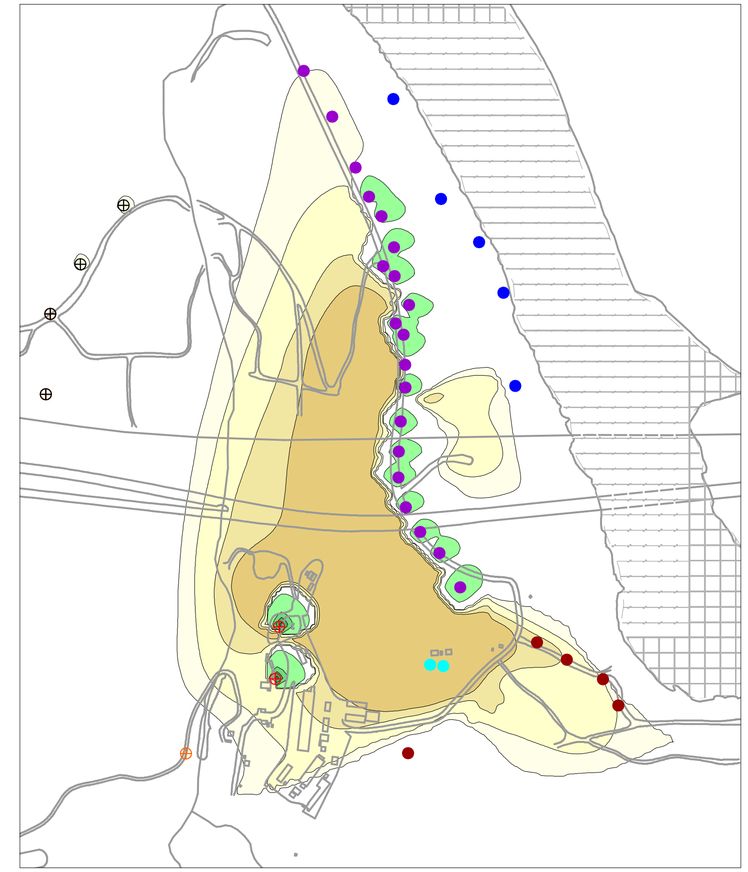
FIGURE
7.3-2



Transition Month 12
NTH IRZ ON



Transition Month 18
FW ON



Transition Month 24
FW, TCS Recirculation Loop, & IRL ON

LEGEND

- NTH IRZ WELLS
- RIVERBANK EXTRACTION WELLS
- IRL INJECTION WELLS
- FRESHWATER INJECTION WELLS
- TCS INJECTION WELLS
- TRANSWESTERN BENCH EXTRACTION WELLS
- EAST RAVINE EXTRACTION WELLS

N

*Note: The intermediate nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive carbon-amended River Bank extraction well water if hexavalent chromium concentrations in the River Bank extraction wells exceed the clean-up goal; and IRL-3 and IRL-4 (southern wells) will receive freshwater. Therefore, the startup scenarios include IRL-3 and IRL-4 with the FW ON; IRL ON includes only IRL-1 and IRL-2. Injection wells IRL-1 through IRL-4 will be constructed for flexibility to inject either/both freshwater or/and River Bank extraction well water during the lifetime of the remedy. FW-1 (not shown) is located west of the area shown.

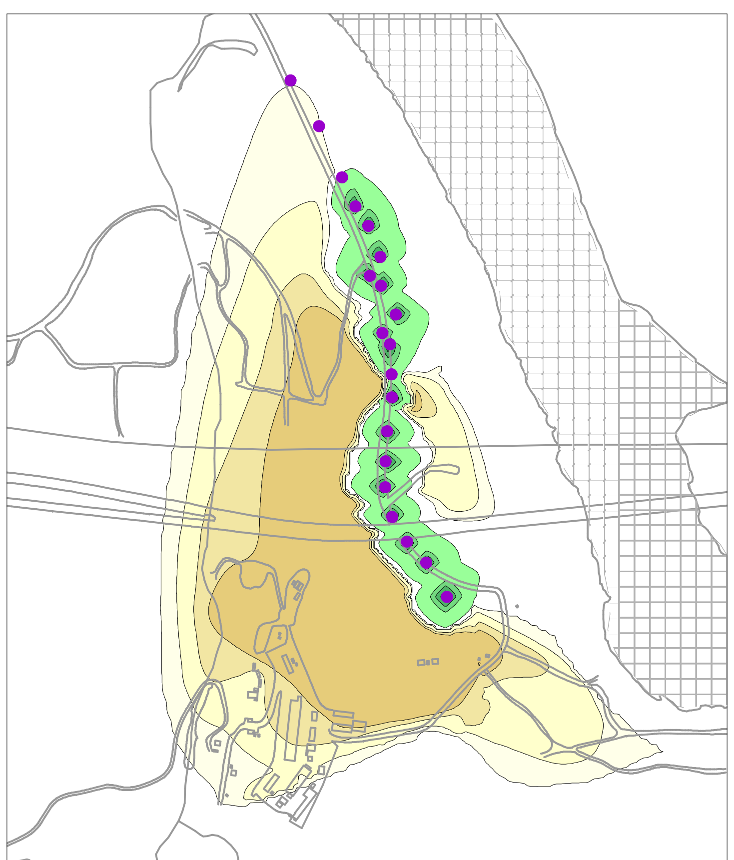
SCALE IN FEET

0 1,000 2,000

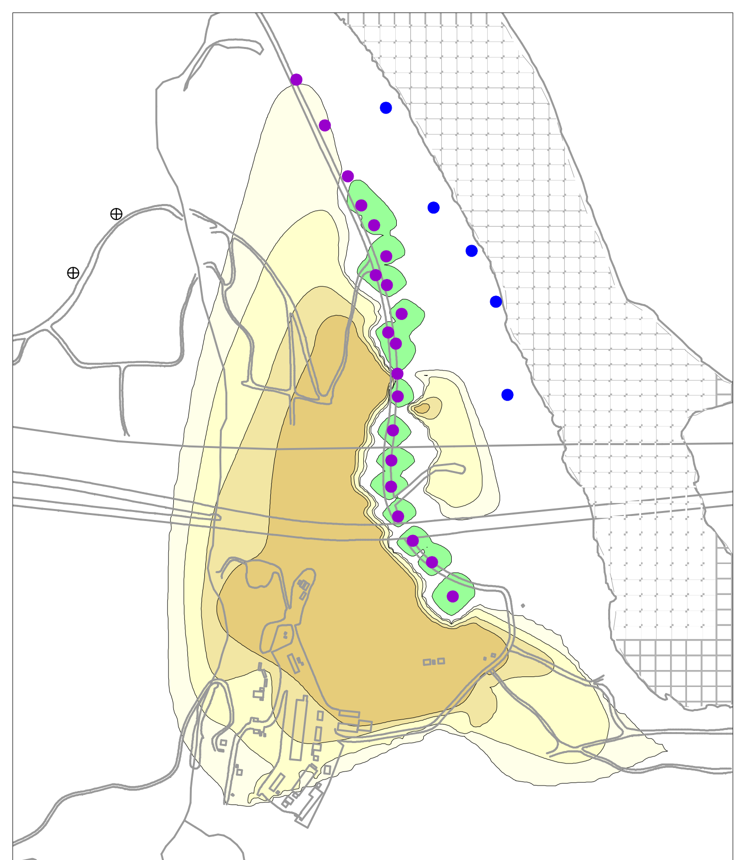
1B

SCENARIO 1B START UP SCHEDULE

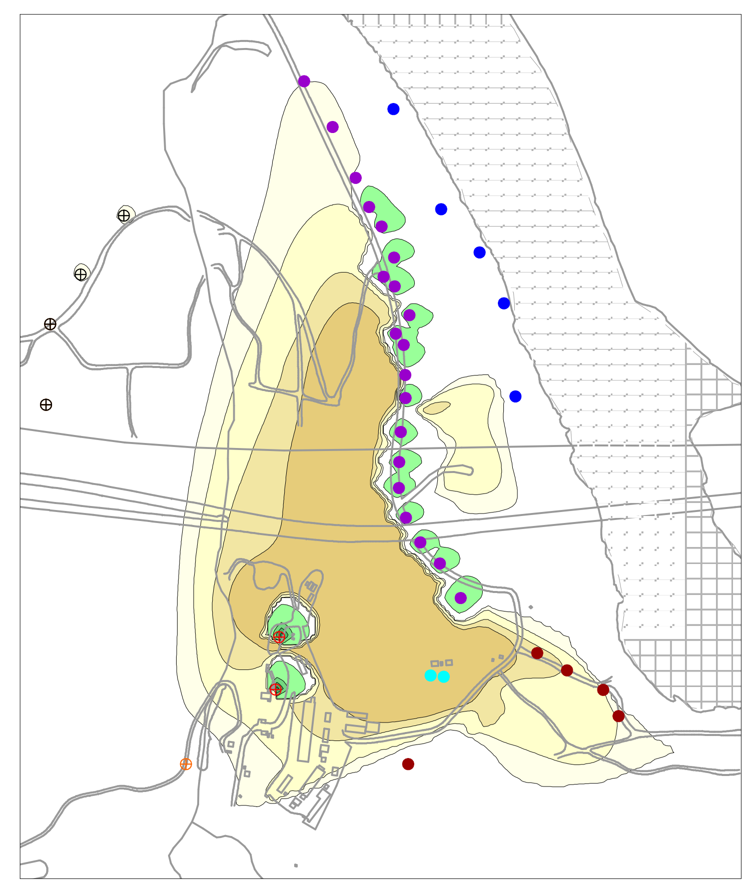
Months 0-12: NTH IRZ ON
Months 12-18: NTH IRZ OFF and FW ON
Months 18-24: NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON



Transition Month 12
NTH IRZ ON



Transition Month 18
IRL ON



Transition Month 24
IRL, FW, & TCS Recirculation Loop ON

2B

SCENARIO 2B START UP SCHEDULE

Months 0-12: NTH IRZ ON
Months 12-18: NTH IRZ OFF and IRL ON
Months 18-24: NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON

Hexavalent Chromium Concentration (ppb)

32 100 500 1,000 5,000 10,000 15,000

Total Organic Carbon Concentration (ppm)

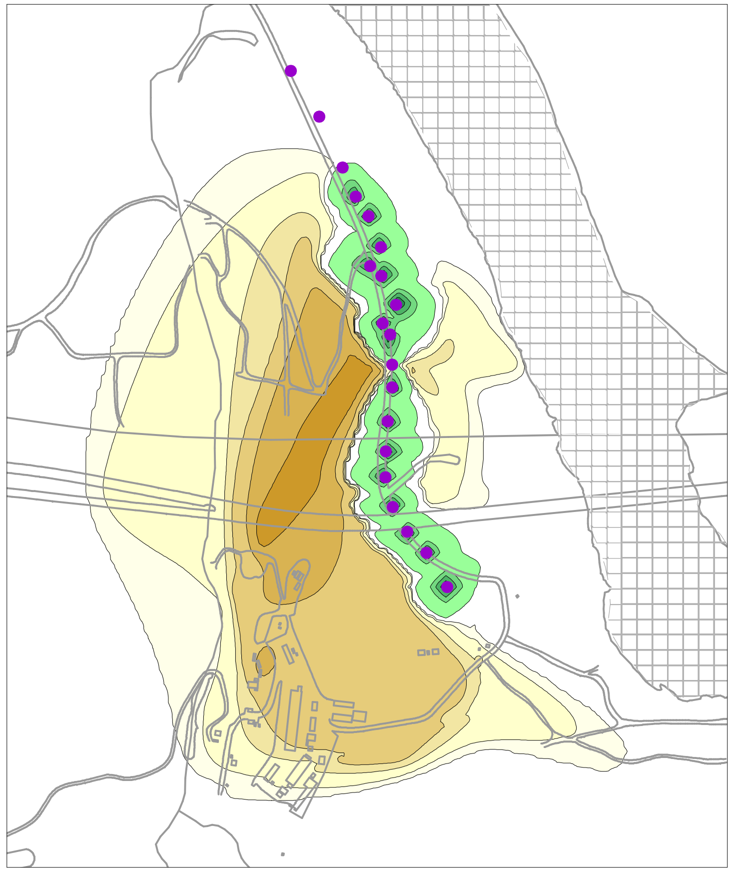
1 25 50 75 100

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

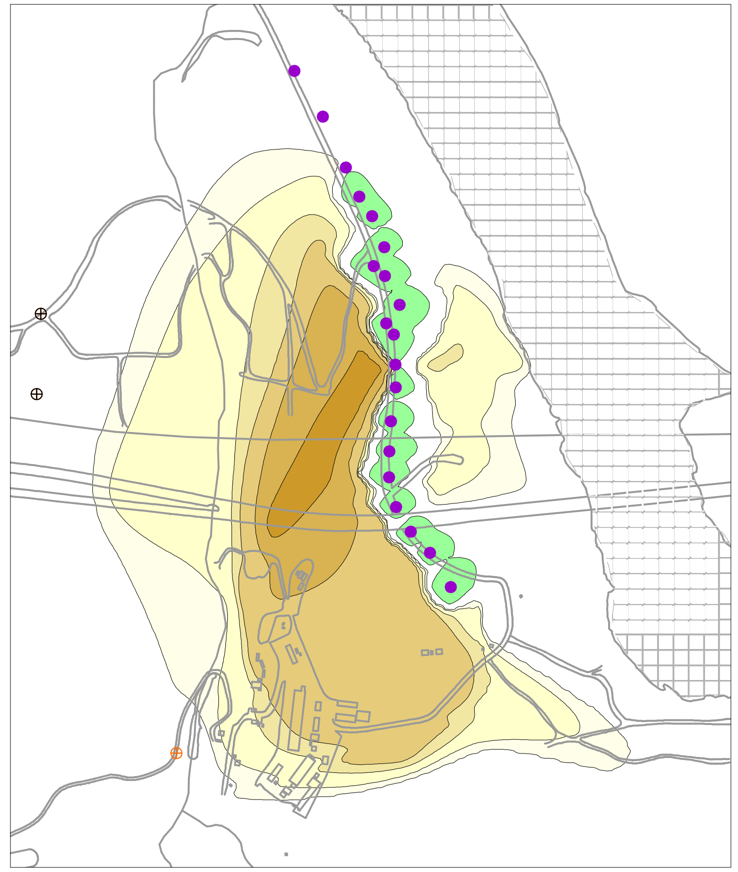
SIMULATED HEXAVALENT CHROMIUM TRANSPORT IN MODEL LAYER 2 FOR 2 YEAR START UP SCENARIOS

ARCADIS

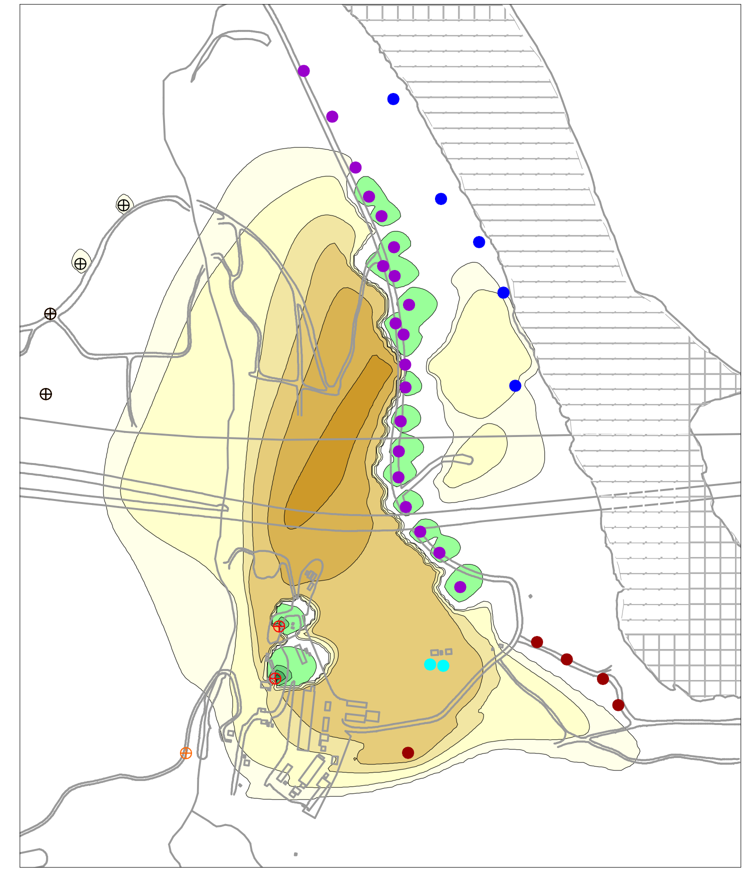
FIGURE
7.3-3



Transition Month 12
NTH IRZ ON



Transition Month 18
FW ON



Transition Month 24
FW, TCS Recirculation Loop, & IRL ON

1B

LEGEND

- NTH IRZ WELLS
- RIVERBANK EXTRACTION WELLS
- IRL INJECTION WELLS
- FRESHWATER INJECTION WELLS
- TCS INJECTION WELLS
- TRANSWESTERN BENCH EXTRACTION WELLS
- EAST RAVINE EXTRACTION WELLS

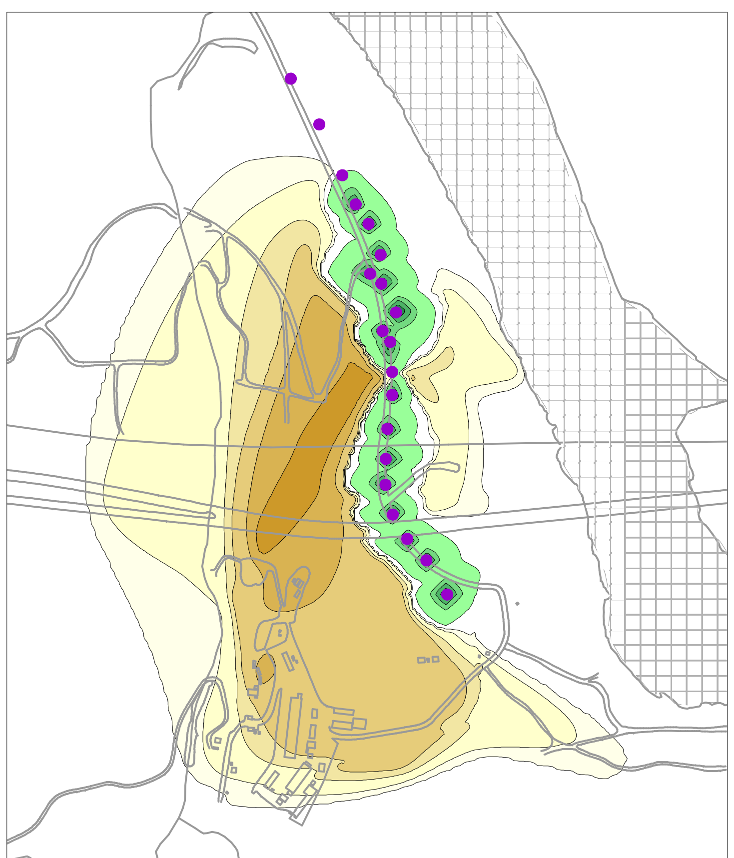
N

*Note: The intermediate nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive carbon-amended River Bank extraction well water if hexavalent chromium concentrations in the River Bank extraction wells exceed the clean-up goal; and IRL-3 and IRL-4 (southern wells) will receive freshwater. Therefore, the startup scenarios include IRL-3 and IRL-4 with the FW ON; IRL ON includes only IRL-1 and IRL-2. Injection wells IRL-1 through IRL-4 will be constructed for flexibility to inject either/both freshwater or/and River Bank extraction well water during the lifetime of the remedy. FW-1 (not shown) is located west of the area shown.

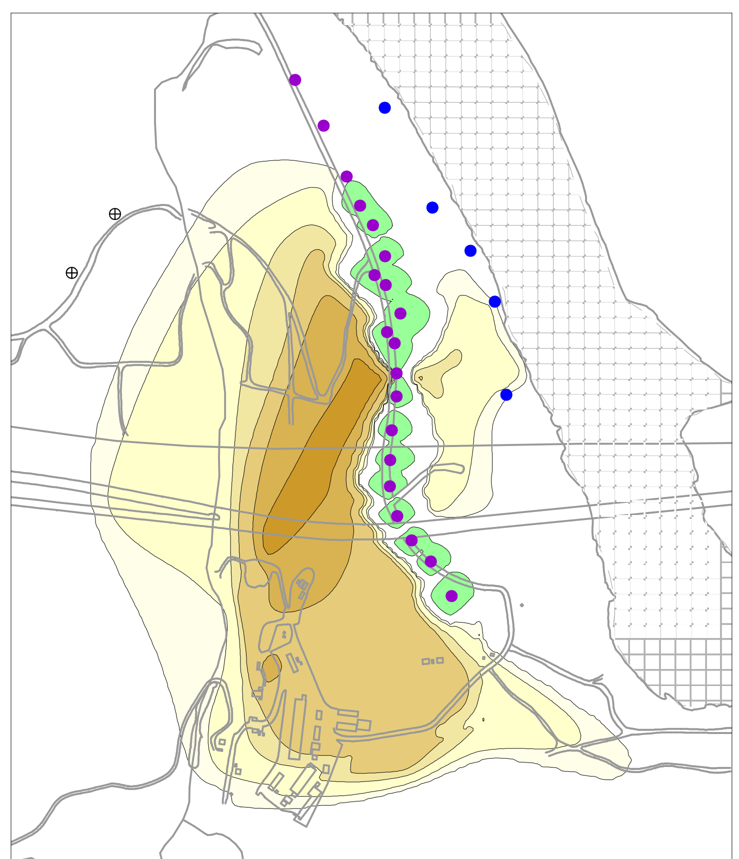
SCALE IN FEET
0 1,000 2,000

SCENARIO 1B START UP SCHEDULE

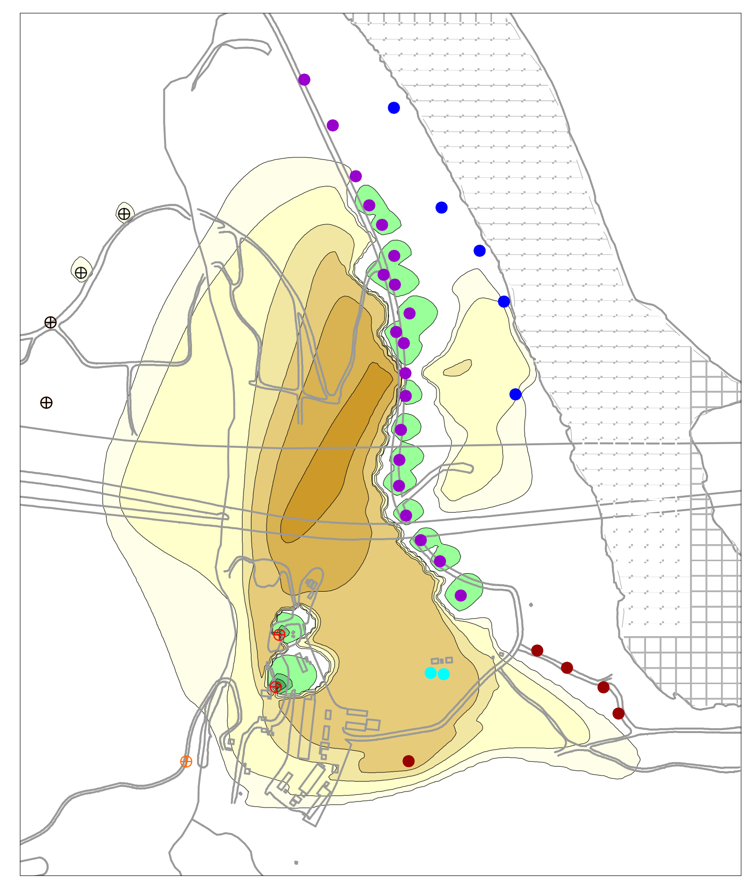
Months 0-12: NTH IRZ ON
Months 12-18: NTH IRZ OFF and FW ON
Months 18-24:NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON



Transition Month 12
NTH IRZ ON



Transition Month 18
IRL ON



Transition Month 24
IRL, FW, & TCS Recirculation Loop ON

2B

SCENARIO 2B START UP SCHEDULE

Months 0-12: NTH IRZ ON
Months 12-18: NTH IRZ OFF and IRL ON
Months 18-24: NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON

Hexavalent Chromium Concentration (ppb)

32 100 500 1,000 5,000 10,000 15,000

Total Organic Carbon Concentration (ppm)

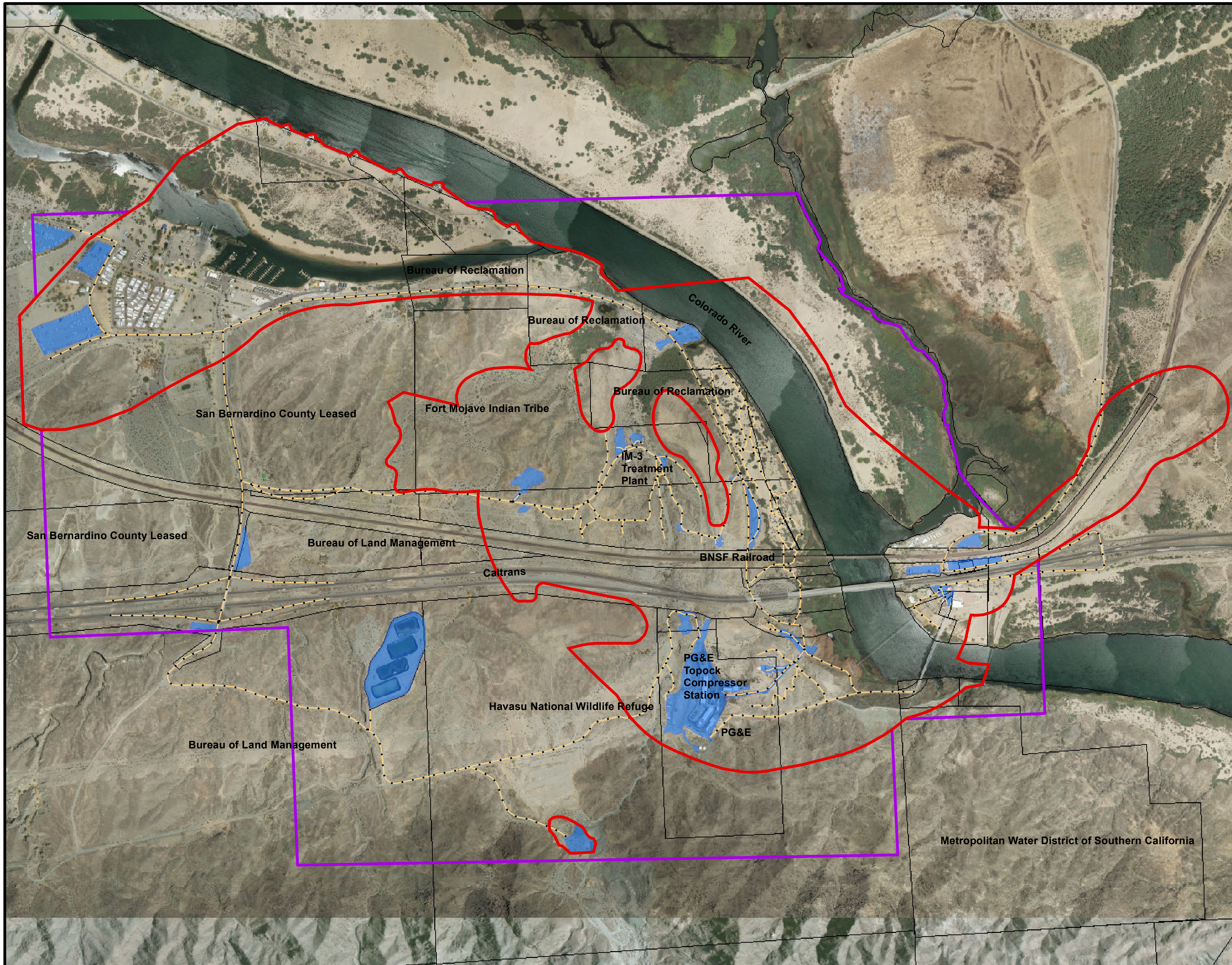
1 25 50 75 100

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SIMULATED HEXAVALENT CHROMIUM
TRANSPORT IN MODEL LAYER 4 FOR
2 YEAR START UP SCENARIOS

ARCADIS

FIGURE
7.3-4



LEGEND

EIR Project Area

Area of Potential Effects (APE)

Proposed Access Routes

Proposed Staging Areas Including Construction Yard

Notes:
1. PG&E may use all or a subset of these potential temporary staging areas during remedy construction.
2. Note that in compliance with EIR mitigation measure CUL-1a-9 as well as PA and CHPMP mitigation measures, the proposed access route west of National Trails Highway is located in an existing, previously disturbed, access road. The location of the access road was field verified and does not create any direct physical impact or effect on the Topock Maze, as it is manifested archaeologically, in compliance with EIR mitigation measure CUL-1a-10 and PA and CHPMP mitigation measures

N

0 500 1,000 2,000 Feet

FIGURE 7.6-1
PROPOSED STAGING AREAS, CONSTRUCTION YARD, AND ACCESS ROUTES

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
INTERMEDIATE (60%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: D:\Projects\Topock\MapFiles\2013\CMS\60%Report\Staging_Access_11X17.mxd Date Saved: 4/1/2013 3:59:24 PM

SECTION 8

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) and the preliminary (30%) design have been updated to reflect current information presented in the intermediate (60%) design. Exhibit 8-1 summarizes the updated costs.

EXHIBIT 8-1

SUMMARY OF COST ESTIMATES—PRESENT VALUE ANALYSIS

Groundwater Remedy Basis of Design Report/Intermediate (60%) Design
PG&E Topock Compressor Station, Needles, California

Period	Cost Type	Total Cost	Total Cost Per Year	Discount Factor[1]	Present Value
COSTS IN CMS/FS REPORT2					
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**
COSTS IN PRELIMINARY (30%) DESIGN3					
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**
COSTS IN INTERMEDIATE (60%) DESIGN4					
0	Capital Cost, Year 0	$103,527,563	-	1.000	$104,000,000
29	Annual O&M Cost, Year 1-30	-	$6,780,174	18.785	$127,365,568
10	Long Term Monitoring, Year 31-40	-	$885,537	3.421	$3,029,422
41	Post-Remediation Deconstruction, Year 41	$20,800,000	-	0.278	$5,782,400
Total Present Value Of Alternative					**$240,000,000**

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 of the Preliminary (30%) Design.
[4] See Appendix H for detailed cost estimates.

SECTION 9
References

AECOM. 2011. *Topock Line 300A Bridge Evaluation Report*. Prepared for Pacific Gas & Electric Company.

American Water Works Association (AWWA). 1999. *Water Quality and Treatment - A Handbook of Community Water Supplies.* 5th Edition. Ed. R.D. Letterman. McGraw-Hill.

ARCADIS. 2009. *Human and Ecological Risk Assessment of Groundwater Impacted by Activities at Solid Waste Management Unit (SWMU) 1/Area of Concern (AOC) 1 and SWMU 2, Topock Compressor Station, Needles California*. November 13.

Arizona Department of Environmental Quality (ADEQ). 1999. Arizona Source Water Assessment Plan Final Draft. Online: www.azdeq.gov/environ/water/dw/download/swapplan.pdf. February 5.

Arizona Rare Plant Committee. 2001. *Arizona rare plant field guide: a collaboration of agencies and organizations*. Washington: U.S. Government Printing Office. Online: http://www.aznps.com/rareplants.html.

California Department of Fish and Game (CDFG). 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. Sacramento, CA. Online: http://www.dfg.ca.gov/bdb/pdfs/guideplt.pdf.

California Department of Fish and Wildlife (CDFW). Letter from Chris Hayes/CDFW, Deputy Regional Manager, inland Deserts Region, to Ms. Yvonne Meeks/PG&E. Subject: Confirmation of Application of the CERCLA 121(e)(1) Permit Exemption to PG&E's Soil and Groundwater Investigation and Remediation Project. March 6.

California Department of Public Health (CDPH). 2012. "Chromium-6 in Drinking Water: MCL Update" Web site. Online: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Chromium6.aspx.

California Department of Toxic Substances Control (DTSC). 1996. *Corrective Action Consent Agreement (Revised), Pacific Gas and Electric Company's Topock Compressor Station, Needles, California.* EPA ID No. CAT080011729. February 2.

_______. 2009. *Interim Advisory for Green Remediation.* Online: http://dtsc.ca.gov/OMF/Grn_Remediation.cfm. December.

_______. 2011a. *Statement of Basis for Groundwater Remedy at Pacific Gas and Electric Company, Topock Compressor Station, Needles, San Bernardino County, California*. EPA ID No. CAT080011729. January 31.

_______. 2011b. Letter from Ms. Karen Baker to Ms. Yvonne Meeks, PG&E. *Corrective Measure Decision for the Groundwater Operable Unit at SWMU1/AOC1 and AOC10, Pacific Gas and Electric, Topock Compressor Station, Needles, California.* EPA ID No. CAT080011729. January 31.

_______. 2011c. Mitigation Monitoring and Reporting Program. Exhibit 2 in Attachment B, January 31, 2011 Memorandum to Karen Baker from Aaron Yue regarding Certification of the PG&E Topock Compressor Station, in the *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project* (DTSC 2011d).

_______. 2011d. *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project*. January 31.

_______.2012. Letter from Ms. Karen Baker/DTSC to Yvonne Meeks/PG&E. Subject: *Second Extension Request for Intermediate (60%) Design at Pacific Gas and Electric Company (PG&E), Topock Compressor Station, Needles, California (EPA ID No. CAT080011729)*. December 31.

California Native Plant Society (CNPS). 2001. *The California Native Plant Society's Inventory of Rare and Endangered Plants of California*. August.

_______.2010. The Online CNPS Inventory of Rare and Endangered Plants (8th Edition). December.

_______.2011. Electronic Inventory of Rare and Endangered Vascular Plants of California. Online: http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi. Last updated October 13, 2011. Accessed October 2011.

California Natural Diversity Database (CNDDB). 2008 (December 1). Results of electronic record search. California Department of Fish and Game, Wildlife and Habitat Data Analysis Branch. Sacramento, CA.

_______. 2011a. RareFind3, version 3.0.5. Electronic database. Sacramento, California.

_______. 2011b. Special vascular plants, bryophytes and lichens list. April 2011. Online: http://www.dfg.ca.gov/whdab/pdfs/spplants.pdf

California Stormwater Quality Association. 2003. *California Stormwater Quality Association Construction BMP Handbook*. Sacramento, CA.

CH2M HILL. 2005. *Groundwater Model Update Report, PG&E Topock Compressor Station, Needles, California*. July 29.

_______. 2006. *Draft RCRA Facility Investigation/Remedial Investigation Soil Investigation Work Plan Part A, PG&E Topock Compressor Station, Needles, California*. November.

_______. 2007a. *Draft RCRA Facility Investigation Soil Investigation Work Plan Part B, PG&E Topock Compressor Station, Needles, California*. December.

_______. 2007b. *Programmatic Biological Assessment for Pacific Gas and Electric Company Topock Compressor Station Remedial and Investigative Actions.* January.

_______. 2008. *Groundwater Background Study, Steps 3 and 4: Final Report of Results, PG&E Topock Compressor Station, Needles, California*. July 23.

_______. 2009a. Revised *Final RCRA Facility Investigation/Remedial Investigation, Volume 2— Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation Report, Pacific Gas and Electric Company (PG&E), Topock Compressor Station, Needles, California.* February 11.

_______. 2009b. *Final RCRA Facility Investigation/Remedial Investigation Report, Volume 2 Addendum— Hydrogeologic Characterization and Results of Groundwater and Surface Water Investigation, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California*. June 29.

_______. 2009c. *Geotechnical Investigation, Topock AOC 4 Remediation – Pre-Work Plan Data Collection Activities, PG&E Compressor Station, Needles, CA*. October.

_______. 2009d. *Final Groundwater Corrective Measure Study/Feasibility Study Report for SWMU 1/AOC 1 and AOC 10, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California*. Prepared for PG&E. December.

_______. 2011a. *Fourth Quarter 2010 and Annual Interim Measures Performance Monitoring and Site-wide Groundwater and Surface Water Monitoring Report, PG&E Topock Compressor Station, Needles, California.* March 15.

_______. 2011b. *Compliance Monitoring Program, Semiannual Groundwater Monitoring Report, Second Half 2010.* January 14.

_______. 2011c. *Second Quarter 2011 Interim Measures Performance Monitoring and Site-wide Groundwater and Surface Water Monitoring Report, PG&E Topock Compressor Station, Needles, California.* August 15.

_______. 2011d. *Compliance Monitoring Program, Semiannual Groundwater Monitoring Report, First Half 2011.* July 15.

_______. 2011e. *Draft Soil RCRA Facility Investigation/Remedial Investigation Work Plan, PG&E Topock Compressor Station, Needles, California.* May 6.

_______. 2011f. *Revised Groundwater Corrective Measure Implementation/Remedial Design (CMI/RD) Work Plan for SWMU 1/AOC 1 and AOC 10, PG&E Topock Compressor Station, Needles, California*. November 2.

_______. 2011g. *Soil Investigation Part A Phase 1 Data Gaps Evaluation Report, PG&E Topock Compressor Station, Needles, California.* (Appendix A of the *Draft Soil RCRA Facility Investigation/Remedial Investigation Work Plan* [CH2M HILL 2011e]). May 6.

_______. 2011h. *Implementation Report for the Time-Critical Removal Action at AOC 4, Pacific Gas & Electric Company, Topock Compressor Station, Needles, CA*. March 15.

_______. 2011i. *Topock Groundwater Remediation Project, Mature Plants Survey Methodology*. October 31.

_______. 2011j. *Topock Groundwater Remediation Project, Floristic Survey Methodology*. October 31.

_______. 2011k. *Topock Groundwater Remediation Project, Ordinary High Water Mark Identification and Mapping Methodology*. November 18.

_______. 2012a. *Fourth Quarter 2011 and Annual Interim Measures Performance Monitoring and Site-Wide Groundwater and Surface Water Monitoring Report, PG&E Topock Compressor Station, Needles, California*. March 15.

_______. 2012b. *First Quarter 2012 Interim Measures Performance Monitoring and Site-Wide Groundwater and Surface Water Monitoring Report, PG&E Topock Compressor Station, Needles, California*. April 30.

_______. 2012c. *Compliance Monitoring Program, Semiannual Groundwater Monitoring Report, Second Half 2011.* January 13.

_______. 2012d. *Fresh Water Source Evaluation Technical Memorandum, PG&E Topock Compressor Station, Needles, California*. April 27.

_______. 2012e. *Mature Plants Survey Report , PG&E Topock Compressor Station, Needles, California*. January 17.

_______. 2012f. *Instream Habitat Typing Survey Technical Memorandum, Topock Compressor Station, Colorado River.* May 25.

_______. 2012g. *Implementation Plan for Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California.* November 20.

_______. 2013a. *Revised Implementation Plan for Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California.* January 28.

_______. 2013b. *Soil RCRA Facility Investigation/Remedial Investigation Work Plan, PG&E Topock Compressor Station, Needles, California.* January 14.

_______.2013c. *2012 Southwestern Willow Flycatcher Presence/Absence Surveys for the PG&E Topock Compressor Station, Needles, California.* January 31.

_______. 2013d. *PG&E Topock Groundwater Remediation Project Supplemental Baseline Sound Level Measurement*. March 18.

_______. 2013e. *Topock Groundwater Remediation Project Floristic Survey Report*. March 29.

_______. 2013f. *Topock Groundwater Remediation Project Ethnobotany Survey Report*. March 29.

_______.2013g. *2012 Focused Survey for the Yuma Clapper Rail and California Black Rail at the Pacific Gas and Electric Groundwater Remediation Project Site, Needles, California*. March 29.

Dzombak, D.A. and Morel, F.M.M. 1990. *Surface Complexation Modeling: Hydrous Ferric Oxide*. Wiley-Interscience, New York, 393 pp.

Green, R.L. 2005. *Trends in Golf Course Water Use and Regulation in California*. UC Riverside Turfgrass Research Facility. Online: http://ucrturf.ucr.edu/

Hemker, C.J. 2011. MicroFEM© Internet site. Online: http://www.microfem.com.

Howard, K.A., B.E. John, and J.E. Nielsen. 1997. Preliminary Geologic Map of the Eastern and Northern Parts of the Topock 7.5-minute Quadrangle, Arizona and California. United States Geological Survey Open-File Report 95-534.

John, B.E. 1987. Geologic Map of the Chemehuevi Mounts area, San Bernardino County, California and Mohave County, Arizona. United Sates Geological Survey Open-File Report 87-666.

LeRoy Crandall and Associates. 1986. *Investigation of Potential Water Supply Sources, Park Moabi*. Prepared for San Bernardino County. February 11, 1986.

McDonald, M.G., and Harbaugh, A.W. 1988. *A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model*. Techniques of Water-Resources Investigations, Book 6. U.S. Geological Survey, Reston, VA. Online: http://pubs.usgs.gov/twri/twri6a1/.

Metzger, D.G., and Loeltz, O.J. 1973. *Geohydrology of the Needles Area, Arizona, California, Nevada*. United Sates Geological Survey Professional Paper 486-J.

Morel, F.M.M. and J.G. Hering. 1993. *Principles and Applications of Aquatic Chemistry*. John Wiley & Sons, Inc., New York.

Odell, Lee H. 2010. *Treatment Technologies for Groundwater*. American Water Works Association.

Office of Environmental Health Hazard Assessment (OEHHA). 2011. "Fact Sheet - Final Public Health Goal for Hexavalent Chromium [07/27/11]" Web page. Online: http://www.oehha.ca.gov/public_info/facts/Cr6facts072711.html.

Pacific Gas & Electric Company (PG&E). 2010. Letter from Yvonne Meeks/PG&E to Cathy Wolf-White/BLM. Re: Proposed Frequency Modifications for Protocol Surveys Performed In Accordance with the Programmatic Biological Assessment for the Pacific Gas and Electric Topock Compressor Station. February 24.

_______. 2011a. *Draft Basis of Design Report/Preliminary (30%) Design Submittal for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California*. Prepared by CH2M HILL. November 18.

_______. 2011b. *Programmatic Sustainable Remediation Guidance*. Prepared by Haley & Aldrich, Inc. and Endpoint Consulting, Inc. for PG&E, San Ramon, CA. July.

_______. 2012. *Programmatic Sustainable Remediation Guidance (Revision 1)*. Prepared by Haley & Aldrich, Inc. and Endpoint Consulting, Inc. for PG&E, San Ramon, CA. July.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. *A Manual of California Vegetation, 2nd ed*. California Native Plant Society, Sacramento, CA.

State Water Resources Control Board (SWRCB). 2009. Construction General Permit Fact Sheet. Adopted Order No. 2009-0009-DWQ. Sacramento, CA.

U.S. Bureau of Land Management (BLM). 2007. *Record of Decision and Lake Havasu Field Office Approved Resource Management Plan*. Online: http://www.blm.gov/az/st/en/info/nepa/environmental_library/arizona_resource_management/LHFO_ROD_07.html. Lake Havasu City, AZ. May.

_______. 2010. Programmatic Agreement among the Bureau of Land Management, Arizona Historic Preservation Officer, California State Historic Preservation Officer, and the Advisory Council on Historic Preservation for the Topock Remediation Project in San Bernardino County, California and Mohave County, Arizona. October.

_______. 2011a. BLM Special Status Plants, California. Online: http://www.blm.gov/ca/st/en/prog/ssp.html.

_______. 2011b. *PG&E Topock Remediation Project Tribal Access Plan for Federal Properties*. November 26.

_______. 2012. *Cultural and Historic Properties Management Plan, PG&E Topock Compressor Station, Needles, California.* January 20.

U.S. Department of the Interior (DOI). 2005. IN THE MATTER OF: Topock Compressor Station, Pacific Gas and Electric Company (Respondent), Proceeding Under Sections 104 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act as amended 42 USC §§ 9604 and 9622—Administrative Consent Agreement. July 11.

_______. 2010. *Groundwater Record of Decision, Pacific Gas and Electric Company, Topock Compressor Station, Needles, San Bernardino County, California*. ROD cover date is December 2010; signed/approved by DOI on January 20, 2011.

_______.2011. Letter from Ms. Pamela Innis/DOI to Ms. Yvonne Meeks of PG&E. *PG&E Topock Compressor Station Remediation Site – Revised Groundwater Corrective Measure Implementation/Remedial Design Work Plan for SWMU1/AOC1 and AOC10, PG&E Topock Compressor Station, Needles, California*. November 3.

_______.2013. Remedial Action/Remedial Design Consent Decree (CD) between the United States of America and Pacific Gas & Electric Company. Case 5:13-cv-00074-VAP-OP, Document 5-1. Filed January 15.

U.S. Environmental Protection Agency (USEPA). 1990. *Guidance on EPA Oversights of Remedial Designs and Remedial Actions Performed By Potentially Responsible Parties, Interim Final, EPA540-G-90/001*. April.

U.S. Fish and Wildlife Service (USFWS). 1996a. *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed, and Candidate Plants*. Sacramento, California.

_______. 1996b. Endangered and Threatened Wildlife and Plants; Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species; Notice of Review; Proposed Rule. Federal Register 61(40): 7596-7613.

_______. 2006. List of federal candidates for listing. Online: http://ecos.fws.gov/endangered/candidates/index.html

_______. 2011. List of federally listed threatened & endangered species which may occur in Riverside County, CA. USFWS, Carlsbad Fish and Wildlife Office, Carlsbad, CA. Online: http://www.fws.gov/carlsbad/TEspecies/CFWO_Species_List.html

U.S. Fish and Wildlife Service (USFWS) and U.S. Bureau of Reclamation (BOR). 1994. *Lower Colorado River National Wildlife Refuges Comprehensive Management Plan 1994-2014.* U.S. Fish and Wildlife Service Region 2, Albuquerque, NM. U.S. Bureau of Reclamation Lower Colorado Region, Boulder City, NV. Online: http://library.fws.gov/CCPs/LowerCOriver_cmp94.pdf.

Zheng, C., 1990. *MT3D: A Modular Three-Dimensional Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems*. Prepared for the U.S. Environmental Protection Agency. Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma. Developed by S.S. Papadopulos & Associates, Inc., Rockville, Maryland.

Zheng, C., and P. Wang, 1999. *MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems*. Prepared for the U.S. Army Corps of Engineers, Washington, DC. University of Alabama, Tuscaloosa, AL.