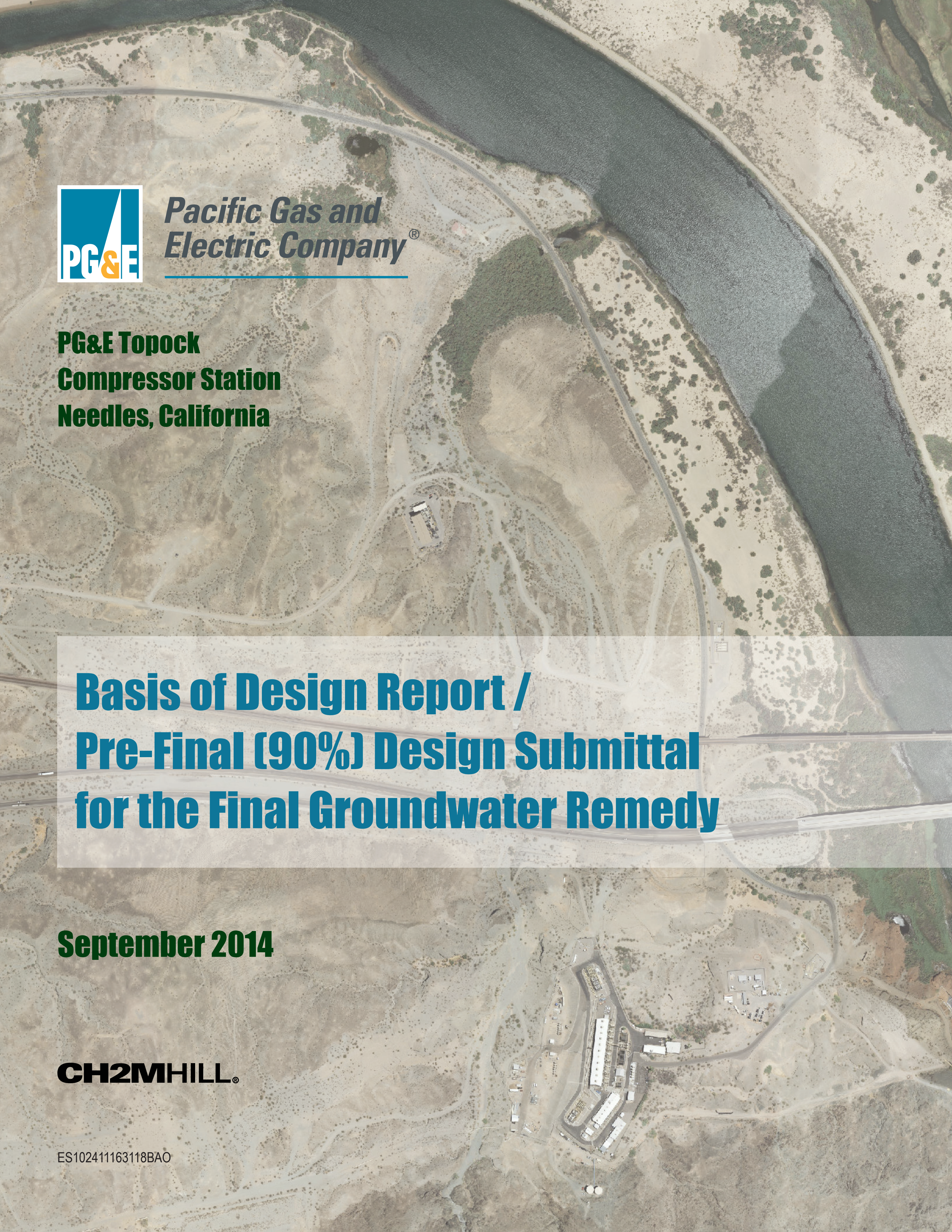


Pacific Gas and Electric Company®

PG&E Topock
Compressor Station
Needles, California

Basis of Design Report / Pre-Final (90%) Design Submittal for the Final Groundwater Remedy

September 2014

CH2MHILL

ES102411163118BAO

Pacific Gas and Electric Company

Yvonne J. Meeks
Manager
Environmental Remediation

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

Location
6588 Ontario Road
San Luis Obispo, CA 93405

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

September 8, 2014

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/Pre-Final (90%) Design Submittal and Construction/ Remedial Action Work Plan 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 (CACA) between the California Department of Toxic Substances Control (DTSC) and Pacific Gas and Electric Company (PG&E) and with the CERCLA Remedial Design/Remedial Action Consent Decree (CD), this letter transmits the *Basis of Design Report/Pre-Final (90%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (90% BOD Report).

Other requirements of the CACA and CD, including the plans and schedules for construction and implementation of the remedy set forth in the design plans and specifications, are addressed in the *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (C/RAWP). This letter also transmits the C/RAWP, which is presented under separate cover and is intended to be a companion document to the 90% BOD Report.

PG&E looks forward to the opportunity to walk through the 90% design documents with the Agencies, interested Tribes, and Stakeholders during the September 17, 2014 Technical Work Group Meeting.

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: Kevin Sullivan/PG&E, Karen Baker/DTSC

Topock Project Executive Abstract

Document Title: *Basis of Design Report/Pre-Final (90%) Design for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* Submitting Agency: DTSC, DOI Final Document? ☐ Yes ☒ No	Date of Document: 09/08/2014 Who Created this Document?: (i.e. PG&E, DTSC, DOI, Other) PG&E
Priority Status: ☒ HIGH ☐ MED ☐ LOW Is this time critical? ☒ Yes ☐ No Type of Document: ☐ Draft ☒ Report ☐ Letter ☐ Memo ☐ Other / Explain:	Action Required: ☐ Information Only ☒ Review & Comment Return to: N/A By Date: As specified by DTSC and DOI ☐ Other / Explain:
What does this information pertain to? ☐ Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)/Preliminary Assessment (PA) ☐ RCRA Facility Investigation (RFI)/Remedial Investigation (RI) (including Risk Assessment) ☐ Corrective Measures Study (CMS)/Feasibility Study (FS) ☒ Corrective Measures Implementation (CMI)/Remedial Action (RA) ☐ California Environmental Quality Act (CEQA)/Environmental Impact Report (EIR) ☐ Interim Measures ☐ Other / Explain:	Is this a Regulatory Requirement? ☒ Yes ☐ No If no, why is the document needed?
What is the consequence of NOT doing this item? What is the consequence of DOING this item? This submittal is required for compliance with the 1996 Corrective Action Consent Agreement (CACA), the CERCLA Remedial Design/Remedial Action Consent Decree (CD), 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/Pre-Final (90%) Design (90% BOD Report) is a continuation and expansion of the intermediate (60%) BOD Report, and contains the design details, drawings, specifications, and appendices for implementation of the remedy including the O&M Manual (Appendix L).

This 90% BOD Report has been prepared to comply with the Agencies' April 4, 2014 direction letter on outstanding 60% design issues, to incorporate responses to comments received on the 60% BOD Report, to incorporate data that have been collected since issuance of the 60% BOD Report in November 2011, and to bring the design details to a 90% detail level.

Other requirements of the CACA and CD, including the plans and schedules for construction and implementation of the remedy set forth in the design plans and specifications, are addressed in the *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California* (C/RAWP). The C/RAWP is presented under separate cover and is intended to be a companion document to this 90% BOD Report.

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:

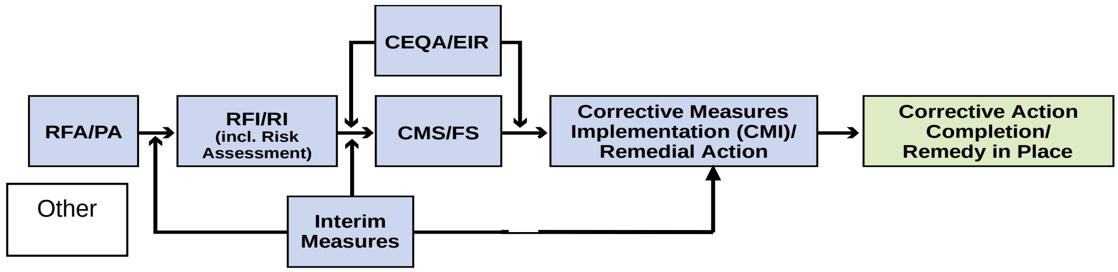
This submittal presents the pre-final (90%) design basis, design criteria, list of specifications, and additional information required for the final groundwater remedy.

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

Basis of Design Report/ Pre-Final (90%) Design Submittal for the Final Groundwater Remedy

PG&E Topock Compressor Station Needles, California

Prepared for

Pacific Gas & Electric Company

September 2014

CH2MHILL®

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), on behalf of the U.S. Department of the Interior (DOI), under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 2012, which was approved by the U.S. District Court for the Central District of California in November 2013.

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 pre-final (90%) design stage. Figure ES-2 shows the schedule for the groundwater remedy design, construction, and initial start-up. As shown, inputs from Interested Tribes and Stakeholders were solicited and received on the preliminary (30%) and intermediate (60%) Basis of Design Submittals (30% BOD [CH2M HILL 2011l] and 60% BOD [CH2M HILL 2013k]) and are being solicited again at this 90% design stage. DTSC and DOI issue direction to PG&E prior to the start of each stage.

This Basis of Design Report/Pre-Final (90%) Design (90% BOD) Submittal is a continuation and expansion of the preliminary (30%) and intermediate (60%) BOD Submittals, and contains additional design details, drawings, specifications, and appendices for implementation of the remedy (including Appendix L, the 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).

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, are addressed in the Construction/Remedial Action Work Plan (C/RAWP; CH2M HILL 2014m) and additional future documents (as outlined in Section 7 of this document). Though published at the same time as this 90% BOD submittal, the C/RAWP is presented under separate cover and is intended to be a companion document to the BOD Report, so for readers' convenience it is included on the CD-ROM version of this BOD Report located inside the front binder cover.

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 Metropolitan Water District of Southern California (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 are proposed in the 90% design include Kinder Morgan, BNSF Railway, 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 Area of Potential Effects (APE) for the Topock site is contained within what the FMIT and other Native American Tribes have identified as a larger area of traditional and cultural importance. 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 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; see Figure 1.2-1 at the end of Section 1) 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 143 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 1.46 billion gallons (approximately 4,500 acre-feet). The total Cr(VI) mass in the plume is currently estimated to be 24,300 pounds.

The volume of the plume within the East Ravine bedrock formation is believed to represent less than 2 percent of the total plume volume. 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, Completion Criteria/ Performance Standards, and Short-Term Goals

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 micrograms per liter (µg/L).
2. Prevent or minimize migration of total chromium (Cr[T]) and Cr(VI) in groundwater to ensure concentrations in surface water do not exceed water quality standards that support the designated beneficial uses of the Colorado River (11 µg/L Cr[VI]).
3. Reduce the mass of Cr(T) and Cr(VI) in groundwater at the site to achieve compliance with 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.

The completion criteria or performance standards for the groundwater remedy are mainly driven by RAO #3, reducing Cr(VI) concentrations throughout the plume to concentrations of 32 µg/L or less. During the time prior to attaining these concentrations, institutional controls (ICs) (see Section ES.4) will be used to prevent use of the groundwater within the chromium plume as a drinking water source, to meet RAO #1. Following attainment of the Cr(VI) concentrations of 32 µg/L or less, the ICs can be lifted. Reducing concentrations of Cr(VI) in groundwater to concentrations of 32 µg/L or less will meet RAO #2 by increasing the level of certainty that surface water quality will continue to remain below surface water quality standards in the future. Reducing concentrations of Cr(VI) in groundwater to concentrations of 32 µg/L or less will meet RAO #4 by reducing, and eventually eliminating, the target remediation area.

Attainment of the completion criteria or achievement of performance standards (Cr[VI] concentrations of 32 µg/L or less) is intended to be applied throughout the area of contaminated groundwater. In establishing this criterion, the following are recognized:

- Attaining the cleanup criteria of 32 µg/L Cr(VI) in groundwater may be through active remediation or through natural attenuation.
- Different areas of the plume may reach the cleanup criteria of 32 µg/L Cr(VI) in groundwater at different times.

Monitored natural attenuation (MNA) is included as a long-term component of the groundwater remedy to address residual chromium that may remain in recalcitrant portions of the aquifer following efforts to enhance and optimize in-situ treatment and flushing systems during the O&M phase. Decisions on specific areas of the plume appropriate for MNA will be made during future evaluations, such as the 5-year reviews to be conducted by DTSC and DOI, based on information about the types and options for active remediation system adjustments, data evaluating the effectiveness of active remediation systems, and location of proposed MNA areas relative to natural reductive zones in the aquifer.

Due to heterogeneity in the aquifer, it is expected that during the decades-long O&M period there will be portions of the site that attain the RAOs at different times. The existing footprint of the chromium plume is expected to change in size and shape, and to diminish over time. In addition, there may be portions of the site where it could be determined that MNA is appropriate to address residual Cr(VI). During future evaluations, such as 5-year reviews, distinct geographical areas of the site where RAOs have been attained and/or where it has been determined that MNA is appropriate to address residual Cr(VI) could be designated (as appropriate) for Corrective Action/Remedial Action Completion. An aspect of long-term monitoring will include monitoring of arsenic in groundwater in compliance with the California State Water Resources Control Board's (SWRCB's) direction issued in a letter to DTSC on November 20, 2013 on the use of Arizona water for flushing in the groundwater remedy (SWRCB 2013). The letter provides the SWRCB's findings and conditions for allowing injection of fresh water containing naturally occurring arsenic above the maximum contaminant level (MCL) without pre-treatment. The letter requires that if the leading edge of the arsenic plume, i.e., arsenic concentrations at the concentration in the injected fresh water, extend more than 150 feet away from injection locations, PG&E must immediately reassess its modeling calculations and quickly identify interim actions it can take to limit the migration of the arsenic plume. The letter further directs the cessation of the injection of untreated fresh water if the arsenic concentration caused by injection of fresh water is detected above the water quality objective (10 parts per billion [10 μg/L]) at 225 feet from the injection locations.

Based on modeling, the current projection of the remedial timeframe is 30 years of active remediation followed by up to 10 years of long term monitoring and up to 20 years of arsenic monitoring.

In addition to the RAOs, short-term goals and criteria are being developed in coordination with DTSC and DOI to facilitate future evaluations of remedy performance including assessments of whether the remedy is Operational and Functional (OF) and Operating Properly and Successfully (OPS). Below is a summary of OF and OPS:

- **Operational and Functional:** Pursuant to CERCLA, 40 CFR § 300.435(f)(2), the groundwater remedy becomes OF either one year after construction is complete, or when the groundwater remedy is determined by DOI and DTSC to be functioning properly and performing as designed, whichever is earlier. DOI may grant extensions to the one-year period, as appropriate. This period is often referred to as "commissioning" or "shakedown," when the construction contractor(s) make minor adjustments as necessary to ensure that the remedy is operating as designed.

- **Operating Properly and Successfully:** Pursuant to Exhibit A to the Settlement Agreement between DTSC and the FMIT (DTSC 2012b), the groundwater remedy is considered to be OPS when a) the remedy is operating as designed, b) the information obtained from remedy operation indicates that the remedy is protective of human health and the environment, and c) the remedy is likely to be able to achieve the cleanup levels or performance goals delineated in the DTSC's Statement of Basis (SOB; DTSC 2011a) and the DOI's Record of Decision (ROD; DOI 2010) for the groundwater remedy at the PG&E Topock site. In general, OPS is expected within 1 to 2 years of the beginning of remedy start-up.

ES.3 Summary of Engineering Design Parameters and Features/Key Changes from 60% to 90% Design

The pre-final (90%) 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) comprised of:

  - Extraction wells near the Colorado River (referred to as the River Bank Extraction Wells) to provide hydraulic capture of 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, and/or fresh water in the upgradient portion of the Cr(VI) plume to flush the plume through the IRZ.

- A TCS Recirculation Loop comprised 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 (TW) Bench 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 fresh water 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.
  - Per DTSC's direction in its comment (#21 DTSC-2 [see Appendix I]) on the 60% BOD, this 90% BOD includes a contingent Freshwater Pre-injection Treatment System (FWPTS) for the removal of arsenic to below the federal/state MCL of 10 µg/L. DTSC also notes that the removal of fluoride from fresh water is not warranted due to the elevated baseline fluoride concentrations (i.e., values already above the MCL) in the area where fresh water will be injected.
- A monitoring well network that consists of existing site wells and new monitoring wells.

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 O&M 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, an Operations facility to house site operation and field staff as well as essential O&M functions (e.g., remote control and monitoring equipment/telecom/information technology, Supervisory Control and Data Acquisition [SCADA] system), and a maintenance/storage facility at Moabi Regional Park that will house a laboratory, a document repository center, a training/conference room, equipment storage, etc. as well as soil storage areas.

Tables ES-1 and ES-2A and -2B (located at the end of this executive summary) provide a summary of the remedy design parameters/key remedy features and borehole count information, respectively, at this pre-final (90%) design stage. Figures ES-4A through 4D show the locations of remedy features in California, at the TCS evaporation ponds, at the Moabi Regional Park, and in Arizona. 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 intermediate (60%) and this pre-final (90%) design. Figures ES-8 through ES-11 illustrate the key changes graphically to facilitate visualization and understanding of these changes; detailed descriptions are provided in the body of this report.

Remedy Features Proposed on the FMIT Parcel

In response to the FMIT's comment on the 60% BOD (see response to comment [RTC] #37 FMIT-16 in Appendix I), this section describes the proposed remedy features on the FMIT parcel and changes from the 60% to the 90% design. Figure ES-12 illustrates the changes graphically to facilitate visualization and understanding of these changes.

As shown in Figure ES-12, the proposed remedy features on the FMIT parcel at the 60% design stage were:

- New remedy wells IRL-1 and IRL-2
- Monitoring wells:
  - New wells (MW-I and MW-P)

   - All existing well clusters (CW-2, CW-3, CW-4, OW-1, OW-2, OW-3, OW-5, MW-41) and existing well MW-13
- Well and electrical vaults
- Belowground remedy piping/conduits
- One aerial crossing (pipe bridge) over Bat Cave Wash
- One new access road to IRL-2 and all existing access roads
- Temporary features during construction: staging areas and support zones

The following lists the changes to these features that were made since the 60% design and the associated rationales:

- Moved remedy well IRL-1 to avoid the installation of a new arsenic monitoring well on the FMIT parcel.
- Moved monitoring well MW-I approximately 45-50 feet south-southeast of the original location to a new location that was acceptable to stakeholders and Tribes during a site walk on July 30, 2013. This is in response to a comment on the 60% BOD from the FMIT (comment #676 in Appendix I).
- Relocated freshwater injection well FW-1 to the north, hence onto the FMIT parcel, to allow for reuse of existing wells for arsenic monitoring at this location. This change avoids the installation of two new monitoring wells on the FMIT parcel.
- Added new monitoring wells MW-AA, MW-BB, and MW-CC to monitor for arsenic in compliance with the SWRCB direction mentioned above.
- Added pending/future provisional monitoring well MW-EE to monitor for arsenic.
   - PG&E originally proposed a location for MW-EE during the February 11, 2014 Technical Working Group meeting. Tribal input during subsequent discussion indicated that the Tribes were opposed to that location, and that either another location on the arc should be selected, or else the location should be considered as a “future provisional” location given the disturbance that would be required with respect to cultural values. A different location on the arc is shown on Figure ES-12 as a placeholder until Tribal feedback is provided regarding an acceptable location. If an acceptable location is identified, the status will be changed to “planned” and it will be installed with other remedy facilities. If an acceptable location cannot be identified, and in light of Tribal opposition to the currently proposed location, DTSC will consider this well as “future provisional” with construction on hold until such time that arsenic concentrations are detected at the injected concentration in samples collected from MW-DD. DTSC will also consider arsenic transport data as observed at all other arsenic monitoring wells during remedy operation, as appropriate.
- Added infrastructure associated with the additional wells such as vaults, instrumentation, and/or controls.

In addition, as discussed at the June 19, 2014 site walk and July 16 Consultative Work Group meeting, PG&E is evaluating alternatives to the aerial crossing (pipe bridge) on the FMIT property due to its proximity to the Tribes’ proposed exclusion area in the Tribal Cultural Values Assessment (CVA) April 25, 2014 Amendment. The preferred alternative is to continue the pipeline alignment in the existing IM-3 access road, i.e., putting the pipes/conduits in the road. Results from this evaluation will be included in the final (100%) design.

The FMIT’s preference to limit remedial activity to the extent practicable and to have as little remedial infrastructure placed on its property as possible is recognized; this preference has been considered during the finalization of the design, consistent with the provisions of the Easement Agreement and the 2006 Settlement Agreement between PG&E and the FMIT.

ES.4 Summary of Institutional Controls

In addition to the remedy features described above, 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 implemented for the federally administered parcels composing the majority of the Topock site. Rather, the DOI's 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 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. It is PG&E's understanding after discussions with DTSC and DOI that with respect to the majority of privately-owned lands, access agreements from existing landowners are appropriate IC mechanisms.

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 as 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 construction and 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 construction and operation of the facilities and the ability of PG&E to construct, 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. With respect to privately-owned lands, PG&E is in the process of obtaining access agreements from existing landowners or employing other similar mechanisms, as appropriate.

ES.5 Summary of Modeling

Central to the design process is the groundwater modeling effort that was used to refine/optimize the key remedy features. 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). In addition, geochemical modeling (batch and one-dimensional transport simulation 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.

Additional modeling efforts completed since the 60% design include an update of the regional groundwater flow model ("the regional flow model") and groundwater flow submodel to reflect hydrogeology encountered at Site B in the vicinity of HNWR-1; an update of the initial hexavalent chromium and manganese distributions utilizing data collected through December 31, 2013; a simulation of arsenic associated with the freshwater source utilized for upland injection; and an update of remedy well locations. Results from the modeling effort are summarized in Section 3.1 and detailed in Appendix B of this BOD Report.

The hydraulic components of the remedy summarized in Section ES.3 and Table ES-1 were incorporated into the groundwater flow and solute transport model. Potential well locations were carefully selected by first avoiding culturally or otherwise sensitive areas to minimize impact. Delineated areas were closely evaluated, and site walks were conducted with Agencies and Tribes to review and adjust the general well locations. Precise well locations will be confirmed in the field prior to construction.

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. Boundary conditions 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), and reinjection destinations. Solute transport model parameters were also adjusted including carbon amendment injection concentrations, carbon decay rates, Cr(VI) partition coefficient, manganese generation/attenuation rates, and arsenic generation/attenuation rates. Threshold optimization criteria included the following:

- Minimize Cr(VI) remedial timeframe;
- Minimize infrastructure; and
- Minimize the impact of potential byproducts.

During remedy well installation and testing, and during remedy startup and operation, data will be collected and analyzed to ensure that the groundwater flow, geochemical, and solute transport models do not differ significantly with respect to hydrogeologic characterization or remedy performance. If there are significant differences, the groundwater flow model and/or the solute transport model will be updated and recalibrated. This will allow the models to be used as predictive tools to evaluate performance and assist in guiding operation of the remedial system.

Model update procedures are summarized in Section 3.1.5 and detailed in Appendix B (Section 12) of this BOD Report in response to 60% comments #359 (FMIT-69), #360 (FMIT-70), #369 (FMIT-79), and #373 (FMIT-83) (see Appendix I). A detailed sensitivity analysis was conducted as part of the modeling effort to evaluate and account for the general sensitivity of relevant solute transport parameters and remedy design variables. However, it is recognized that uncertainty exists, and field variations in Cr(VI) concentration distribution, lithology, hydrogeology, etc. are anticipated to be encountered. To deal with the uncertainty in these parameters in implementation, the remedial system was designed to be flexible, and the remedy will be implemented with an adaptive operational strategy.

During system installation and baseline sampling, additional data will be collected that will refine the current conceptual model. Where appropriate, the data may be used to refine the design, for example, of remedial well screens and perhaps locations. The data will also be used to update the groundwater flow and solute transport model and refine remedy projections as discussed above. During remedy implementation, monitoring data will be collected and used to guide the operations of the system, including changes in operational flowrates, injection parameters, and potentially remedial well locations. The Sampling and Monitoring Plan (Volume 2 of the O&M Manual [Appendix L]) details the plan for data collection and interpretation, and provides guidance for adapting operations as the remedy is implemented.

TABLE ES-1
Summary of Engineering Design Parameters and Key Remedy Features
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
National Trails Highway In-situ Reactive Zone (NTH IRZ)	• **Well location/number of wells** – 24 IRZ Injection Wells (plus 30 future provisional 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 while minimizing necessary infrastructure. – 4 IRZ Extraction Wells (plus 1 future provisional well) located at the ends and in the central portion of the NTH IRZ line to minimize potential for the extraction of reduced water containing organic carbon or dissolved minerals, provide hydraulic control of the northern end of the Cr(VI) plume, and maintain eastern flow component of groundwater. • **Extraction/injection flow** – Total nominal injection flow rate is 300 gallons per minute (gpm) with a range of 200-400 gpm (see Table 3.2-1 for details). – Total nominal extraction flow rate is 300 gpm with a range of 200-400 gpm. • **Carbon substrate dosing** – The system will be initiated with an anticipated initial total organic carbon (TOC) amendment concentration of 100 micrograms per liter (mg/L) to achieve sufficient lateral distribution of organic carbon while minimizing byproduct generation.	See Figure ES-4A for general locations
Inner Recirculation Loop (IRL)	• **Well location/number of wells** – 5 River Bank (RB) Extraction Wells (plus up to 4 future provisional wells) 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. – 4 IRL Injection Wells (plus 3 future provisional wells) near the western margin (upgradient) of the groundwater plume north of I-40 to induce groundwater flow through the NTH IRZ. • **Extraction/injection flow** – Total nominal extraction flow rate is 150 gpm with a range of 0-500 gpm (see Table 3.2-2 for details). – Total nominal injection flow rate is 450 gpm average with a range of 150-900 gpm. • **Carbon substrate dosing** – Anticipated TOC amendment concentration range of 0 to 50 mg/L; the minimum of 0 mg/L TOC is applicable when Cr(VI) concentrations in the extracted groundwater do not exceed the cleanup level; 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.	See Figure ES-4A for general locations

TABLE ES-1
Summary of Engineering Design Parameters and Key Remedy Features
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
Topock Compressor Station (TCS) Recirculation Loop	• **Well location/number of wells** – 5 East Ravine Extraction Wells (plus up to 6 future provisional wells) 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. – 2 Transwestern (TW) Bench Extraction Wells (plus 2 future provisional wells) in the area northeast of the TCS 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. – 2 TCS Injection Wells in the area of the TCS to directly treat Cr(VI) impacted groundwater in the immediate vicinity of the TCS and accelerate groundwater flow toward the TW Bench Extraction Wells and the NTH IRZ. • **Extraction/injection flow** – Total nominal East Ravine extraction flow rate is 5 gpm, with a range of 4-104 gpm (see Table 3.2-3 for details), to provide hydraulic capture of Cr(VI) impacted groundwater in the East Ravine bedrock. – Total nominal TW Bench extraction flow rate is 22 gpm, with a range of 2-60 gpm, to provide hydraulic capture of Cr(VI) impacted groundwater in the Embayment Area. – Total nominal injection flow rate is 27 gpm, with a range of 10-75 gpm, to allow for adequate lateral distribution of organic carbon. • **Carbon substrate dosing** – The system will be initiated with an anticipated initial TOC amendment concentration of 100 mg/L to achieve sufficient lateral distribution of organic carbon while minimizing byproduct generation.	See Figure ES-4A for general locations
Freshwater Injection	• **Well location/number of wells** – 2 Freshwater (FW) Injection Wells located upgradient of the groundwater plume to induce groundwater flow through the NTH IRZ and prevent westward migration of the Cr(VI) plume. • **Injection flow** – Total nominal injection flow rate is 150 gpm, with a range of 75-300 gpm (see Table 3.3-1 for details).	See Figure ES-4A for general locations
Monitoring wells	• 36 new monitoring well locations (plus 4 identified future provisional wells) (see Table 3.6-2 for design details). Up to 10 additional, unidentified future provisional monitoring wells. • Reuse existing monitoring wells.	See Figures ES-4A and 3.6-1 for general locations
Carbon amendment and carbon storage facilities	• One 3,000-gallon aboveground carbon storage tank and carbon amendment facility at the TW Bench. • One 15,000-gallon aboveground carbon storage tank and carbon amendment facility at the MW-20 Bench.	See Figure ES-4A for general locations of the two bench areas, and Figures ES-7 and ES-8 for conceptual visualizations of equipment on the bench areas.

TABLE ES-1
Summary of Engineering Design Parameters and Key Remedy Features
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
Freshwater source/ supply well/storage	• Freshwater supply will be primarily from the existing well HNWR-1A, located on the Refuge in Arizona. Fresh water can also be supplied from the existing, nearby well HNWR-1 as a secondary source and from the existing Site B well located approximately 0.9 mile north of HNWR-1, as a contingent source. Provision is included in the 90% design to allow for connecting to both HNWR-1 and Site B wells. • Space is reserved for a Contingent Freshwater Pre-Injection Treatment System (FWPTS)[1] and associated tanks/chemical storage at the Compressor Station – *flowrate is 450 gpm average, 900 gpm maximum (see Section 3.3.3.4 for details).* An equipment decontamination pad will be installed in the footprint of the Contingent FWPTS building. • One 10,000-gallon freshwater storage tank for use by the remedy.	See Figures ES-4A and 4D for general locations.
Piping corridor (water pipes, electrical conduits, fibers, etc.)	• Approximately 110,000 feet (ft) of water/liquid/utility pipes, and approximately 61,000 ft of electrical conduits and cables. Over 95% of conveyance pipes/conduits will be belowground.	See Figure ES-4A and 4D for general piping layout
Supporting facilities during remedy operation and maintenance	• The primary power supply source for remedy facilities in California will be power generated by the TCS. Two new natural gas engine-driven generators with associated switchgear and auxiliary systems will be installed in the existing Auxiliary Building, which houses the existing generators and generator switchgear. This location was selected due to its close proximity to the existing generators and the remedy system. A new power supply conduit will run underground from the electrical switchgear inside the Auxiliary Building to a connection point outside the nearby Remedy-produced Water Conditioning Building. The existing switchgear in the existing Auxiliary Building will be replaced/enhanced with new switchgear to enable full integration with the existing equipment and increase power reliability for the remediation facilities. To free up the space for the new generators to be installed inside the Auxiliary Building, the existing air compressors will be consolidated with the existing air dryer in a new Air Compressor Building located just to the east of their current location. This new air compressor location is preferred by the compressor station staff for ease of operation and maintenance of both the power and the compressed air systems. • Primary power will be supplied at 480 volts alternating current (VAC) and will be stepped up to 12K VAC with a 1,000-kilovolt-ampere (kVA) transformer; a step-down transformer (225 to 300kVA) will return the voltage to 480 VAC 3 phase at each load center. Six load centers are planned with a transformer/distribution equipment at each one. The transformers will be mounted aboveground on shallow concrete foundations. • A portable, rental backup generator of similar make and model to the existing generator (Isuzu Model 6WG1X) will be mobilized onsite as needed during project implementation to provide power. A connection panel is included in the 90% design (see Appendix D, Drawing E-00-51, Detail 4) and space is reserved for the portable rental generator behind the Remedy-produced Water Conditioning Plant (see Figures ES-4A and 3.5-1). • Secondary power supply can also be power generated from small photovoltaic solar panels at various locations such as at the Operations Building at the TW Bench and at select remote well locations. • For the primary freshwater supply well (HNWR-1A), the secondary supply well (HNWR-1), and the contingent well (Site B) in Arizona, the power supply source will be power provided by Mojave Electric Cooperative. • One Remedy-produced Water Conditioning System[2] and associated tanks located at the Compressor Station – flowrate is 20 gpm average, 35 gpm maximum (see Exhibit 3.4-5 for details). Space is reserved for a Contingent Dissolved Metals Removal System	See Figures ES-4A through 4D for general location. See Figures ES-6 through ES-12 for photo simulations of select remedy facilities

TABLE ES-1
Summary of Engineering Design Parameters and Key Remedy Features
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
	(DMRS)[3] inside the the Remedy-produced Water Conditioning Plant -flowrate is 20 gpm average, 35 gpm maximum (see O&M Manual Volume 3, Contingency Plan, for details). • One Operations Building (approx. 1,480sq.ft.) to house all essential functions for long-term O&M (Supervisory Control and Data Acquisition [SCADA] system, programmable logic controllers (PLCs), uninterruptible power supply, communications, etc.) at the TW Bench. Space is reserved in the Operations Building for a small, packaged drinking/potable water system.[4] Shared use of existing TW Bench with Transwestern. • One long-term remedy support area (approx. 1.3 acres) and two soil storage/ management areas (approx. 1.55 acres each) in Moabi Regional Park. Details on activities/functions anticipated during the long-term O&M period are included in Section 3.5-3. Details on activities/functions anticipated during the construction period are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m). • Shared use of the Compressor Station Hazardous Material Storage Building with TCS. • Improvements at the TCS evaporation ponds to improve evaporation rate[5] and to minimize trucking offsite. In the event that trucking offsite is necessary during remedy operations, the existing truck loading station will also be improved to enhance the ability to pump pond water to tanker trucks (see footnote of Exhibit 3.4-2 for details).	
Access pathways and roadways for remedy operation and maintenance	• Reuse all existing access pathways and roadways in the project area. • Two new graded access roads are 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 during construction and O&M of the remedial facilities and Transwestern, one new access road east of the TW bench is needed for access to Transwestern's gas transmission equipment. • A new road in the floodplain is needed for the construction and maintenance of the IRZ/RB wells, future provisional wells, and associated piping. • Access pathways/roads to remedy infrastructure on private properties in California and Arizona are needed to access the remedy features[6]	See Figures 3.5-9A and 3.5-9B in Section 3 for access pathways and roads.
Supervisory Control and Data Acquisition (SCADA) system	A SCADA system will be installed for controlling and monitoring the remedy. The Remedy SCADA equipment will be located inside the Operations Building at the Transwestern Bench. The main components of the Remedy SCADA system include the following: • Operator Interface Terminal (OIT) or Human Machine Interface (HMI) devices that present process data to a human operator, and through which the human operator monitors and controls the process. From the OIT 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. • 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 treatment process, converting sensor signals to digital data and sending digital data to the supervisory system. • 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. The control scheme for the PLCs has been developed and is included in the technical specifications for the PLC (see Appendix E, Section Number 40 96 00). • Communication infrastructure connecting the supervisory system to the remote terminal units. • Various process and analytical instrumentation (e.g., flow, pH, and conductivity measurement).	See Figure ES-13 for a a schematic of the Remedy SCADA system. For additional details, see BOD Section 3.5 and O&M Plan Sections 2.5 and 3 (Volume 1 of O&M Manual)

TABLE ES-1
Summary of Engineering Design Parameters and Key Remedy Features
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Remedy Feature	Design Parameters/Quantity	Location
	The Remedy SCADA system will communicate with numerous digital controllers organized into six nodes (see Figure ES-13). 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 OITs. 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 wells will be transmitted back to the main control station using wires, fiber optic communications, radio transmission (e.g., information from freshwater supply well(s) in Arizona; select monitoring wells in the floodplain/along the NTH IRZ, near the TCS, and in the East Ravine; and the equipment at the TCS ponds will be transmitted via radio to the Station PLC and from the Station PLC network to the Remedy SCADA), 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 Operations Building at the Transwestern Bench.	
Other ancillary facilities for use during remedy operation and maintenance	• Two aboveground pipe bridges for aerial crossing of Bat Cave Wash -- one pipe bridge crosses the southern portion of the wash near the TCS and the other pipe bridge crosses the northern portion of the wash, in the uplands.[7] • Small photovoltaic solar panels at various locations such as at the Operations Building at the TW Bench and at select remote well locations. Small communication radios at remote monitoring well locations, freshwater supply well in Arizona, and equipment at the TCS ponds to allow for remote data collection. • Security equipment (e.g., gate, security cameras) for remote facilities.	See Figure ES-4A for general locations of the two pipe bridges.

Notes:

Key remedy features included in this summary table are those needed for remedy operation and maintenance. A similar summary is provided in the Construction/Remedial Action Work Plan for features needed for remedy construction and start-up.

[1] Contingent system for removal of arsenic in fresh water to below the federal/state MCL of 10 µg/L, if needed (see Section 3.4 for details).

[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.

[3] Contingent system for removal of scaling ions in remedy-produced water, if needed (see Appendix A of the Contingency Plan [O&M Manual Volume 3] for details).

[4] Primary drinking/potable water at the Transwestern Bench will be supplied by the Compressor Station. Sink-mounted point-of use reverse osmosis systems may also be used to supply drinking/potable water. Space is reserved for a small packaged system to supply potable water to remedy crews/operators and visitors, if needed in the future (see Section 3.5.3 for details).

[5] The power supply for the improvements could be generated by a generator operating on natural gas or by direct connection to the compressor station power system. If the generator is installed, it will be in a building inside the pond fence line that also includes a control panel and a bank of batteries, inside a completely enclosed vented shed at the entrance to the pond area and inside the secure fencing. Natural gas for the generator will be piped from the PG&E transmission line 300B, approximately 500 feet away. If the power is supplied directly from the compressor station power system, the new electrical conductors will be installed along the right-of-way that currently contains the discharge pipeline that carries water from the compressor station to the ponds. A small control building or panel would be installed to house the pond controls and communications equipment. PG&E is evaluating the power supply options and will include the selected option in the final (100%) design.

[6] Private properties include those owned by the FMIT in California and by private property owners in Arizona.

[7] As discussed at the June 19 Technical Working Group site walk and the July 16 Consultative Working Group meeting, PG&E is evaluating alternatives to the northern pipe bridge due to its proximity to the Tribes' proposed exclusion area in the Tribal Cultural Values Assessment (CVA) April 25, 2014 Amendment. The preferred alternative is to continue the pipeline alignment in the existing IM-3 access road, i.e., putting the pipes/conduits in the road (see Section 3.3.3.1 for details). Results from the evaluation will be included in the final (100%) design.

TABLE ES-2A
Estimated Borehole Count Associated with Well Construction: Summary
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Type	EIR Limit (by Well Type)	Installed	Planned	Future Provisional	Total (by Well Type)
Monitoring Well Boreholes	60	16	53	24	93
Remediation Well Boreholes	110	2	47	46	95
Total (by Status)	**170**	**18**	**100**	**70**	**188**

TABLE ES-2B
Estimated Borehole Count Associated with Well Construction: Count Details
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Added in 90% BOD	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
1	ER-TCS GW Investigation	Monitoring	No	Installed	--	--	16	--	--
2	MW-10D	Monitoring	Yes	Planned	1	1	--	1	0
3	MW-11D	Monitoring	Yes	Planned	1	1	--	1	0
4	MW-70BR-D	Monitoring	Yes	Planned	1	1	--	1	0
5	MW-A	Monitoring	No	Planned	4	2	--	2	0
6	MW-B	Monitoring	No	Planned	4	2	--	2	0
7	MW-C	Monitoring	No	Planned	4	2	--	2	0
8	MW-D	Monitoring	No	Planned	3	2	--	2	0
9	MW-E	Monitoring	No	Planned	2	1	--	1	0
10	MW-F	Monitoring	No	Planned	2	1	--	1	0
11	MW-G	Monitoring	No	Planned	1	1	--	1	0
12	MW-H	Monitoring	No	Planned	4	2	--	2	0
13	MW-I	Monitoring	No	Planned	4	2	--	2	0
14	MW-J	Monitoring	No	Planned	4	2	--	2	0
15	MW-K	Monitoring	No	Planned	1	1	--	1	0
16	MW-L	Monitoring	No	Planned	4	2	--	2	0
17	MW-M	Monitoring	No	Planned	4	2	--	2	0
18	MW-N	Monitoring	No	Planned	3	2	--	2	0
19	MW-O	Monitoring	No	Planned	4	2	--	2	0
20	MW-P	Monitoring	No	Planned	4	2	--	2	0
21	MW-Q	Monitoring	No	Planned	4	2	--	2	0

TABLE ES-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Added in 90% BOD	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
22	MW-R	Monitoring	No	Planned	4	2	--	2	0
23	MW-S	Monitoring	No	Planned	2	1	--	1	0
24	MW-T	Monitoring	Yes	Planned	TBD	1	--	1	0
25	MW-U	Monitoring	Yes	Planned	2	1	--	1	0
26	MW-V	Monitoring	Yes	Future Provisional	2	1	--	0	1
27	MW-W	Monitoring	Yes	Planned	2	1	--	1	0
28	MW-X	Monitoring	Yes	Planned	4	2	--	2	0
29	MW-Y	Monitoring	Yes	Planned	4	2	--	2	0
30	MW-Z	Monitoring	Yes	Planned	4	2	--	2	0
31	MW-AA	Monitoring	Yes	Planned	2	1	--	1	0
32	MW-BB	Monitoring	Yes	Planned	2	1	--	1	0
33	MW-CC	Monitoring	Yes	Planned	2	1	--	1	0
34	MW-DD	Monitoring	Yes	Planned	2	1	--	1	0
35	MW-EE	Monitoring	Yes	Pending/Future Provisional	2	1	--	0	1
36	MW-FF	Monitoring	Yes	Planned	2	1	--	1	0
37	MW-GG	Monitoring	Yes	Planned	2	1	--	1	0
38	MW-HH	Monitoring	Yes	Planned	2	1	--	1	0
39	MW-II	Monitoring	Yes	Planned	2	1	--	1	0
40	Slant Wells Under River	Monitoring	Yes	Future Provisional	TBD	2	--	0	2
41	10 Unidentified MW Locations	Monitoring	Yes	Future Provisional	4 (per location)	20	--	0	20
42	Site B	Remediation	Yes	Installed	--	--	1	--	--
43	HWNR-1A	Remediation	Yes	Installed	--	--	1	--	--
44	ER-1	Remediation	No	Planned	1	1	--	1	0
45	ER-2	Remediation	No	Planned	1	1	--	1	0
46	ER-3	Remediation	No	Planned	1	1	--	1	0
47	ER-4	Remediation	No	Planned	1	1	--	1	0
48	ER-5	Remediation	No	Future Provisional	1	1	--	0	1
49	ER-6	Remediation	No	Installed	0	0	(Included in Item 1)	0	0

TABLE ES-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Added in 90% BOD	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
50	ER-7	Remediation	Yes	Future Provisional	1	1	--	0	1
51	ER-8	Remediation	Yes	Future Provisional	1	1	--	0	1
52	ER-9	Remediation	Yes	Future Provisional	1	1	--	0	1
53	ER-10	Remediation	Yes	Future Provisional	1	1	--	0	1
54	ER-11	Remediation	Yes	Future Provisional	1	1	--	0	1
55	FW-1	Remediation	No	Planned	1	1	--	1	0
56	FW-2	Remediation	No	Planned	1	1	--	1	0
57	IRL-1	Remediation	No	Planned	1	1	--	1	0
58	IRL-2	Remediation	No	Planned	1	1	--	1	0
59	IRL-3	Remediation	No	Planned	1	1	--	1	0
60	IRL-4	Remediation	No	Planned	1	1	--	1	0
61	IRL-5	Remediation	No	Future Provisional	1	1	--	0	1
62	IRL-6	Remediation	No	Future Provisional	1	1	--	0	1
63	IRL-7	Remediation	No	Future Provisional	1	1	--	0	1
64	IRZ-01	Remediation	No	Planned	1	1	--	1	0
65	IRZ-02	Remediation	No	Future Provisional	4	2	--	0	2
66	IRZ-03	Remediation	No	Future Provisional	4	2	--	0	2
67	IRZ-04	Remediation	No	Future Provisional	4	2	--	0	2
68	IRZ-05	Remediation	No	Planned	2	1	--	1	0
69	IRZ-06	Remediation	No	Future Provisional	4	2	--	0	2
70	IRZ-07	Remediation	No	Future Provisional	4	2	--	0	2
71	IRZ-08	Remediation	No	Future Provisional	4	2	--	0	2
72	IRZ-09	Remediation	No	Planned	2	1	--	1	0
73	IRZ-10	Remediation	No	Future Provisional	4	2	--	0	2
74	IRZ-11	Remediation	No	Planned	4	2	--	2	0
75	IRZ-12	Remediation	No	Future Provisional	4	2	--	0	2
76	IRZ-13	Remediation	No	Planned	4	2	--	2	0
77	IRZ-14	Remediation	No	Future Provisional	4	2	--	0	2
78	IRZ-15	Remediation	No	Planned	4	2	--	2	0
79	IRZ-16	Remediation	No	Planned	4	2	--	2	0
80	IRZ-17	Remediation	No	Planned	4	2	--	2	0

TABLE ES-2B
Estimated Borehole Count Associated with Well Construction: Count Details
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Added in 90% BOD	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
81	IRZ-18	Remediation	No	Future Provisional	4	2	--	0	2
82	IRZ-19	Remediation	No	Planned	4	2	--	2	0
83	IRZ-20	Remediation	No	Planned	4	2	--	2	0
84	IRZ-21	Remediation	No	Planned	4	2	--	2	0
85	IRZ-22	Remediation	No	Future Provisional	4	2	--	0	2
86	IRZ-23	Remediation	No	Planned	1	1	--	1	0
87	IRZ-24	Remediation	No	Future Provisional	2	1	--	0	1
88	IRZ-25	Remediation	No	Planned	2	1	--	1	0
89	IRZ-26	Remediation	No	Future Provisional	2	1	--	0	1
90	IRZ-27	Remediation	No	Planned	2	1	--	1	0
91	IRZ-28	Remediation	No	Future Provisional	2	1	--	0	1
92	IRZ-29	Remediation	No	Planned	2	1	--	1	0
93	IRZ-30	Remediation	No	Future Provisional	2	1	--	0	1
94	IRZ-31	Remediation	No	Planned	2	1	--	1	0
95	IRZ-32	Remediation	No	Future Provisional	2	1	--	0	1
96	IRZ-33	Remediation	No	Planned	2	1	--	1	0
97	IRZ-34	Remediation	No	Future Provisional	1	1	--	0	1
98	IRZ-35	Remediation	No	Planned	1	1	--	1	0
99	IRZ-36	Remediation	No	Future Provisional	1	1	--	0	1
100	IRZ-37	Remediation	No	Planned	1	1	--	1	0
101	IRZ-38	Remediation	No	Future Provisional	1	1	--	0	1
102	IRZ-39	Remediation	No	Planned	1	1	--	1	0
103	IRZ-40	Remediation	No	Future Provisional	1	1	--	0	1
104	RB-1	Remediation	No	Planned	2	1	--	1	0
105	RB-2	Remediation	No	Planned	2	1	--	1	0
106	RB-3	Remediation	No	Planned	2	1	--	1	0
107	RB-4	Remediation	No	Planned	2	1	--	1	0
108	RB-5	Remediation	No	Planned	2	1	--	1	0
109	RB-6	Remediation	Yes	Future Provisional	2	1	--	0	1
110	RB-7	Remediation	Yes	Future Provisional	2	1	--	0	1
111	RB-8	Remediation	Yes	Future Provisional	2	1	--	0	1

TABLE ES-2B

Estimated Borehole Count Associated with Well Construction: Count Details

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design

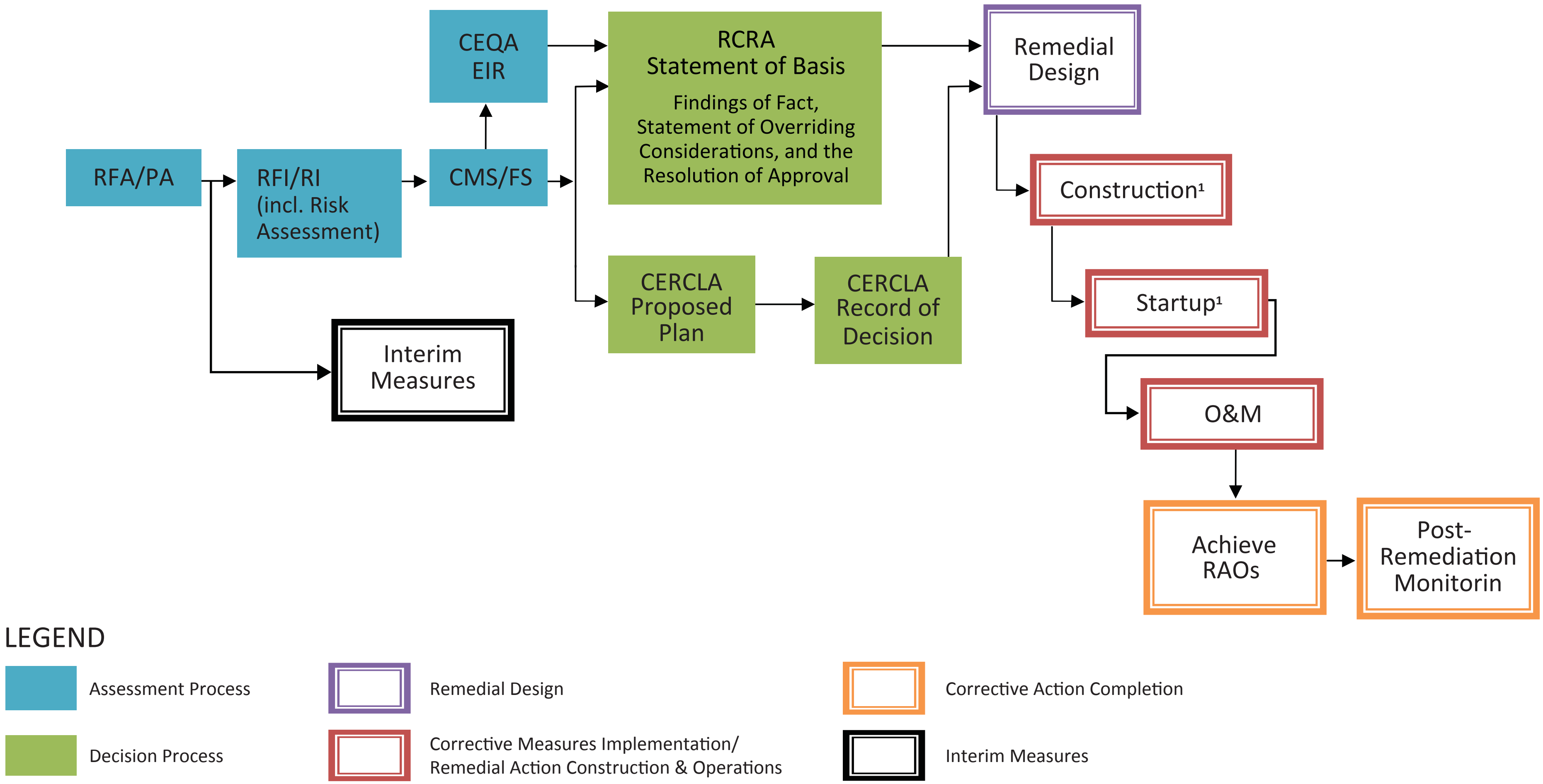
PG&E Topock Compressor Station, Needles, California

Item	Location Name	Well Type	Added in 90% BOD	Status	Est. # of Well Screen Intervals	Calculated # of Boreholes	Number of Boreholes Installed	Est. # of Planned Boreholes	Est. # of Future Provisional Boreholes
112	RB-9	Remediation	Yes	Future Provisional	2	1	--	0	1
113	TCS-1	Remediation	No	Planned	2	1	--	1	0
114	TCS-2	Remediation	No	Planned	2	1	--	1	0
115	TWB-1	Remediation	No	Planned	1	1	--	1	0
116	TWB-2	Remediation	No	Planned	1	1	--	1	0
117	TWB-3	Remediation	No	Future Provisional	1	1	--	0	1
118	TWB-4	Remediation	No	Future Provisional	1	1	--	0	1

Key Assumptions:

1. Up to 2 well casings (screens) will be nested in each borehole at MW locations where there are multiple screens. The estimated number of screened intervals could change based on actual field conditions.

2. Remediation wells will be constructed with one well per borehole (this includes dual screen wells along the IRZ, for which some have up to 2 separate dual screen wells per location).



[1] Construction and Startup activities overlap. Five-year reviews will be conducted by DTSC and DOI to assess remedy performance.

RFA/PA: RCRA Facility Assessment/Preliminary Assessment

RFI/RI: RCRA Facility Investigation/CERCLA Remedial Investigation

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

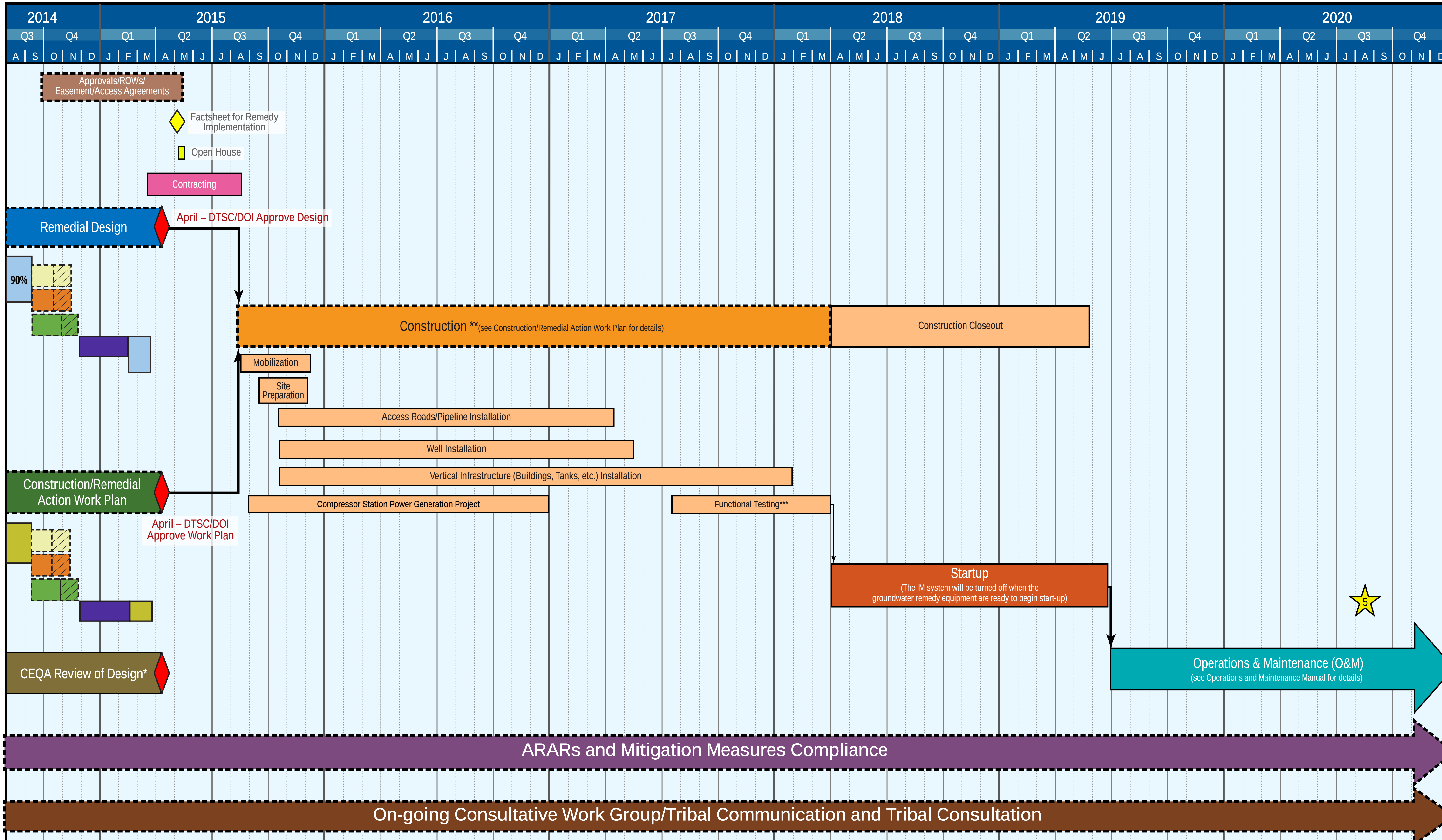
CEQA EIR: California Environmental Quality Act Environmental Impact Report

RAOs: Remedial Action Objectives

O&M: Operations & Maintenance

FIGURE ES-1
SITE CLEANUP PROCESS
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Groundwater Remedy Design, Construction, Startup, and Initial O&M Schedule

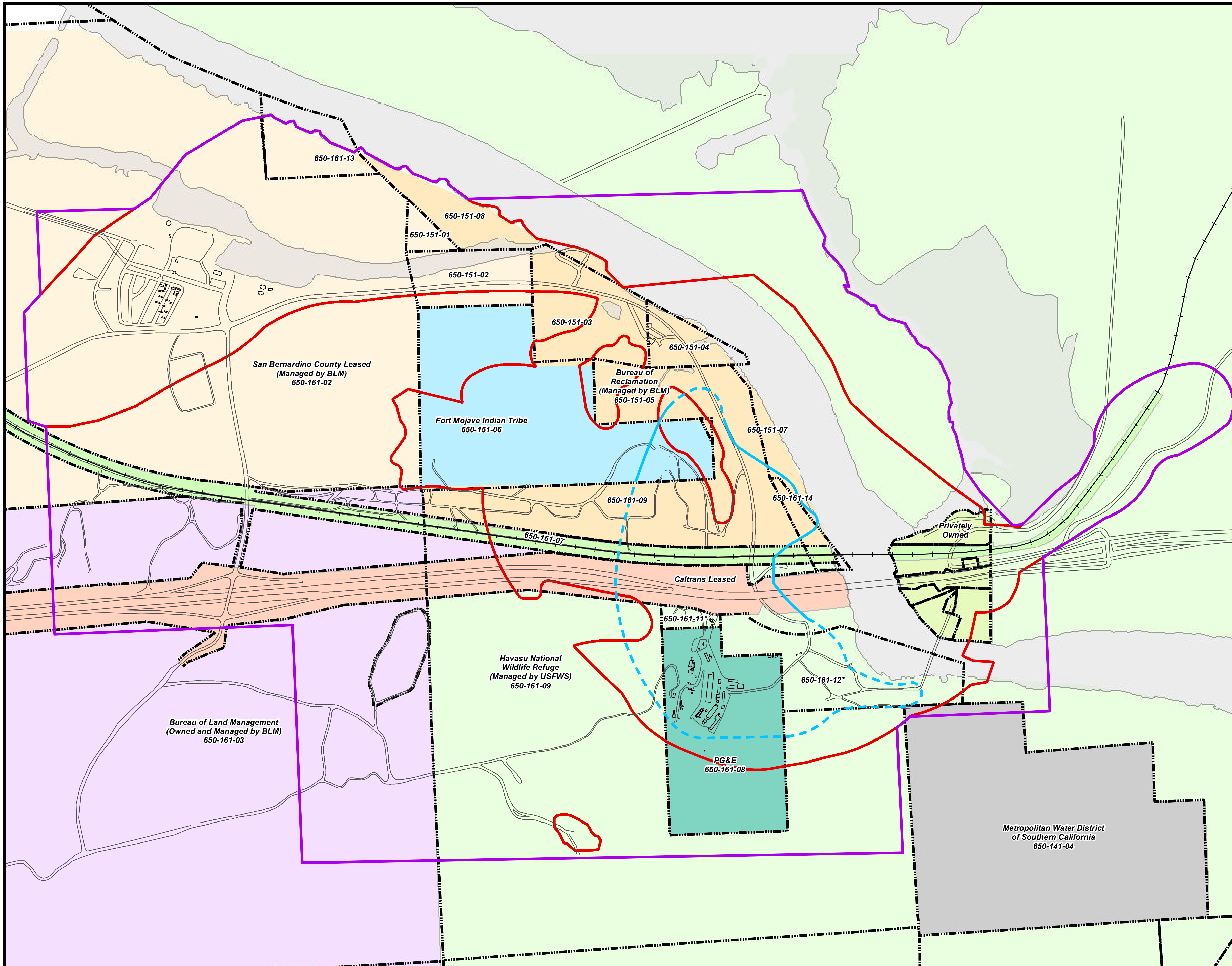


LEGEND
- Draft/Final Work Plan
- Consultative Work Group/ Technical Work Group Review
- Preliminary/Intermediate/ Pre-Final/Final Design
- Tribal Consultation
- Agencies Review
- Comment Resolution
- Extended Period
- Agencies 5-year Review

* Duration of review is dependent on type of CEQA document
** Start of construction depends on completion of CEQA review
*** This period is often referred to as "commissioning" or "shakedown", which is the period when the construction contractors make minor adjustments as necessary to insure the system or components is operating and functioning as designed.

FIGURE ES-2
GROUNDWATER REMEDY SCHEDULE
GROUNDWATER REMEDY BASIS OF DESIGN REPORT, PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL.



LEGEND

- 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 2013 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.

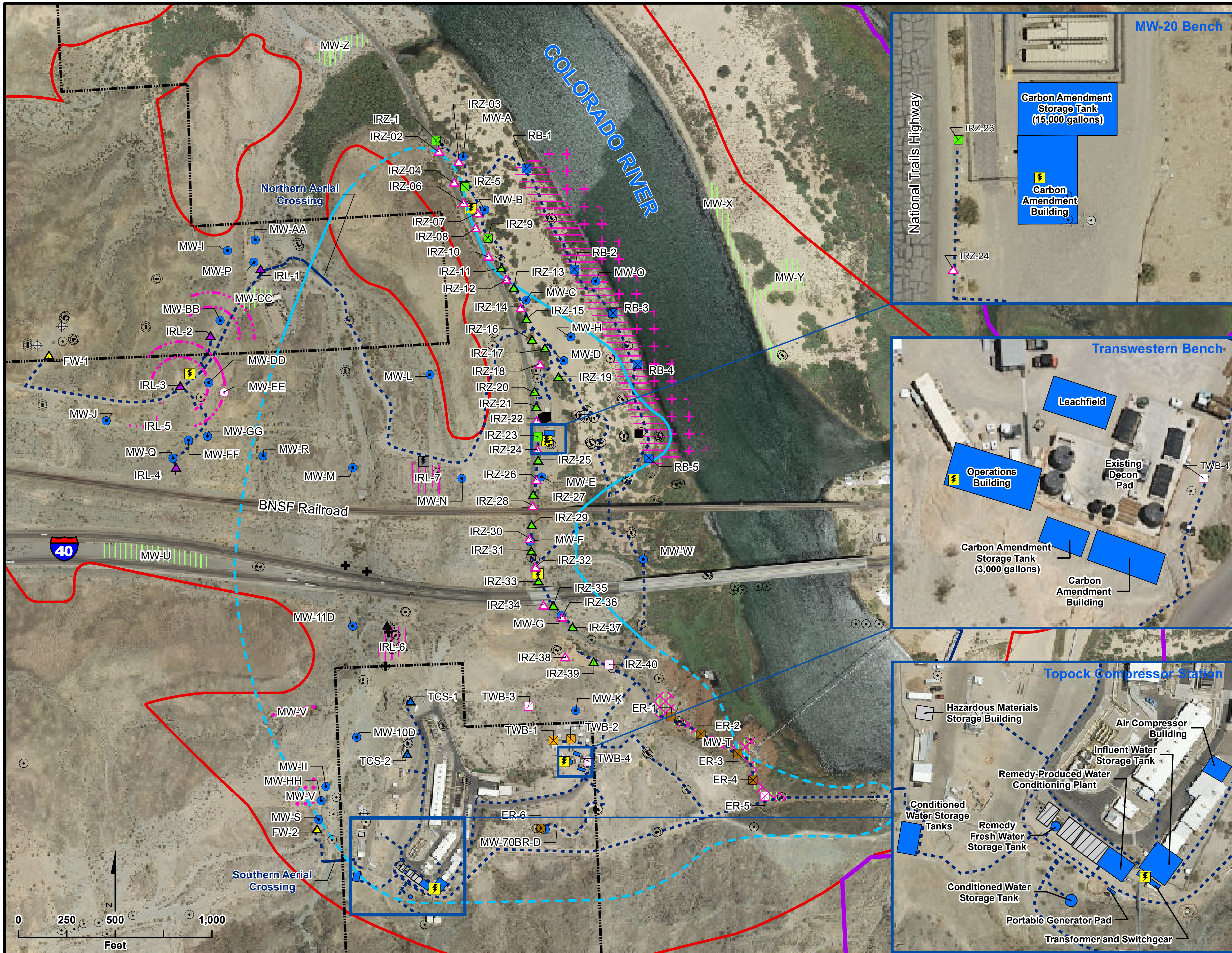
N

0 350 700 1,400 Feet

FIGURE ES-3
SURROUNDING PROPERTY MAP
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES3_SurroundingProp.mxd



LEGEND

- Property Boundaries
- Area of Potential Effects (APE)
- EIR Project Area

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:

(Items in Pink are Provisional)

- Extraction Well
- Injection Well
- Monitoring Well (MW-EE is a pending/future provisional monitoring well)
- Arc for IRL-2 and IRL-3 Arsenic Monitoring Wells [3]
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:

- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Pipeline Corridor for Remedy

- Aboveground Pipe
- Underground Pipe/Conduit

Remedy Facilities

- Planned Transformer
- Future Provisional Transformer
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth ingroundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:

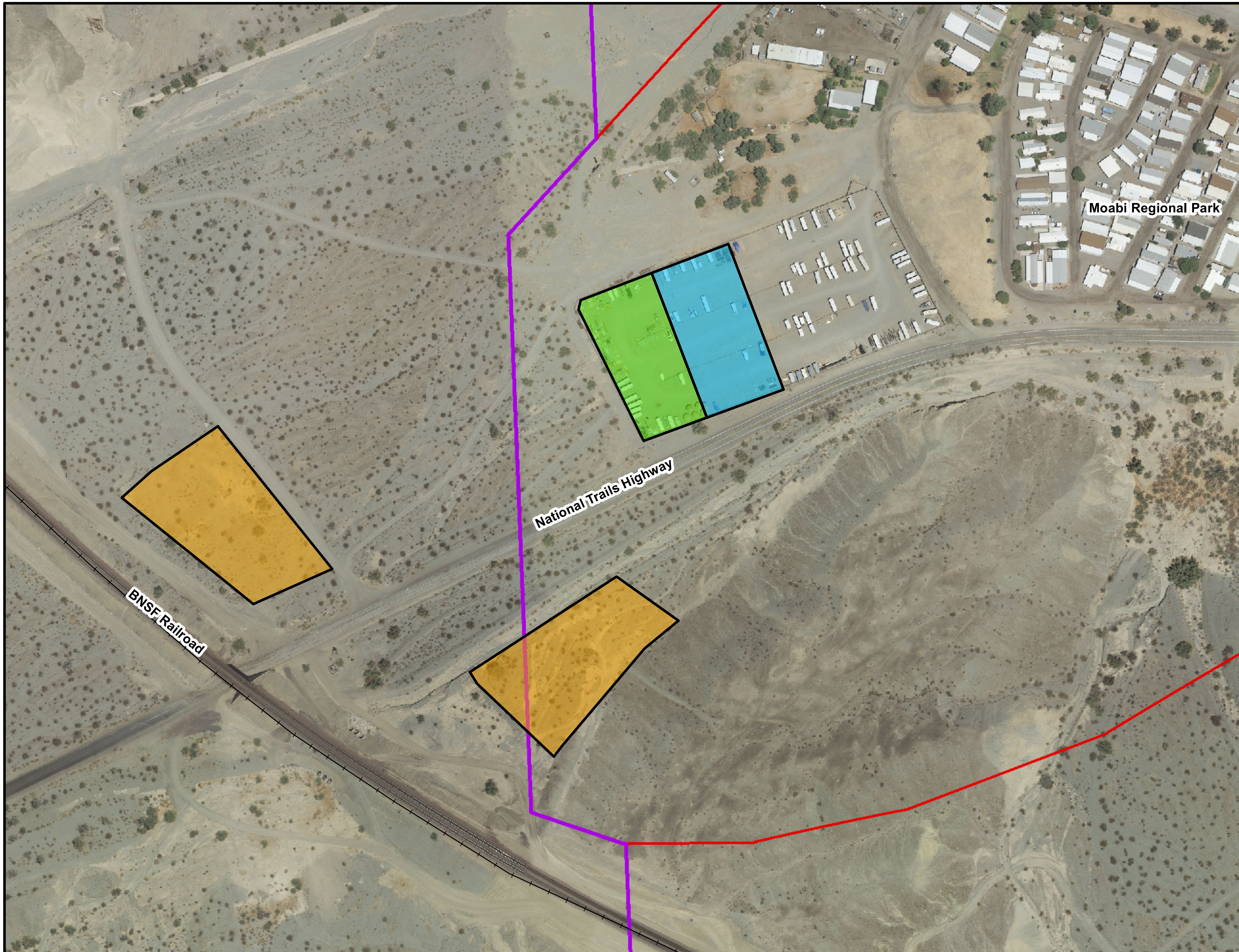
1. Note that in compliance with EIR mitigation measure CUL-1a-9, as well as PA and CHPMP mitigation measures, the pipeline along the dirt road west of National Trails Hwy is located in an existing, previously disturbed, access road. In addition, the location of the road and pipeline was field verified 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.
2. All well and structure locations are approximate.
3. Arcs for IRL-2 and IRL-3 arsenic monitoring wells represent a range of potential well locations. Portions of the arcs are not suitable for well installation due to technical and/or cultural resources constraints.

FIGURE ES-4A
GENERAL REMEDY SYSTEM LAYOUT - CALIFORNIA

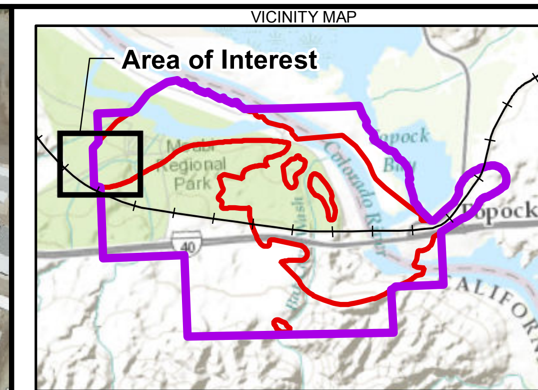
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES4A_90pct_CAdetails.mxd



VICINITY MAP



LEGEND

- Long Term Remedy Support Area (1.2 acres approx.)
- Soil Storage Area (Each 1.5 acres approx.)
- Temporary Construction Laydown Area (1.3 acres approx.)
- Area of Potential Effects (APE)
- EIR Project Area

Notes:
1. This is a conceptual layout. Locations are approximate.
2. Descriptions of activities/functions anticipated for the construction support areas are included in the Construction/Remedial Action Work Plan.
3. Descriptions of activities/functions anticipated for the long-term remedy support areas are included in Section 3.5 of this BOD, and the O&M Manual.

N

0 95 190 380 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

FIGURE ES-4B
GENERAL REMEDY SYSTEM LAYOUT - MOABI REGIONAL PARK
GROUNDWATER BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES4B_PM_StagingRemedy_11x17.mxd

LEGEND

Underground Gas Supply Pipe

Proposed Remedy Structure

Notes:

1. All remedy structure locations are approximate.
2. An alternate method of supplying power to the pumps and agitators is by direct connection to the compressor station power system. With this alternative, the new electrical conductors will be installed along the right-of-way that currently contains the discharge pipeline that carries water from the compressor station to the ponds. A small control building or panel would be installed to house the pond controls and communications equipment. PG&E is evaluating this option and will include the selected power supply method in the final (100%) design.

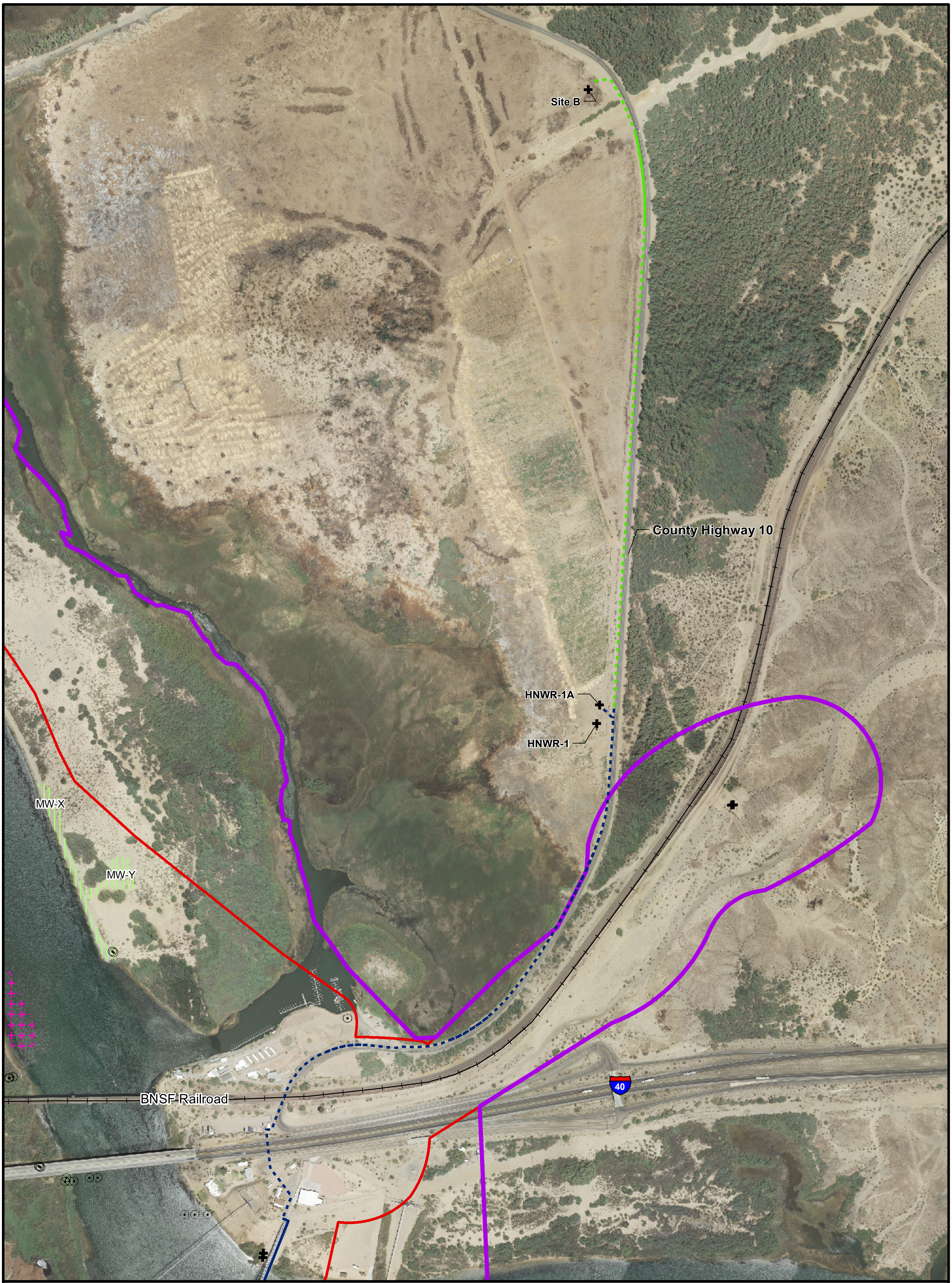
N

0 75 150 300 Feet

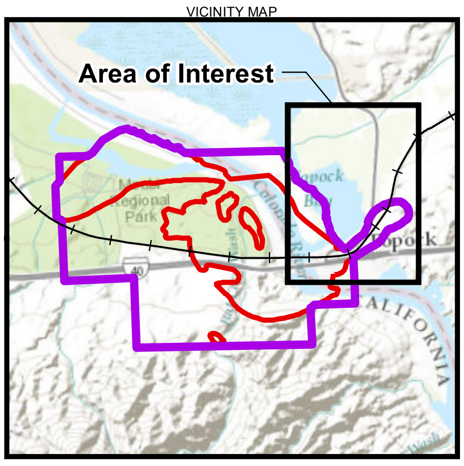
FIGURE ES-4C
GENERAL REMEDY SYSTEM LAYOUT - TCS EVAPORATION PONDS
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2014\CMS\ES4C_POND_PHOTO.MXD ECLARK1 8/18/2014 9:32:31 AM

CH2MHILL



VICINITY MAP



LEGEND

Existing Wells:
- Monitoring Well
- Water Supply Well

Planned Wells:
- Area for Monitoring Well (Applies to MW-X and MW-Y)

Provisional Wells:
- Area for Potential Slant Well Screens

Pipeline Corridor for Remedy
- Aboveground Freshwater Pipe
- Underground Freshwater Pipe
- Future Provisional/Contingent Fresh Water Pipe

- Area of Potential Effects (APE)
- EIR Project Area

Note:
All wells and remedy structure locations are approximate.

N

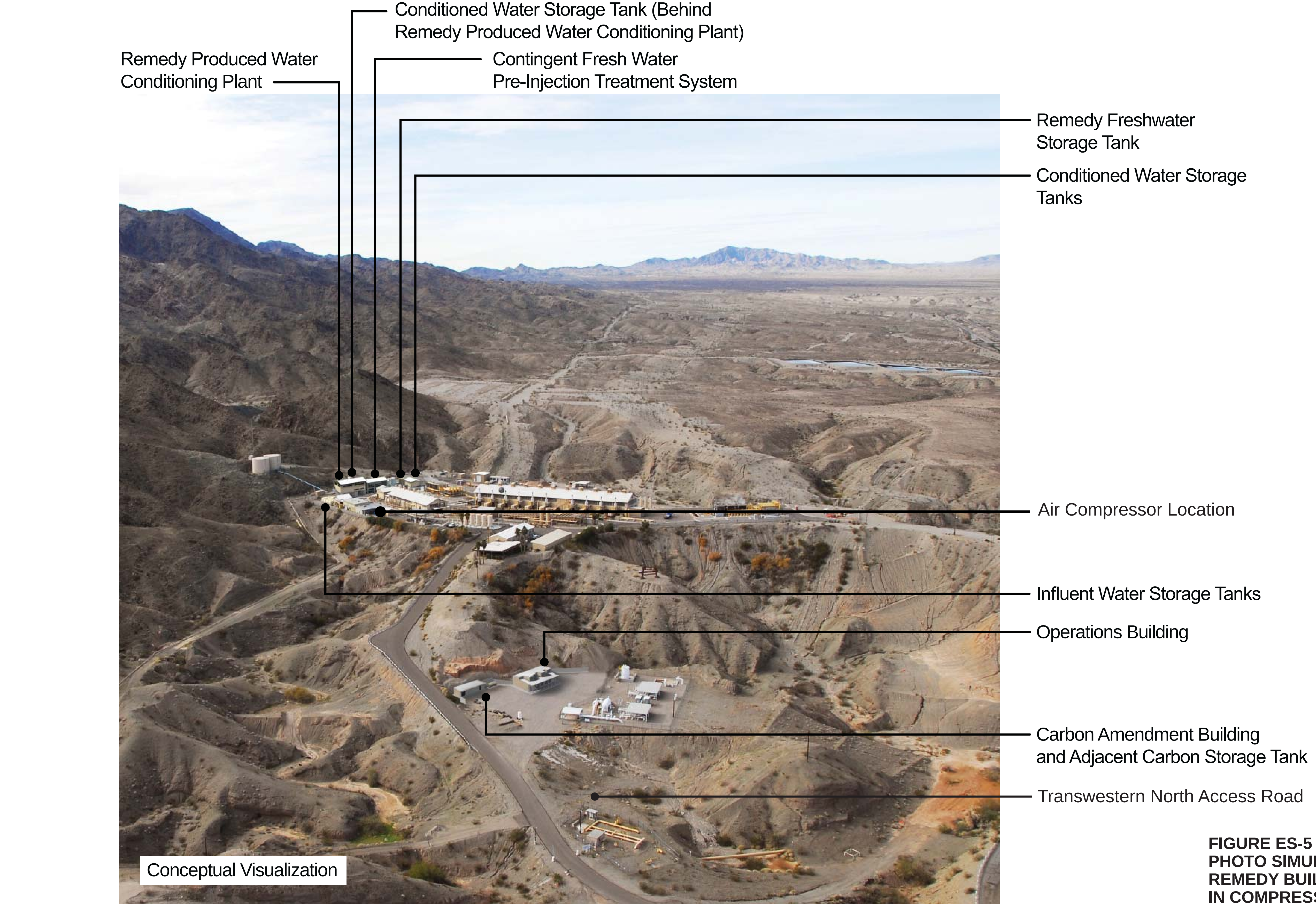
0 200 400 800 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

FIGURE ES-4D
GENERAL REMEDY SYSTEM LAYOUT - ARIZONA
GROUNDWATER BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

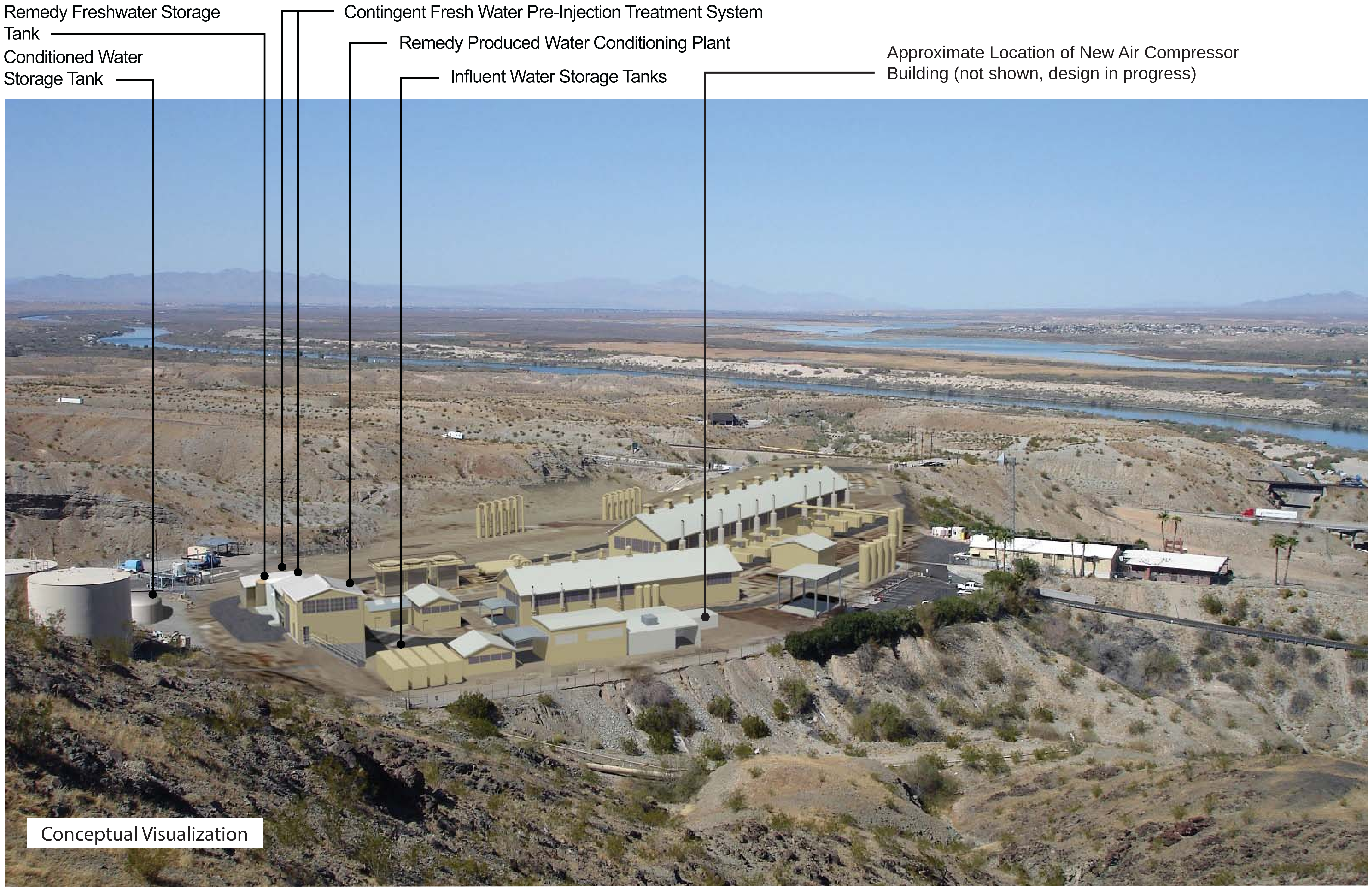
CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES4D_ArizonaFW_11x17.mxd



Source: IDC Architects 2014.

FIGURE ES-5
PHOTO SIMULATION OF NEW REMEDY BUILDINGS/STRUCTURES IN COMPRESSOR STATION AND TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



Source: IDC Architects 2014.

FIGURE ES-6
NEW REMEDY BUILDINGS AND STRUCTURES IN THE COMPRESSOR STATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.

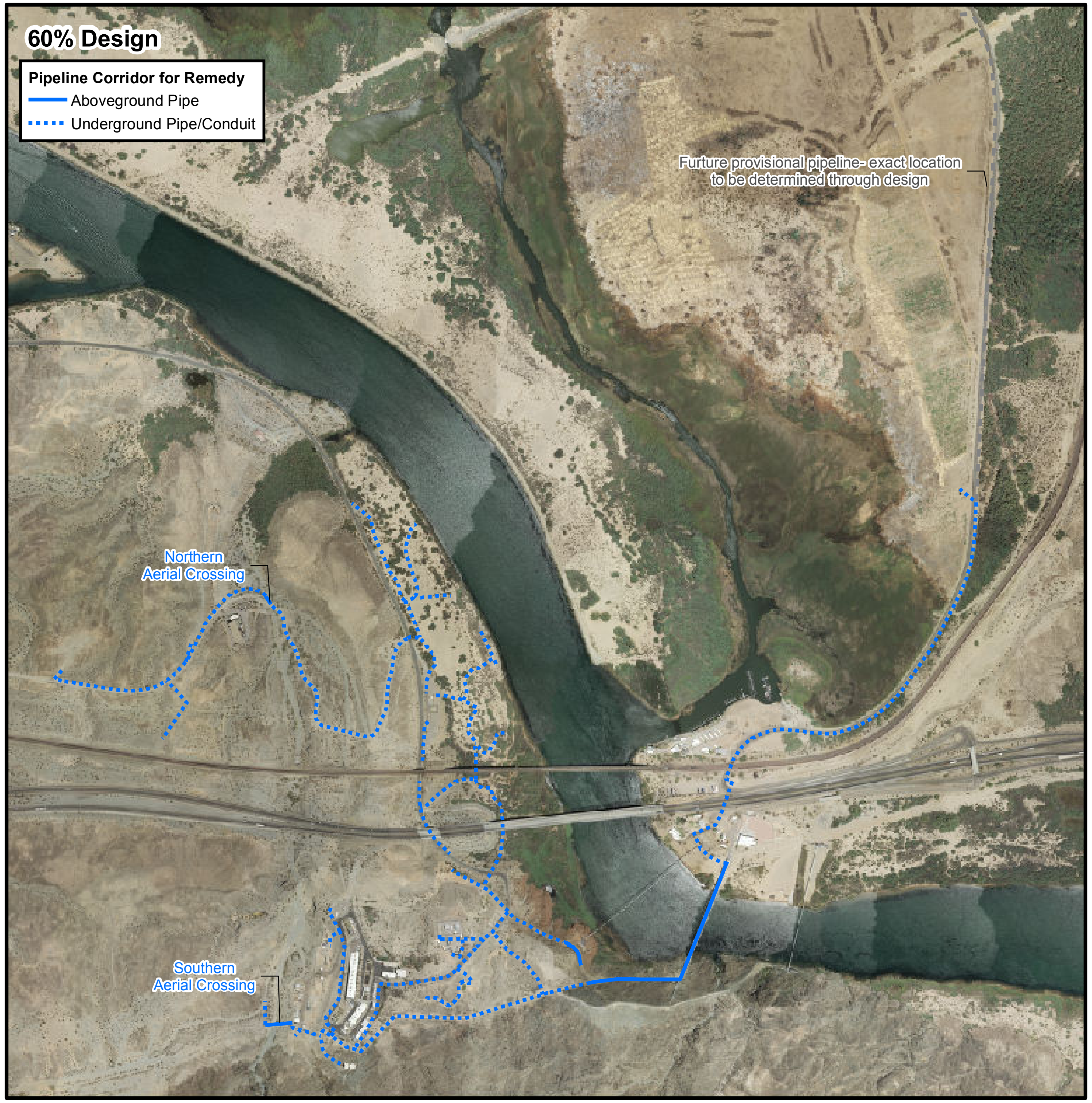
Source: IDC Architects 2014.

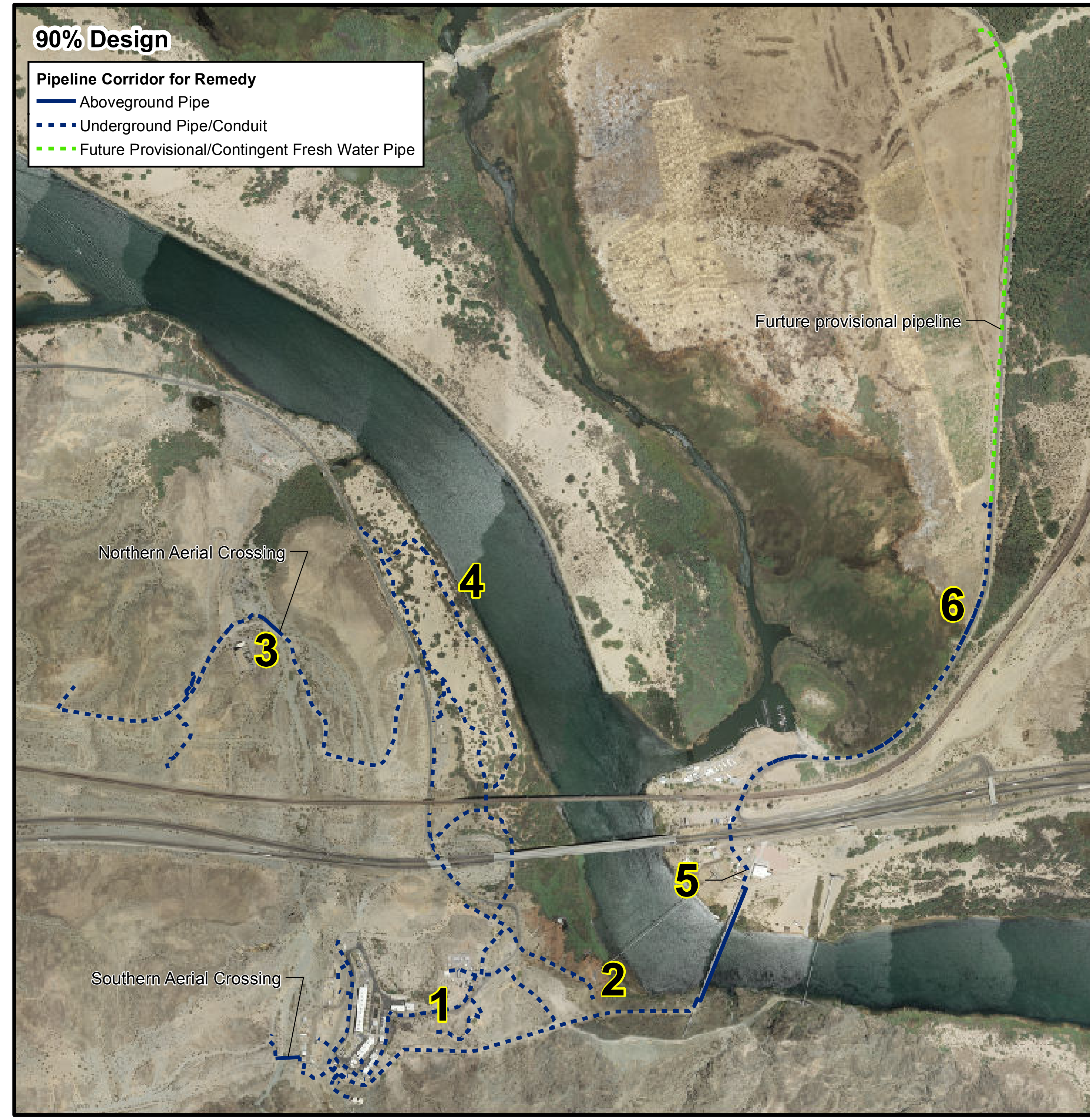
FIGURE ES-7
PHOTO SIMULATION OF NEW REMEDY BUILDINGS AND STRUCTURES AT THE TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.

Source: IDC Architects, April 2013.

FIGURE ES-8
PHOTO SIMULATION OF NEW REMEDY BUILDING AT THE MW-20 BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA





KEY CHANGES

1. Rerouted piping at entrance to TCS to avoid utility conflicts.
2. Brought the aboveground portion of pipe that conveys extracted groundwater from the East Ravine underground after review of subsurface data obtained from potholing efforts.
3. Evaluating alternative crossing of Bat Cave Wash in the uplands.
4. Rerouted piping/added access road in floodplain to facilitate O&M of planned and future provisional river bank extraction wells.
5. Rerouted piping to get on Arch Bridge (in AZ) to avoid private driveway with leaning wall.
6. Moved freshwater pipe from east to west side of County Highway 10 to avoid overhead electrical line for construction safety.

N

0 500 1,000 2,000

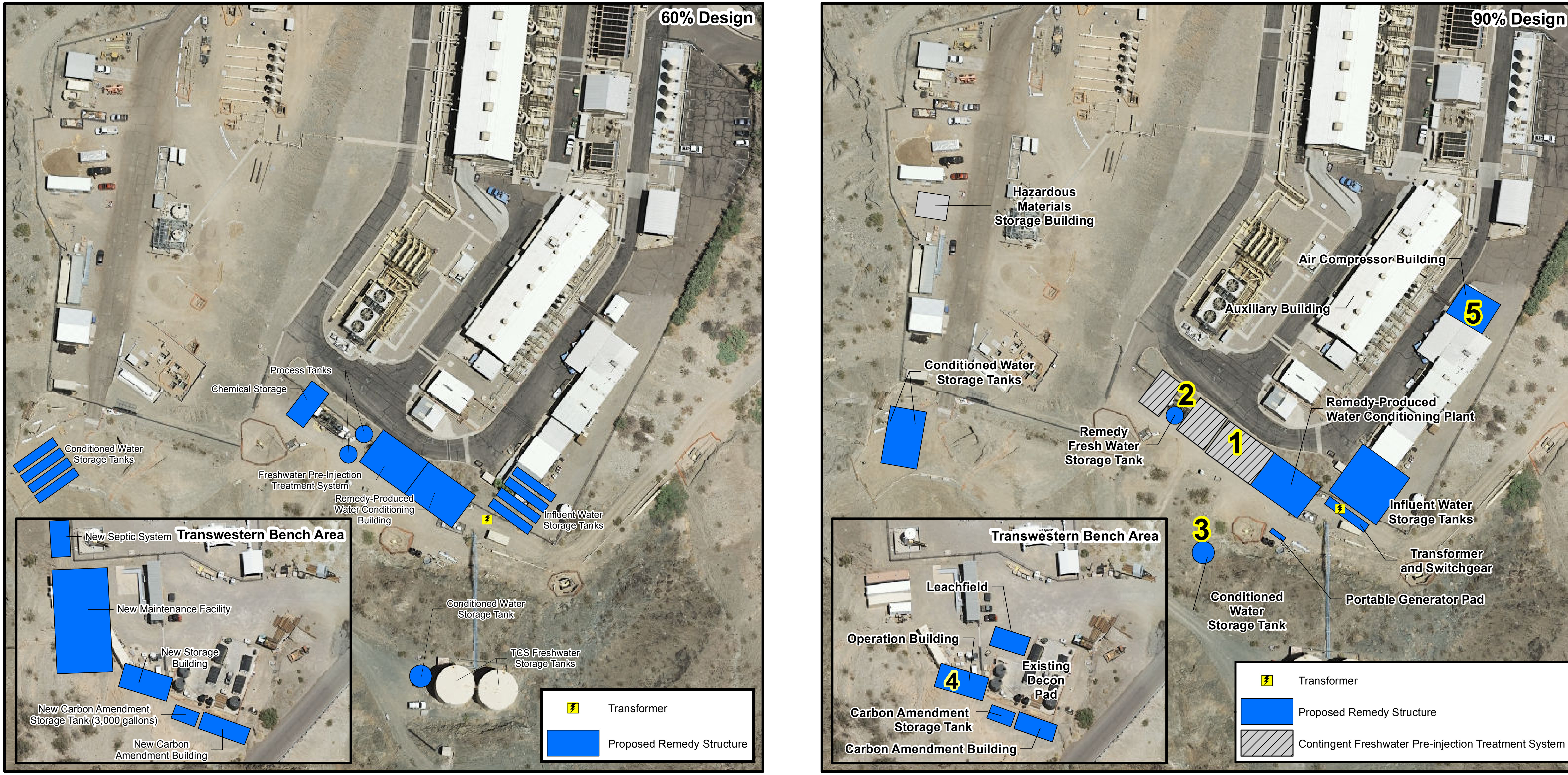
Feet

Note:
All pipeline locations are approximate.

FIGURE ES-9
ILLUSTRATION OF KEY CHANGES FROM 60% TO 90% DESIGN – PIPELINE ALIGNMENT
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES9_6090_ComparePipeAlignment.mxd



Key Changes from 60% to 90%

1. Made the Fresh Water Pre-Injection Treatment System (As treatment) into a contingent system. An equipment decontamination pad will be built in the footprint of the Contingent building.
2. Separated freshwater storage for remedy from Compressor Station. Added a smaller 10,000-gallon tank.
3. Moved the conditioned water storage tank to a lower elevation.
4. To free up space at TW Bench, retained critical operation functions in Operations Building at TW Bench. Moved rest of functions to Moabi Regional Park.
5. Added new air compressor building to house existing air compressors that are relocated to free up space for new generators in the Auxiliary Building.

Note:
All remedy structure locations are approximate.

N

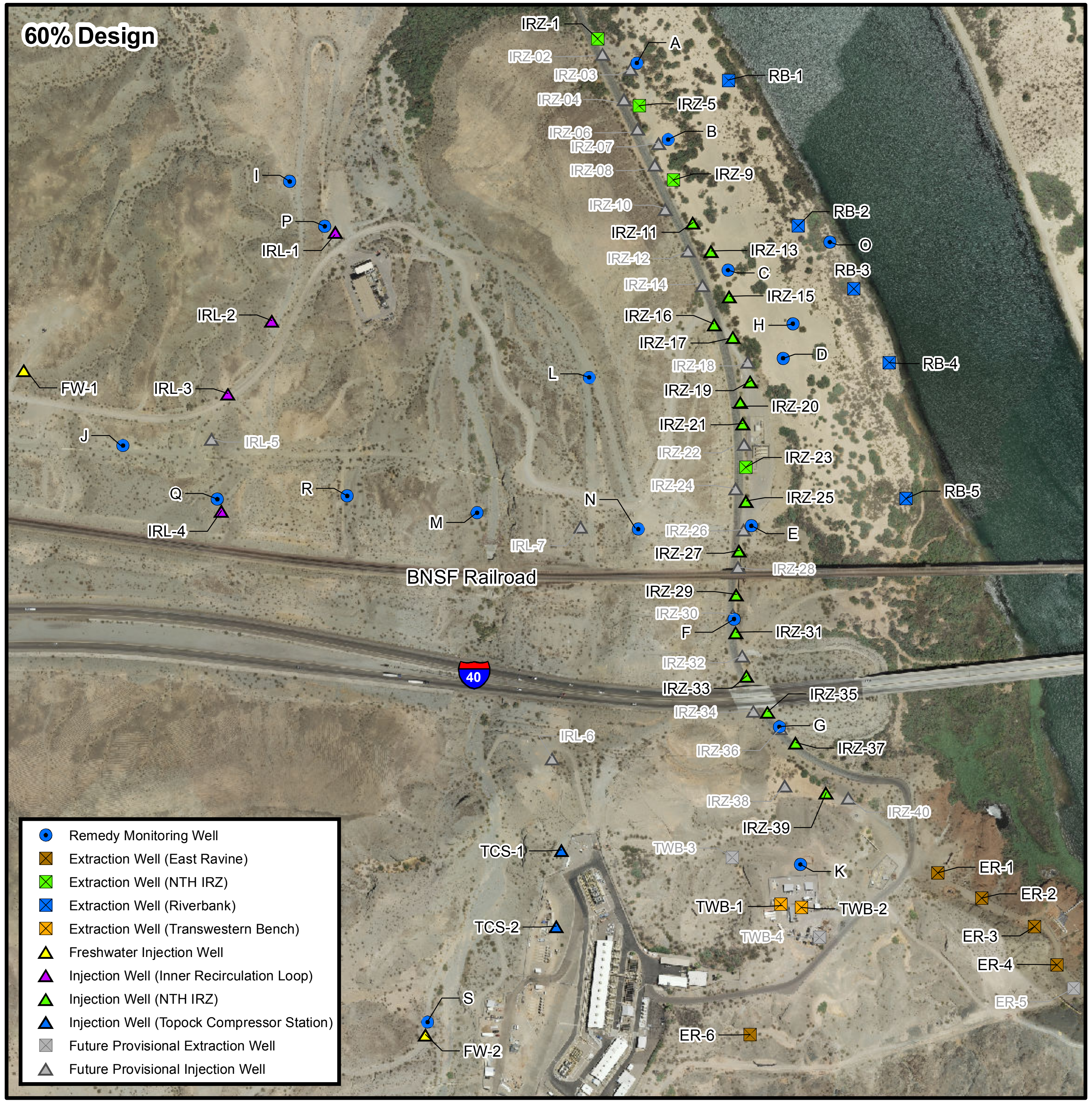
0 35 70 140 Feet

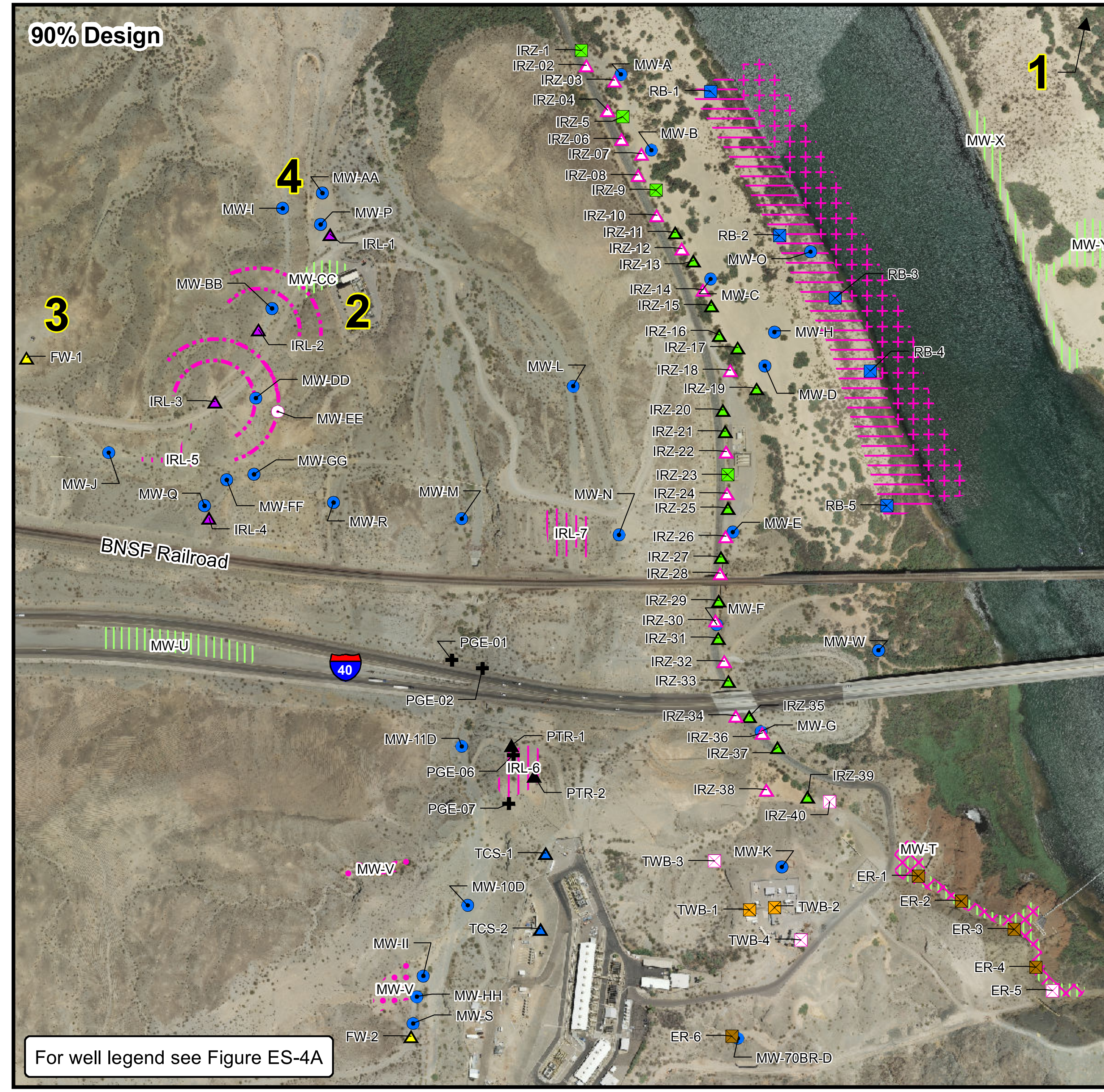
FIGURE ES-10
ILLUSTRATION OF KEY CHANGES FROM THE 60% TO 90% DESIGN - REMEDY FACILITIES AT THE COMPRESSOR STATION AND TRANSWESTERN BENCH

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES10_6090CompareRemedyFacilities.mxd





KEY CHANGES:

1. Installed two water supply wells in Arizona – HNWR-1A (primary source) and Site B (contingent source), not shown on this figure.
2. Added Arsenic monitoring wells in the uplands.
3. Moved FW-1 to the north to avoid installation of new Arsenic monitoring wells on FMIT property.
4. Moved remedy well IRL-1 to avoid the installation of an arsenic monitoring well on FMIT parcel. In addition, in response to a comment from the FMIT (60% RTC #676 FMIT-178), moved MW-I approximately 45 to 50 feet south-southeast to a location acceptable to stakeholders and Tribes during a site walk on July 30, 2013.
5. Added planned and future provisional wells per April 4, 2014 Agencies direction letter and response to 60% comments.

Note:
All remedy structure locations are approximate.

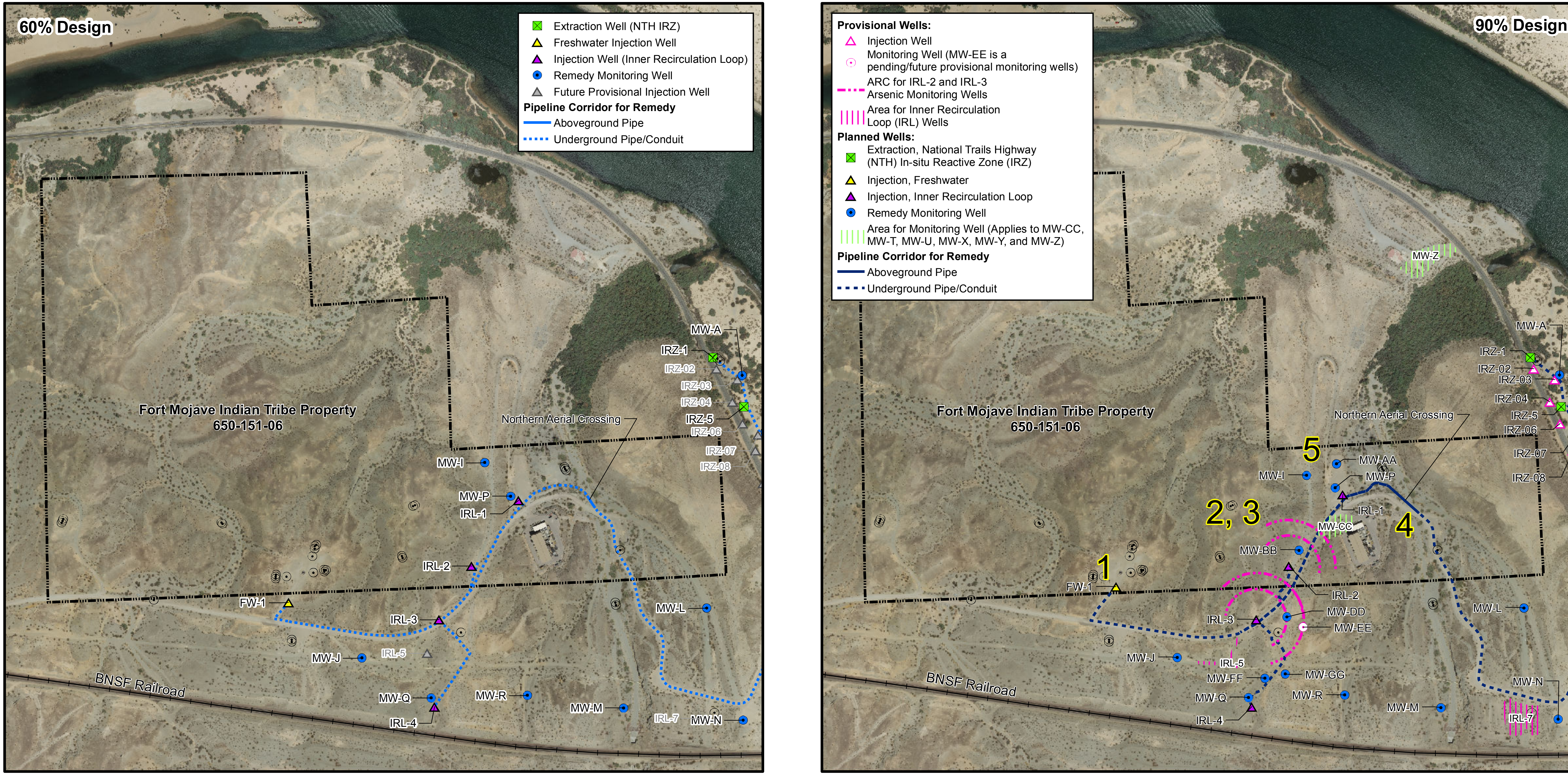
N

0 250 500 1,000 Feet

FIGURE ES-11
ILLUSTRATION OF KEY CHANGES FROM 60% TO 90% DESIGN - WELL NETWORK
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES11_6090CompareWellNetwork.mxd



KEY CHANGES

1. Moved freshwater injection well FW-1 to the north to allow for reuse of existing wells for arsenic monitoring at this location. This change avoids the installation of two new monitoring wells on FMIT parcel.
2. Added new Arsenic monitoring wells MW-AA and MW-BB
3. Added future provisional arsenic monitoring wells, MW-CC and MW-EE. The necessity for these wells will be determined pending operational data from other arsenic monitoring wells. CW-2S location is a potential alternate location for MW-EE.
4. Evaluating alternative crossing of Bat Cave Wash.
5. Moved remedy well IRL-1 to avoid the installation of an arsenic monitoring well on FMIT parcel. In addition, in response to a comment from the FMIT (60% RTC #676 FMIT-178), moved MW-I approximately 45 to 50 feet south-southeast to a location acceptable to stakeholders and Tribes during a site walk on July 30, 2013.

Notes:
1. All wells and remedy structure locations are approximate.
2. Arcs for IRL-2 and IRL-3 arsenic monitoring wells represent a range of potential well locations. Portions of the arc are not suitable for well installation due to technical and/or cultural resources constraints.

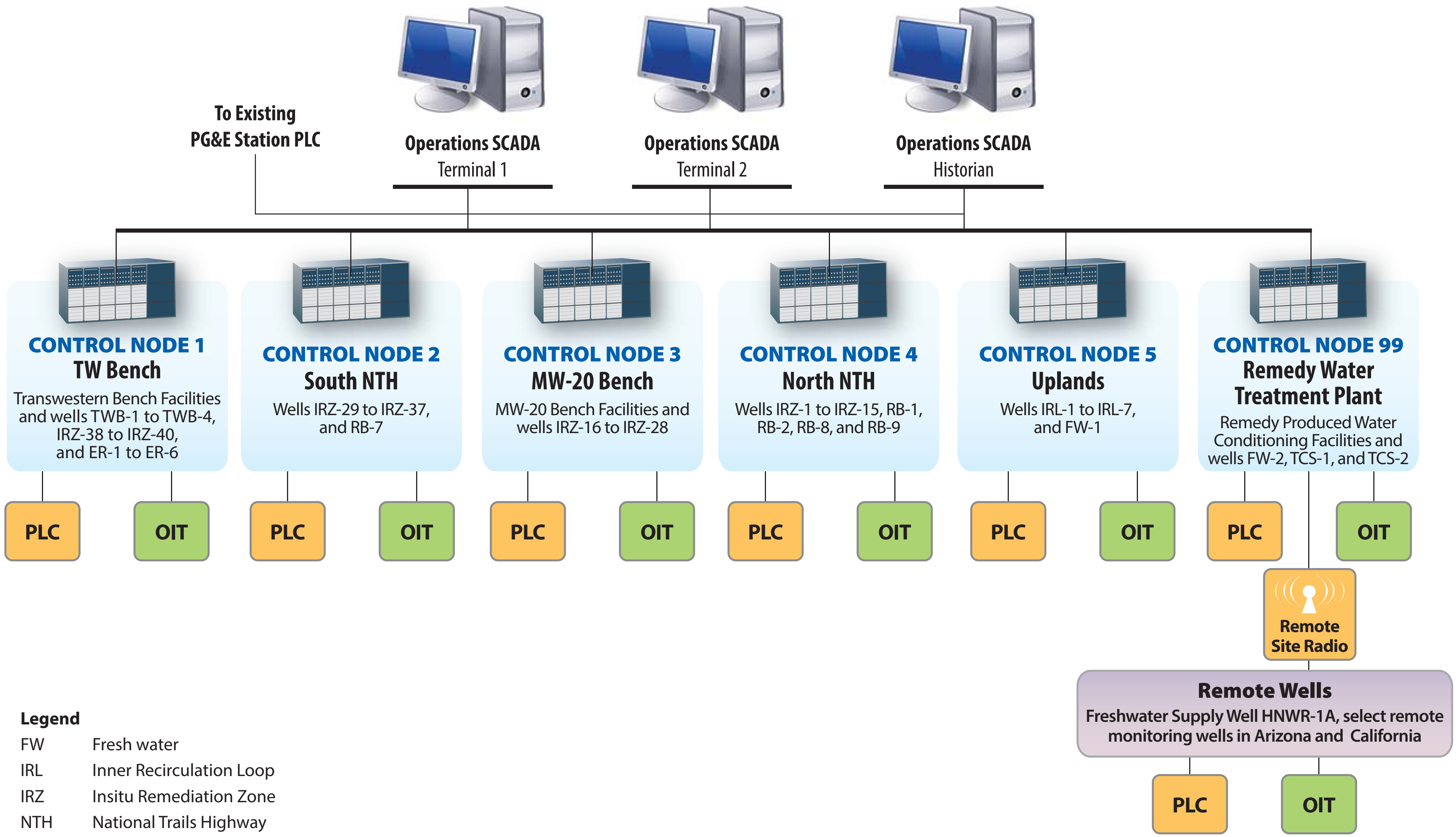
0 237.5 475 950 Feet

N

FIGURE ES-12
ILLUSTRATION OF KEY CHANGES FROM 60% TO 90% DESIGN – REMEDY FEATURES ON FMIT PROPERTY
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\ES12_6090_FortMojaveCompare.mxd



Legend

FW	Fresh water
IRL	Inner Recirculation Loop
IRZ	Insitu Remediation Zone
NTH	National Trails Highway
OIT	Operator Interface Terminal
PLC	Programmable Logic Controller
RB	River Bank
SCADA	Supervisory Control and Data Acquisition
TCS	Topock Compressor Station
TW	Transwestern Bench

FIGURE ES-13
SCHEMATIC OF REMEDY SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

ES102411163118BAO_Topock_Schm_RemedySupControl-SCADA_v2.ai_090214_lho

CH2MHILL.

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 Submittal
60% BOD	Basis of Design Report/Intermediate (60%) Design Submittal
90% BOD	Basis of Design Report/Pre-Final (90%) Design Submittal
AA	activated alumina
ACEC	Area of Critical Environmental Concern
ADOT	Arizona Department of Transportation
AE	Applied Earthworks, Inc.
AMM	Avoidance and Minimization Measure
AOC	Area of Concern
APE	Area of Potential Effects
APN	Assessor's Parcel Number
ARARs	applicable or relevant and appropriate requirements
As	arsenic
As(III)	trivalent arsenic
As(V)	pentavalent arsenic
AST	aboveground storage tank
AWWA	American Water Works Association
BAGS	Brady and Associates Geological Services
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
C/RAWP	Construction/Remedial Action Work Plan
CACA	Corrective Action Consent Agreement
Caltrans	California Department of Transportation
CD	Consent Decree
CDFW	California Department of Fish and Wildlife
CDNPA	California Desert Native Plants Act
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 Program
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
CPVC	chlorinated polyvinyl chloride
CQAPP	Construction Quality Assurance Project Plan
Cr(III)	trivalent chromium
Cr(T)	total chromium
Cr(VI)	hexavalent chromium
CRIT	Colorado River Indian Tribes
CRPR	California Rare Plant Ranked
CWA	Clean Water Act
CWG	Consultative Working Group
DMRS	dissolved metals removal system
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
ft w.c.	feet of water column
ft/ft	feet per foot
FW	freshwater (wells)

FWPTS	Freshwater Pre-injection Treatment System
GFH	granular ferric hydroxide
GHG	greenhouse gas
gpd	gallons per day
gpm	gallons per minute
GREM	Green Remediation Evaluation Matrix
HDPE	high-density polyethylene
HMBP	Hazardous Materials Business Plan
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
IRL	Inner Recirculation Loop
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

OF	Operational and Functional
OHWM	ordinary high water mark
OIT	Operator Interface Terminal
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
PLC	programmable logic controller
PMO	PG&E's Chromium Project Management Office
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
RTC	response to comment
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
SWFL	southern willow flycatcher
SWMU	Solid Waste Management Unit
SWRCB	California State Water Resources Control Board
TCS	Topock Compressor Station

TDH	total dynamic head
TDS	total dissolved solids
TMU	Tribal Monthly Update
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
WDR	waste discharge requirement

SECTION 1

Introduction

This Basis of Design Report/Pre-Final (90%) Design Submittal (90% BOD) presents the pre-final design basis, design criteria, drawings, specifications, and appendices (including Appendix L, the Operation 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 pre-final 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://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), on behalf of DOI, under CERCLA in 2012, which was approved by the U.S. District Court for the Central District of California in November 2013.

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 90% BOD 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 pre-final (90%) design submittal that provides design detail, drawings, specifications, and appendices (including the O&M Manual) for implementation of the remedy. As shown in the Groundwater Remedy Design, Construction, Start-up, and Operation and Maintenance Schedule (see Exhibit 1.0-1), the pre-final (90%) design will continue to be refined with input from the Agencies, interested Native American Indian Tribal Nations, and other stakeholders through the final design (100%) stage, which is scheduled to continue through early 2015.

On November 18, 2011, PG&E submitted the Draft Basis of Design Report/Preliminary (30%) Design Submittal (30% BOD) (CH2M HILL 2011l) 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 (RTC) table transmitted on April 13, 2012, and Part 2 is the Freshwater Source Evaluation Technical Memorandum transmitted on April 27, 2012 (CH2M HILL 2012d; see Appendix J). Technical Working Group (TWG) meetings were held on April 19, 2012 in Henderson, Nevada and on May 16, 2012 via WebEx to discuss the RTCs.

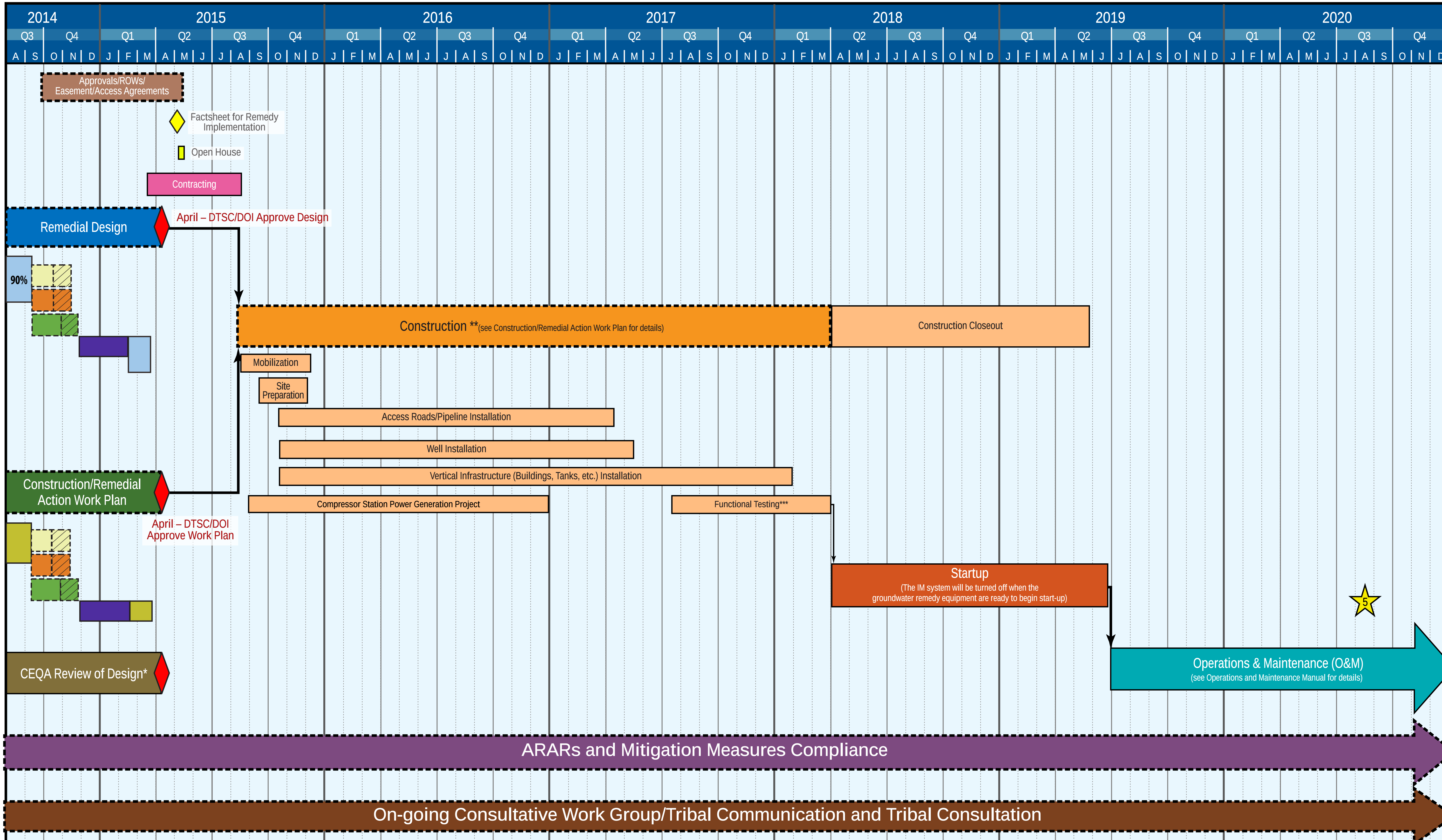
In the preliminary (30%) design, PG&E presented a plan to obtain freshwater from a well on the Havasu National Wildlife Refuge (HNWR)—well HNWR-1. As part of the response to comments on the 30% design, PG&E prepared a memo that provided additional detail on this potential freshwater source. Following 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 was 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 (60% BOD) to allow for continued discussion with DTSC and the RWQCB about arsenic treatment and to explore other freshwater sources.

In addition, with the RWQCB's consent, PG&E opened discussions with the SWRCB regarding the need to treat naturally occurring arsenic. While awaiting the SWRCB's 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 Freshwater Sources Evaluation (Implementation Plan) (CH2M HILL 2012g). Comments from Tribes, Agencies, and other 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. Two comment resolution meetings were held on May 14 and May 21, 2013. The Final Implementation Plan was issued on July 19, 2013 (redline version) and August 2, 2013 ("clean" version) (CH2M HILL 2013j). Additional comments were received from one Tribe on the Final Plan. These comments were considered by DTSC and DOI prior to approving the Final Plan on September 4, 2013. Field implementation of alternative freshwater studies commenced on October 2, 2013 and was completed on June 30, 2014.

On November 30, 2012, PG&E requested a second (6-month) extension 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 sources 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 submit the 60% design no later than April 5, 2013 and to bifurcate the freshwater source details from the 60% design (DTSC 2012a). 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 was anticipated to guide further direction from DTSC regarding the ultimate use of the freshwater source and what level of treatment, if any, would be required for various constituents. As such guidance was still forthcoming at the time of the 60% BOD submittal on April 5, 2013, PG&E made the conservative assumption for freshwater treatment goals, specifically that the arsenic treatment goal was to below the federal/state maximum contaminant level (MCL) of 10 micrograms per liter (µg/L) and the fluoride treatment goal was to below the state MCL of 2 milligrams per liter (mg/L).

Groundwater Remedy Design, Construction, Startup, and Initial O&M Schedule

PG&E Topock Compressor Station | Needles, California
September 2014



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
- Agencies 5-year Review

* Duration of review is dependent on type of CEQA document
** Start of construction depends on completion of CEQA review
*** This period is often referred to as "commissioning" or "shakedown", which is the period when the construction contractors make minor adjustments as necessary to insure the system or components is operating and functioning as designed.

EXHIBIT 1.0-1
GROUNDWATER REMEDY SCHEDULE
GROUNDWATER REMEDY BASIS OF DESIGN REPORT, PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION, NEEDLES, CALIFORNIA

CH2MHILL.

ES032811224427BAO Topock_GW_Timeline_SEP_2014_v3.ai 090414_lho

On April 5, 2013, PG&E submitted the 60% BOD (CH2M HILL 2013k) for review and comment. The comment period was approximately 4.5 months, from April 8 through August 23, 2014. More than 800 comments were received from the DOI, DTSC, RWQCB, MWD, FMIT, Hualapai Indian Tribe, Cocopah Indian Tribe, Chemehuevi Indian Tribe, Colorado River Indian Tribe (CRIT), and the TRC on behalf of the Tribes. Comment resolution occurred over a 7.5-month period from early September 2013 through mid-April 2014. Responses to each comment and its resolution are documented in an RTC table; the final RTC table was transmitted on April 18, 2014 (see Appendix I). Multiple venues for discussion and resolution of comments were held, including monthly TWG meetings, site walks, and ad hoc meetings.

Two key directions related to freshwater supply occurred after the submittal of the 60% design. The first was direction from DTSC, in a comment on the 60% design, to include a freshwater pre-injection treatment system to reduce arsenic only to below the federal/state MCL of 10 µg/L in this 90% design as a contingency. DTSC further noted that removal of fluoride was not warranted due to the elevated baseline values already above the MCL where water will be injected. The second was the SWRCB's decision letter on November 20, 2013 that provides the SWRCB's rationale and conditions for allowing injection of groundwater containing naturally occurring arsenic above the MCL without pre-treatment (SWRCB 2013).

On April 4, 2014, DTSC and DOI issued direction on the nine remaining 60% design issues and path forward for the 90% design (DTSC and DOI 2014). This Basis of Design Report/Pre-Final (90%) Design Submittal has been prepared to comply with DTSC's and DOI's April 4, 2014 directive, to incorporate responses to comments received on the 60% BOD, to incorporate data that has been collected since issuance of the 60% BOD in April 2013, and to bring the design details to a 90% 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 90% BOD submittal.

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.

A recent (2013) discovery of a 1964 site record shows a steel pipe extending from a "water treatment chamber" at the former sludge drying bed area on the TCS to an "abandoned water well" in the bottom of Bat Cave Wash; detailed information was provided in the RFI/RI Volume 1 Addendum (CH2M HILL 2014a).

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. DTSC had previously sampled some of the identified white powder materials. Additional white powder material that is located on the northern slope of the East Ravine below the station access road will be sampled as part of the upcoming supplemental Soil RFI/RI. 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 Area of Potential Effects (APE) for the Topock site is contained within what the FMIT and other Native American Tribes have identified as a larger area of traditional and cultural importance.. 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 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.”

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; 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.

1.1.3 Ecological Resources

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 ACEC and the Topock-Needles Special Cultural Resource Management Area (SCRMA), designated under the BLM Resources Management Plan (BLM 2007).

Remedial and investigative activities conducted to date at the Topock site are in conformance with the requirements of the 2007 Programmatic Biological Assessment (PBA; CH2M HILL 2007b) and its 2012 Addendum (USFWS 2012). Activities associated with implementation of the groundwater remedy will be under a new PBA, in conformance with the requirements of the federal Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, and the Migratory Bird Treaty Act, as well as the EIR mitigation measure BIO-2b. PG&E, BLM, USFWS, and DOI coordinated on the new PBA (CH2M HILL 2014k) for the final remedy. On July 7, 2014, the USFWS issued a letter to the BLM and provided concurrence with the findings presented in the new PBA (USFWS 2014). The findings in the PBA state that the proposed action associated with the remedy was not likely to adversely affect five species listed under the ESA and was not likely to jeopardize one species proposed for listing as threatened under the ESA and one candidate species for listing under the ESA. With this concurrence, the new PBA for the final remedy became effective as of July 7, 2014.

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, Completion Criteria/Performance Standards, and Short-Term Goals

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.

The completion criteria or performance standards for the groundwater remedy are mainly driven by RAO #3, reducing Cr(VI) concentrations throughout the plume to concentrations of 32 µg/L or less. Attainment of the completion criteria or achievement of performance standards (Cr[VI] concentrations of 32 µg/L or less) is intended to be applied throughout the area of contaminated groundwater. In establishing this criterion, the following are recognized:

- Attaining the cleanup criterion of 32 µg/L Cr(VI) in groundwater may be through active remediation or through natural attenuation.
- Different areas of the plume may reach the cleanup criteria of 32 µg/L Cr(VI) in groundwater at different times.

Additional discussions about the Corrective Measures/Remedial Action Completion Criteria are included in Section 7 of this BOD Report and in Section L4 of the main text of the O&M Manual (Appendix L of this BOD Report).

In addition to the RAOs, short-term goals and criteria are being developed in coordination with DTSC and DOI to facilitate remedy performance assessments including assessments of whether the remedy is Operational and Functional (OF) and Operating Properly and Successfully (OPS).

Pursuant to CERCLA 40 CFR§300.435(f)(2), the groundwater remedy becomes OF either one year after construction is complete, or when the groundwater remedy is determined by DOI and DTSC to be functioning properly and performing as designed, whichever is earlier. DOI may grant extensions to the one-year period, as appropriate. This period is often referred to as “commissioning” or “shakedown,” when the construction contractor(s) make minor adjustments as necessary to ensure the remedy is operating as designed.

Pursuant to Exhibit A to the Settlement Agreement between DTSC and the FMIT (DTSC 2012b), the groundwater remedy is considered to be OPS when a) the remedy is operating as designed, b) the information obtained from remedy operation indicates that the remedy is protective of human health and the environment, and c) the remedy is likely to be able to achieve the cleanup levels or performance goals delineated in the DTSC SOB (DTSC 2011a) and the DOI ROD (DOI 2010) for the groundwater remedy at the PG&E Topock Site. In general, OPS is expected within 1 to 2 years of the beginning of remedy start-up.

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, including a Cultural Impact Mitigation Program (CIMP) (PG&E 2014), capable of reducing these impacts to less-than-significant levels, where possible. For impacts to cultural resources within the Topock Cultural Area and noise impacts in the Topock Cultural Area, the prescribed mitigation measures are not capable of reducing these impacts to less-than-significant, and the EIR concluded that those impacts would be significant and unavoidable. 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 90% BOD submittal.

1.3 Organization and Content of Basis of Design Report/Pre-final (90%) Design Submittal

In conformance with the 1996 CACA and the 2013 CD requirements, this 90% 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 60% BOD Report that are reflected in this 90% BOD Report.

- **Executive Summary** provides a brief summary of the 90% design and highlights the changes from the 60% to the 90% 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, 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 only).
  - Appendix A2 contains an update of the draft aerial map of disturbed areas.
  - Appendix A3 contains the technical memorandum for the ordinary high water mark (OHWM) identification/mapping, as well as a report documenting wetlands and waters of the U.S. in the project area and a report documenting the nature and extent of California Department of Fish and Wildlife (CDFW) jurisdictional areas in the project area (presented on CD-ROM only).
  - Appendix A4 contains technical memoranda on methodologies for mature plants surveys and floristic surveys (CH2M HILL 2011i-j), the January 2012 Mature Plants Survey Report (CH2M HILL 2012e), as well as an addendum to the 2012 report (CH2M HILL 2014j) (presented on CD-ROM only).
  - Appendix A5 contains two Floristic Survey Reports; one summarizes the 2011/2012 results (CH2M HILL 2013e) and the other summarizes the 2013 survey results (CH2M HILL 2013h) (presented on CD-ROM only).
  - Appendix A6 contains the Instream Habitat Typing Survey Technical Memorandum (CH2M HILL 2012f) (presented on CD-ROM only).
  - Appendix A7 contains two Ethnobotanical Survey Reports; one summarizes the 2011-2013 survey results (CH2M HILL 2014e) and the other summarizes the additional 2013 survey results (CH2M HILL 2014f) (presented on CD-ROM only).
  - Appendix A8 contains the Supplemental Baseline Sound Level Measurement Technical Memorandum (CH2M HILL 2013d) and responses to 60% design comments on Appendix A8 (presented on CD-ROM only).

  - Appendix A9 contains the Paleontological Resources Management Plan: MMRP CUL-3 (Parus 2014) (presented on CD-ROM only).

- **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 90% 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 only) provides a list of specifications.
- **Appendix F** is the updated Remedy-produced Water Management Technical Memorandum and the responses to comments from Agencies on the draft memorandum (presented on CD-ROM only).
- **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 RTCs on the 60% BOD submittal and indicates where in this revised 90% BOD Report the changes resulting from responding to comments are reflected.
- **Appendix J** contains the Freshwater Supply Technical Memorandum and RTCs, as well as supplemental information regarding the Topock-2/-3 Pump Test Results (presented on CD-ROM only).
- **Appendix K** contains the Final Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation along with RTCs on the interim Revised Addendum (CH2M HILL 2013i) (presented on CD-ROM only).
- **Appendix L** contains the Operation 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: Operation and Maintenance Plan
  - Volume 2: Sampling and Monitoring Plan
  - Volume 3: Contingency Plan
  - Volume 4: Soil Management Plan
  - Volume 5: Health and Safety Plan
- **Appendix M** contains the Contingent Freshwater Pre-Injection Treatment System Design Basis Memorandum and RTCs on the memorandum.
- **Appendix N** contains two technical memoranda that summarize the results from field implementation of the alternative freshwater sources evaluation**.**

TABLE 1.3-1
Overview of Key Changes from 60% to 90% Basis of Design Submittals
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

<table>
<tr><th>Intermediate (60%) Design
Submitted: April 5, 2013</th><th>Pre-final (90%) Design
Submitted: September 8, 2014</th></tr>
<tr><td>
• 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 for removal of arsenic and fluoride. 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 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.
</td><td>
• Executive Summary provides a brief summary of the 90% design and highlights changes from the 60% design submittal to the 90% 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 water quality in the freshwater injection areas) and surveys conducted since the 60% design.
• Section 3 presents updated information on the design basis/assumptions in response to comments and to reflect the additional details at this 90% design stage. Section 3.3.3.3 of the 60% BOD regarding the freshwater pre-injection treatment system (originally intended to remove arsenic and fluoride) was moved to after the Freshwater Injection Wells section and therefore was renumbered to Section 3.3.3.4; the Revised Section 3.3.3.4 discusses the updated contingent freshwater pre-injection treatment system for removal of arsenic only.
• Section 4 provides an updated discussion of the application of sustainability practices into the remedial design and implementation phases and provides an updated listing of Best Management Practices (BMPs) currently used in the design.
• Section 5 provides an updated discussion about ICs and applicable IC mechanisms, as well as approvals, permits, and easements/access requirements.
• Section 6 presents an update of the compliance status with ARARs, EIR MMRP, PA, CHPMP, and CIMP at this 90% design stage.
• Section 7 provides an updated discussion of the project delivery strategy, the project schedule, and the proposed locations to be used for temporary staging for construction activities and main construction headquarters.
• Section 8 includes an updated cost estimate.
• Section 9 has been updated with new references cited in this 90% document.
• Appendix A1 contains updated analytical data.
• Appendix A2 contains the aerial map of disturbed areas (this map was updated since the 60% BOD to reflect results from mapping of the additional area in Arizona associated with freshwater supply and the additional area in California associated with the soil storage areas in Park Moabi).
• Appendix A3 still contains the technical memorandum on methodology for ordinary high water mark (OHWM) identification/mapping, which remains unchanged since the 30% and 60% BOD Reports. Two NEW reports were added: the first documents wetlands and waters of the U.S. in the project area, and the second documents the nature and extent of CDFW jurisdictional areas in the project area. Both reports were previously submitted to DTSC as appendices to the Q4 2013 EIR MMRP.
• Appendix A4 still contains technical memoranda on methodologies for mature plants surveys and floristic surveys (these documents remain unchanged since the 30% BOD). Also included are two NEW reports:-the January 2012 Mature Plants Survey Report and an addendum to the 2012 report.
• Appendix A5 still contains the original Floristic Survey Report which summarizes the 2011/2012 surveys. A NEW Revised Floristic Survey Report was added to summarize the 2013 survey results.
• Appendix A6 still contains the Instream Habitat Typing Survey Technical Memorandum, which remains unchanged since the 60% BOD.
• Appendix A7 still contains the original Ethnobotany Survey Report which summarizes the 2011-2013 surveys. A NEW Revised Ethnobotany Survey Report was added to summarize the additional 2013 survey results.
• Appendix A8 contains the Supplemental Baseline Sound Level Measurement Technical Memorandum which remains unchanged since the 60% BOD. In response to a comment, the NEW RTCs on Appendix A8 are also included in Appendix A8.
• NEW Appendix A9 contains the Paleontological Resources Management Plan: MMRP CUL-3.
• 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 updated design criteria and includes various technical memoranda 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 90% design level engineering plans and drawings, and equipment list. Over 500 drawings (some NEW, many others updated) are included in this appendix.
• Appendix E provides the updated specifications.
</td></tr>
</table>

TABLE 1.3-1
Overview of Key Changes from 60% to 90% Basis of Design Submittals
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Intermediate (60%) Design **Submitted: April 5, 2013**	**Pre-final (90%) Design** **Submitted: September 8, 2014**
• **NEW Appendix I** contains the RTCs table for the Draft BOD/Preliminary (30%) Design submittal. • **NEW Appendix J** contains the Freshwater Supply Technical Memorandum and Responses to Comments (RTCs). • 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 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 Operation and Maintenance Manual. • **NEW Appendix M** contains the Freshwater Pre-Injection Treatment System Design Basis Memorandum.	• **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, in addition to the original evaluation reports from both Kinder Morgan (formerly EPNG) and PG&E, **NEW drawings** of 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 90% design. • **Appendix I** contains the **NEW RTCs table** for the agency review comments on the 60% BOD submittal. • **Appendix J** contains the original Freshwater Supply Technical Memorandum, Topock-2/-3 supplemental info, and RTCs (all remain unchanged since the 60% BOD). • **Appendix K** contains the **NEW Final Addendum** to the Summary of Findings Associated with the East Ravine Groundwater Investigation, as well as **NEW RTCs** on the interim Revised Addendum**.** • **Appendix L** (submitted under separate cover in a standalone volume) contains an update of the O&M Manual to incorporate comments and include additional information at this 90% stage. The Sampling and Monitoring Plan (Volume 2) contains new flowcharts and action levels, information regarding short-term goals and criteria, as well as a COPC boundary monitoring plan. The Contingency Plan (Volume 3) contains two new contingencies: one is the contingent Freshwater Pre-Injection Treatment System for arsenic removal, and the other is the contingent Dissolved Metals Removal System to remove scaling ion (iron, manganese, calcium, and magnesium) from remedy-produced water (this contingent system was added in response to a review comment on the 60% BOD). The **NEW Project Health and Safety Plan** (Volume 5) outlines the health and safety procedures and policy to be implemented during remedy O&M. • **Appendix M** contains the **Revised** Contingent Freshwater Pre-Injection Treatment System Design Basis Memorandum and **NEW RTCs**. • **NEW Appendix N** contains the Summary of Findings from Implementation of Alternative Freshwater Sources Evaluation Technical Memorandum and the Addendum to the Memorandum.

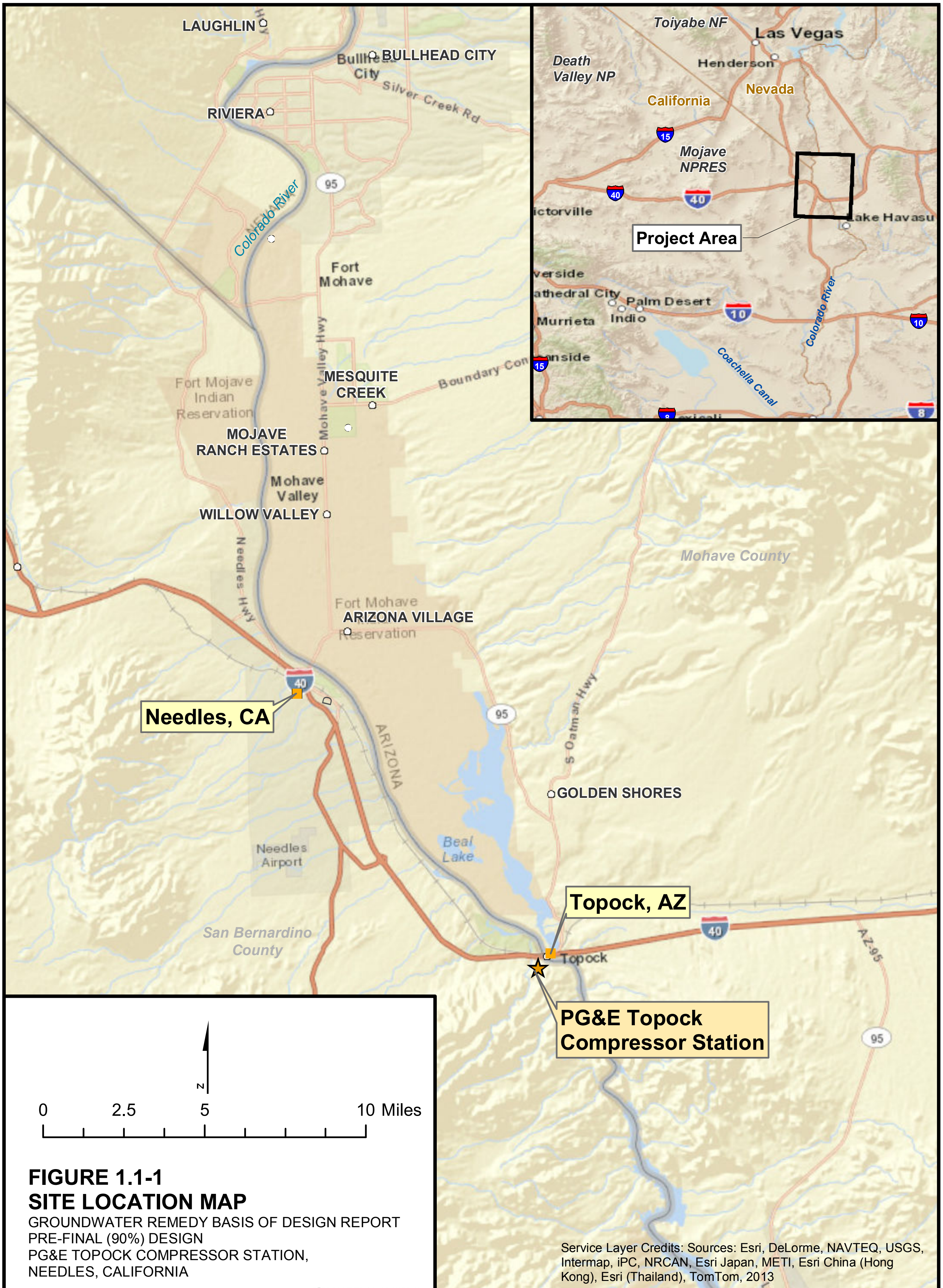
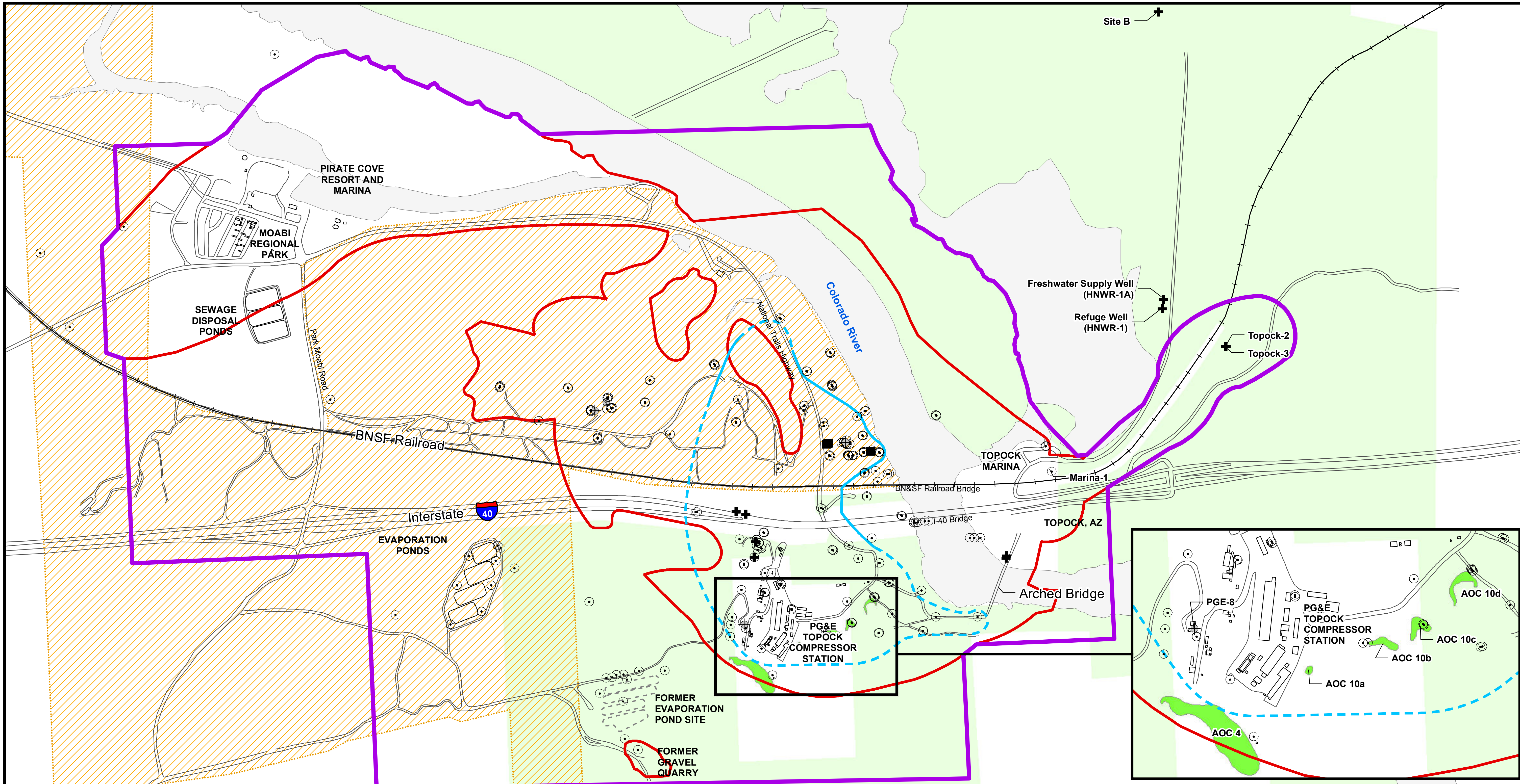


FIGURE 1.1-1
SITE LOCATION MAP
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



LEGEND

Existing Wells:

- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well
- Area of Potential Effects (APE)
- EIR Project Area
- Area of Concern (AOC)
- Havasu National Wildlife Refuge
- Area of Critical Environmental Concern

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Note:
The locations of existing infrastructure are approximate. The figure is not intended to be a comprehensive depiction of all existing infrastructure in the APE.

FIGURE 1.2-1
GROUNDWATER REMEDY PROJECT AREA

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2014\CMS\DESIGN90\FIG121_GWRP_AREA_SYTEMLAYOUT_V2.MXD ECLARK1 8/7/2014 10:02:22 AM

SECTION 2

Baseline Site Conditions and Pre-Design Work

This section provides information about site characteristics, sources of information, and 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, 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 17-year period since the initiation of RCRA Facility Investigation (RFI) activities in 1997. The geologic and hydrogeologic conditions of the site described below are discussed in greater detail in the Revised Final RFI/Remedial Investigation (RI) Volume 2 Report (CH2M HILL 2009a), the Final Volume 2 Addendum (CH2M HILL 2009b), the Summary of Findings Associated with the East Ravine Groundwater Investigation included in Appendix A of the Corrective Measures Study/Feasibility Study (CMS/FS) (CH2M HILL 2009d) and its Final Addendum (CH2M HILL 2014q; Appendix K), 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.[1]

---

[1] The following discussion focuses on the influence of the Chemehuevi detachment fault on groundwater flow in the vicinity of the Compressor Station. The 2006 Bedrock Tech Memo (*Information Review of Groundwater Conditions in Bedrock Formations at PG&E's Topock Compressor Station, Needles, California* [CH2M HILL 2006b]) provides additional information on the detachment fault and the influence of faults on groundwater flow in nearby basins.

The footwall of the Chemehuevi detachment fault is the exposed metadiorite bedrock on the slopes south of the TCS. In most locations near the Compressor Station, alluvium lies in contact with the metadiorite, so the tectonic features associated with faulting are less apparent, although distinct tectonic features are observable in some outcrops nearby and in rocks in the mountains south of the TCS. In some locations in the East Ravine and the TCS, Miocene conglomerate overlies the metadiorite and evidence of faulting has been observed in rock cores across this contact. Evidence of faulting within the metadiorite has not been identified in site core. The contact between the conglomerate and the metadiorite has only been encountered at depth during the installation of three wells: MW-57, MW-67, and MW-68. At MW-67 only 7 feet of conglomerate were encountered, which may have been a boulder laying on the metadiorite rather than an intact part of the conglomerate formation. In MW-57, the conglomerate near the contact was dry when drilled but once saturated began to collapse into the hole. The conglomerate at the contact had been altered and exhibited mylonitic texture and very weak cementation. In the three wells where the contact between the conglomerate and the metadiorite was encountered; the conglomerate at the contact was completely dry. The lack of cementation in the conglomerate would tend to heal fractures that formed at the contact. Thus, the most obvious feature of the detachment fault, the contact between the conglomerate and the metadiorite, does not represent a conduit for groundwater flow. Hydraulic testing from two wells that are screened across this contact also shows that it does not produce water. In MW-57, depth-specific flow measurements were conducted that did not identify any flow at the contact. Depth-specific flow data were not collected from MW-68BR-280, but this well is open across the contact and produces very little water. It will pump dry at a rate of 0.5 gpm. The contact was encountered in the very bottom of MW-67 but no depth-specific flow testing was done and the well is not screened across the contact. It should be noted that the fault is a zone of fracturing, not just a single break in the rock. Slickensides (evidence of rock movement along a fracture) have been observed on fracture surfaces within the metadiorite. Given the regional nature and advanced age of the detachment fault, it is likely that all the bedrock wells at the site are technically within the fault zone, so the fault itself is not an important feature in the groundwater flow at the site. The fault does not affect the chromium plume in the alluvial aquifer, all of which lies above the fault.

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 (see Figures 2.1-2 and 2.2-1 for well locations). 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 MW-57-185 test, steady state was achieved for approximately the last two hours of the test (see the *Summary of Findings Associated with the East Ravine Groundwater Investigation Report* [CH2M HILL 2009e], Attachment A4-2, MW-57BR Constant Rate Test [page 387 of 1003 of the PDF file] for additional details of the drawdown in the pumping well during the test).

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)[2]. Drawdown in the other nine bedrock observation wells was less than 0.05 foot. During the MW-70BR-225 test, steady state was achieved early in the test, and remained at steady state during the majority of the test (see the Revised Addendum to the East Ravine Groundwater Investigation Report [CH2M HILL 2014r], Attachment D, Site H Constant Rate Test. The first graph shows the drawdown for the constant rate test performed in MW-70BR-225; see page 800 of 885 of the 2014 Revised Addendum PDF for additional details of the drawdown in the pumping well during the test).

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

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 2013, 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. 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, Fourth Quarter 2013

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 2009f), 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 2013 (October through December). The data used to prepare these maps were previously reported in the groundwater monitoring reports (CH2M HILL 2014g-h).

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 2013 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 2013 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 143 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 1.46 billion gallons (approximately 4,500 acre-feet). The total Cr(VI) mass in the plume is currently estimated to be 24,300 pounds.

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. The volume of the plume within the East Ravine bedrock formation is believed to represent less than 2 percent of the total plume volume. This estimate derives from the groundwater transport model. The model is initialized with the December 2013 chromium plume. The porosity values in the model are as follows: a) alluvial aquifer porosity is 12 percent mobile and 23 percent immobile; b) total bedrock aquifer porosity is 2 percent, with mobile porosity at 1.9 percent and immobile porosity 0.1 percent. Assuming these porosity values with equal concentrations in mobile and immobile phases, the volume of the chromium plume in bedrock is less than 1 percent of the total. The figure of less than 2 percent was used to account for the uncertainty in the bedrock porosity value.

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 2013are discussed below. It should be noted that the COPCs (selenium, molybdenum, and nitrate) are not expected to have any significant effect on the performance of the in-situ reduction. However, the COPCs will be monitored throughout the remedy. Remedy pumping and injection will be operated so that the extent of elevated concentrations of COPCs at the completion of the remedy does not extend beyond the current extent of the chromium plume. The COPCs can be removed from groundwater within the IRZs. During operation, the areas of elevated COPCs are not expected to expand beyond the current boundaries of the chromium plume or the floodplain downgradient from the IRZ. COPC concentration trends in wells on either side of the IRZ will be monitored to evaluate the degree to which COPCs are being attenuated by the IRZ. 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 will be monitored throughout the remedy. It is not expected to have any significant effect on the performance of the in-situ reduction; however, remedy pumping and injection will need to be operated so that the extent of elevated concentrations of selenium at the completion of the remedy does not extend beyond the current extent of the chromium plume. The cluster of wells MW-67-185 and MW-67-225 represents the only location where the average selenium concentrations during the baseline period of July 1997 through December 2013 exceeded the chemical-specific ARAR for selenium (50 µg/L) (Figure 2.3-1). The deepest well in this cluster, MW-67-260, has a much lower average concentration (2.2 µg/L) with only 40 percent detection rate, demonstrating the limited vertical extent at this location.

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-68-180, MW-69-195, and TW-01. 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 ranging from 500 to over 15,000 µg/L (see Figure 2.2-1), and are therefore considered central plume wells. The two exceptions are MW-21, a well with no detectable chromium but yet still close to the TCS, and 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 MW-67-185 and MW-67-225. The source of the elevated selenium around these wells is unknown. 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 in several of the wells listed above it is likely that selenium has only shown concentrations above background values in those wells due to occasional colloid breakthrough and not from consistent dissolved concentrations in the aquifer. The frequency of UTL exceedances for selenium is 13.5 percent and the frequency of ARAR exceedances is 2.3 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 will be monitored throughout the remedy. It is not expected to have any significant effect on the performance of the in-situ reduction; however, remedy pumping and injection will need to be operated so that the extent of elevated concentrations of molybdenum at the completion of the remedy does not extend beyond the current extent of the chromium plume. The 19 well locations with the highest average molybdenum results (greater than 70 μg/L) during the baseline period of July 1997 through December 2013 include: MW-10 (near the historical Cr[VI] discharge, average concentration of 114 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-66-230, MW-67-260, MW-68BR-280, MW-70-105, MW-72-80, MW-72BR-200, 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 32.8 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 and shallow saturated zones, 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 will be monitored throughout the remedy. It is not expected to have any significant effect on the performance of the in-situ reduction; however, remedy pumping and injection will need to be operated so that the extent of elevated concentrations of nitrate at the completion of the remedy does not extend beyond the current extent of the chromium plume. 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 9.9 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. The septic systems at the Topock Compressor Station may be a potential source of nitrate. 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, given that the highest nitrate concentrations occur in groundwater wells near the Compressor Station.

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 2013. 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 of 24.3 µg/L 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-74-240). 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 4.1 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 HILL 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 4.2 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 HILL 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). Eleven 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, MW-56S, 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 HILL 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. 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.

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, near the current evaporation ponds) 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, with the most frequent values ranging between about 4,000 (33rd percentile) to 7,000 mg/L (66th percentile) and a median value of about 5,000 mg/L. With the exception of the wells near the evaporation ponds, none of the monitoring wells associated with the compressor station have TDS below the secondary drinking water standard of 500 mg/L. In general, high TDS is associated with (1) bedrock wells, (2) deep alluvial/fluvial wells, and (3) a few shallow fluvial wells. The lowest TDS at the site is typically found in monitoring wells near the evaporation ponds (MW-1 through MW-8). Relatively low TDS (less than 1,000 mg/L) is also found in some shallow fluvial wells close to the river. 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. Because wells MW-9, MW-10, and MW-11 are chromium-contaminated wells, the TDS associated with them cannot be attributed to only natural TDS, but must represent a mixture including TDS associated with waste discharge from the Compressor Station. 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. This higher TDS is likely associated with older, connate water in the bedrock and deeper alluvium in this part of the basin. 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. 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).

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.

2.3.4 Freshwater Injection Area Baseline Concentrations

The parameter concentration ranges discussed in Sections 2.3.1, 2.3.2, and 2.3.3 apply to the site as a whole. In this section, selected parameters are discussed for the specific area surrounding the planned freshwater injection locations (FW-1, FW-2, IRL-1 through 4 wells). As shown on Figure ES-4A, the planned injection area is located in the uplands, immediately west of the plume. This corridor extends from the northwest boundary of the plume at IRL-1 to the southwest boundary at FW-2. There are 27 site monitoring wells that represent this area of the aquifer, situated at 14 locations (see Figure 3.6-1 in Section 3): CW-01 cluster (2), CW-02 cluster (2), CW-03 cluster (2), CW-04 cluster (2), MW-13, MW-14, MW-15, MW-35 cluster (2), MW-37S, MW-40S, MW-41 cluster (3), OW-01 cluster (3), OW-02 cluster (3), and OW-03 cluster (3). Two locations, MW-37S and MW-40S, are part of clusters whose deeper wells are screened in the chromium plume. The exclusion of the deeper wells of these clusters demonstrates that this baseline injection area well set was not chosen strictly on the basis of geographic location, but to represent the non-plume groundwater in which the injection wells will most likely be screened. Note that the only monitoring wells near the southern area of proposed injection, which is located west of upper Bat Cave Wash, are within the chromium plume footprint and therefore not included in this discussion. Data from wells listed above are expected to represent the proposed southern injection area as well as the remaining injection areas along the corridor that extends from the northwest boundary of the plume at IRL-1 to the southwest boundary at FW-2.

Constituents that will be monitored during injection include the COPCs (molybdenum, selenium, and nitrate), manganese (an in-situ byproduct), and fluoride (a general geochemical indicator parameter). Table 2.3-2 presents the range of concentrations of these constituents over the monitoring period of July 1997 through December 2013 along with vital statistics including calculated UTL values. This section provides a summary of these data to form a conceptual model of the freshwater injection zone. It also presents a discussion of other general chemistry constituents that further assist in characterizing the area. These data form the baseline condition for the freshwater injection areas.

2.3.4.1 Molybdenum

Average molybdenum concentrations in the injection area range from 8.77 to 46.01 µg/L, with a mean around 20 µg/L. The calculated UTL for this injection area dataset is 46.8 µg/L (Table 2.3-2), which exceeds the background UTL of 36.3 µg/L. The wells within the influence of IM-3 injection (i.e., the OW- and CW- well clusters presented in Table 2.3-2) have all shown breakthrough of IM-3 effluent water, which contains much lower molybdenum concentrations than the native groundwater. As a result, the average values for these wells have been skewed downward by the IM-3 injection operations. Pre-breakthrough concentrations in some of these wells ranged between 50 and 90 µg/L during the period 2004-2006. These data demonstrate that the injection area contains moderately elevated natural molybdenum concentrations compared to the dataset used for the regional background study.

2.3.4.2 Selenium

Average selenium concentrations range from 0.72 to 5.21 µg/L in the injection area with a mean of 3.7 µg/L and a calculated UTL of 5.21 µg/L (Table 2.3-2). The range is well within the background UTL of 10.3 µg/L, and unlike molybdenum, selenium concentrations have been relatively unaffected by IM-3 injection. This is likely due to the very low natural levels of selenium in this area of the site, which are comparable to IM-3 discharge levels.

2.3.4.3 Nitrate

Nitrate (as nitrogen) concentrations fall between 0.83 and 4.90 mg/L, with a mean of 2.56 mg/L and calculated UTL of 5.04 mg/L (Table 2.3-2). The injection area UTL is almost exactly the same as the background study UTL of 5.03 mg/L, indicating that the injection area is representative of the alluvial zone as a whole. The generally oxidizing conditions of most of the groundwater in these wells supports the stability of nitrate, as opposed to the more reducing zones in the floodplain where nitrate is typically below detection limit. As discussed previously, nitrate concentrations tend to be higher close to the mountain front recharge areas (Section 2.3.1.3). Because there are no non-plume wells in the injection area at the mountain front, a natural nitrate level cannot be clearly defined for this area. The three wells with the highest nitrate concentrations in the present data set, MW-14, MW-15, and MW-40S, are the closest to the mountain front recharge area, suggesting higher concentrations may be encountered when new data are collected during remedy construction.

The effect of IM-3 injection was minor, with IM-3 treatment effluent averaging about 3 mg/L, close to the average natural concentration in the area.

2.3.4.4 Manganese

The manganese concentration range in the injection area is from 3.6 to 142 µg/L. The mean concentration is 35.8 µg/L and calculated UTL is 191 µg/L. IM-3 injection has had the effect of lowering the manganese averages in the OW- and CW- cluster wells, many of which recorded concentrations above 100 µg/L and as high as 810 µg/L during the pre-breakthrough period of 2004-2006. Manganese is variable in concentration even in the generally aerobic groundwater environment of the injection zone. The average detection rate in the injection area wells is only 22.7 percent, but slightly reducing zones may exist in these environments, allowing concentrations to persist in the hundreds of micrograms per liter, as observed in some well samples.

2.3.4.5 Fluoride

Fluoride is elevated in many wells at the site due to natural background concentrations. The injection area range is from 0.79 to 4.60 mg/L, with a mean of 2.40 mg/L and calculated UTL of 4.43 mg/L. By comparison, the background UTL is 7.12 mg/L, so the injection area concentrations lie well within the range of the background study. The IM-3 treatment effluent averages approximately 2.1 mg/L fluoride, similar to the injection area average, so IM-3 injection has had little effect on well averages for the OW- and CW- clusters.

2.3.4.6 General Chemistry Parameters

The injection area represents a typical cross-section of the alluvial zone of the Alluvial Aquifer, with aerobic conditions prevailing and a groundwater chemistry dominated by sodium and chloride. The TDS concentration increases with depth, ranging from less than 1,000 mg/L in the shallow zone to nearly 13,000 mg/L in the well screened closest to bedrock (MW-41D). The average TDS among the injection zone wells is 4,115 mg/L, similar to the IM-3 effluent TDS that is currently injected.

Sulfate in the injection area ranges from 118 to 762 mg/L, with a mean of 382 mg/L. The distribution with depth is similar to that of TDS. The IM-3 effluent has an average of 494 mg/L, somewhat greater than the injection area average, but the range of sulfate concentrations in IM-3 effluent is within that of the injection area.

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 refine or update the site condition information.

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 Metropolitan Water District of Southern California. 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 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 Railway, 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 including the owner(s) of 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 ADOT, 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 has been working 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. The map was updated in early 2014 to include areas with planned facilities associated with freshwater supply in Arizona, and areas west of Moabi Regional Park associated with soil storage. An updated 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 outside the Compressor Station has been conducted and is included in Figure 2.4-1A). The inventory was used to determine the methods of crossing the existing infrastructure and to locate the remedy pipeline. This information was gathered through meetings, document review, and potholing efforts.

Existing infrastructure that could interact with the groundwater remedy construction or operation has been 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-ft-long 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 Gas Transmission has been 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. 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. In addition, in compliance with DTSC's January 31, 2011 remedy approval letter, a portable, rental backup generator of similar make and model of the existing generator (Isuzu Model 6WG1X) will be mobilized onsite as needed during project implementation (see Section 3.5 for more details).Section 3.5 discusses the power supply design and the backup generator.
- 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 Transwestern Meter Station Bench (also known as the Transwestern Bench or TW Bench), at the MW-20 Bench, and at Moabi Regional Park.
- 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 (e.g., improvement of the access road to FW-2).

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. Certain 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), the Final Soil RFI/RI Work Plan (CH2M HILL 2013b), and the Addendum to the RFI/RI Report, Volume 1 (CH2M HILL 2014a). 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 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 (CH2M HILL 2014m) describes 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 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 has considered 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 has also been 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 USACE/CDFW Jurisdictional Wetlands and Waters

Within the areas proposed for the groundwater remedy infrastructure, the U.S. Army Corps of Engineers (USACE) regulates wetlands, which are aquatic features exhibiting wetland plants, soils, and hydrology. Other jurisdictional areas in the groundwater remedy area include non-wetland waters (i.e., ephemeral desert washes) that are regulated by both the USACE and CDFW. A field survey of the jurisdictional wetlands and waters was completed from February 13 through 18, 2012 and July 16 through 17, 2012 to update the previous 2005 identification of the USACE and CDFW jurisdictional areas. Additional surveys related to freshwater source areas in Arizona were conducted in 2013 with the results presented in the *Summary of Findings Associated with the Evaluation of Alternative Freshwater Sources in the Topock Remediation Project*

Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California (CH2M HILL 2014b). The purpose of the updated surveys of jurisdictional areas was to incorporate this knowledge into the design of the groundwater remedy design in order to minimize impacts.

In compliance with EIR mitigation measure BIO-1, the wetlands delineation findings are documented in the report entitled *Wetlands and Waters of the United States, Final Delineation for the Topock Compressor Station Groundwater Remediation Project* (CH2M HILL 2014c). In addition, in compliance with EIR mitigation measure BIO-1, the nature and extent of CDFW jurisdictional areas in the project area are documented in the report titled *Riparian Vegetation and California Department Fish and Wildlife Jurisdiction for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California* (CH2M HILL 2014i). Both reports are included in Appendix A3 of this 90% BOD Report.

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 to satisfy the substantive requirements of the Clean Water Act (CWA) that prohibit discharge of dredged or fill material in the jurisdictional waterways unless there is no practical alternative that would have less adverse impact. Figures 2.4-5 and 2.4-5A present an overlay of planned remedial facilities on the latest maps of jurisdictional wetlands and waters in the project area.

On March 6, 2013, the CDFW issued a letter confirming that the 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 Avoidance and Minimization Measures (AMMs) that PG&E must comply with for the duration of the project (CDFW 2013).

On July 10, 2013, the USACE also confirmed that CERCLA 121(e)(1) permit exemption applies to the Topock remediation project. For this reason, PG&E is not required to comply with the administrative and procedural elements of Section 404 of the CWA; however, PG&E is obligated to comply with the substantive elements that would normally be required by a permit. For this reason, the USACE also stated in their response that it would not verify the wetlands and waters delineation. Therefore, PG&E is not seeking verification from the USACE, but rather, assumes that the jurisdictional waters and wetlands that were delineated in the aforementioned report represent all the jurisdictional wetlands and waters under Section 404 of the CWA.

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 also 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 were combined with results of the 2012 and 2013 field delineation surveys described above.

2.4.5 Surface Water Quality

The site surface water monitoring program conducted to date has yielded an extensive chemical analytical dataset. More than 1,895 surface water samples have been collected from July 1997 through December 2013. 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. In November 2013, barium was added to the surface water program in response to a comment on the 60% design (Response to Comment [RTC] #74 DTSC-73). PG&E

will continue to monitor surface water quality during the implementation of the remedy and compare downgradient concentrations to upgradient concentrations.

2.4.6 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 with a field check in November 2011. Subsequent surveys were conducted in July 2012 and April 2014. Appendix A4 includes the technical memorandum on the mature plants survey methodology, the January 2012 Mature Plants Survey report (CH2M HILL 2012e) that documents results of the 2011 surveys, and the addendum to the 2012 report (CH2M HILL 2014j) that documents results of subsequent surveys.

Additional information on vegetation communities was collected during the November 2011, March 2012, July 2012, and March 2013 floristic surveys (see Section 2.4.6). This detailed plant information is being used to guide the design and construction of the remedy, as well as support for planning future revegetation efforts. Figures 2.4-8 and 2.4-9 are updated maps of mature plants from Key Views 5 and 11, and of vegetation communities map based on these plant surveys, respectively.

Results from the 2011 and 2012 surveys are summarized in a report entitled *Topock Groundwater Remediation Project Floristic Survey Report* (CH2M HILL 2013e). The 2013 survey results are summarized in the *Topock Groundwater Remediation Project Revised Floristic Survey Report* (CH2M HILL 2013h). All floristic survey reports are included in Appendix A5 of this 90% BOD Report.

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 arrowweed 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.

2.4.7 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; CDFW 2008), 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 fourteen 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)

In addition to the above species, the ring-tailed cat or ringtail (*Bassariscus astutus*) also has the potential to occur in the project area. The ring-tailed cat is a fully protected species in California. Fully protected species may not be taken or possessed at any time, and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation for the protection of livestock.

Additional information regarding the ringtail can be found on the CDFW website (http://www.dfg.ca.gov/wildlife/nongame/nuis_exo/ferret/ferret_issues_5.html). An individual was observed within the Topock Compressor Station on October 25, 2007 and a second ringtail sighting was made a few years later. No other ringtail sightings have been reported in the project area before or after these occasions.

Protocol surveys for the Yuma clapper rail and the California black rail occurred during six weekly visits in 2012 on the following dates: March 15, 22, and 28; April 26; and May 3 and 10). Protocol surveys for the SWFL have been conducted since 2005, with the most recent occurring in 2012 on the following dates: May 21 through 25; June 4 through 8; June 16 through 20; and June 29 through July 3. Additional SWFL protocol surveys were completed in 2014 on the following dates: June 2 through 6; June 16 through 20; and June 29 through July 3. Protocol surveys for the western yellow-billed cuckoo were initiated in 2014 and were also completed between June 16 through 20; and between June 29 through July 3. The 2012 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 detect Yuma clapper rail at the mouth of East Ravine or along the Colorado River; however, Yuma clapper rails were detected in the southern portion of the Topock Marsh in Arizona adjacent to the project area. There were also sightings of transient SWFLs on the California side of the Colorado River; however, no bird nests have been detected during protocol or pre-construction surveys conducted to date. In compliance with the EIR mitigation measure BIO-2a, PG&E submitted the Final Bird Impact Avoidance and Minimization Plan (CH2M HILL 2014d) for mitigating potential disturbance of special-status birds and loss of habitat for the Topock remediation project on April 30, 2014.

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, 2012, and 2013 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. None of these protocol surveys indicated the presence of live desert tortoises, as only aged desert tortoise remains and inactive burrows were found. There have been no CNDDB desert tortoise occurrences within 15 kilometers of the PG&E Topock survey area. The Topock site upland areas were considered to be marginal desert tortoise habitat and the existing transportation features (e.g., BNSF railroad, Interstate 40, and other paved roadways) likely present physical barriers to prevent in-migration. 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 PBA (CH2M HILL 2007b) remains in effect to date. On April 1-2 and May 12-13, 2013, USFWS-authorized biologist, Gabriel Valdes, conducted an additional protocol survey for desert tortoise in support of the design including the freshwater supply sites in Arizona. Through coordination with the biologists, 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.

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. However, because the groundwater remedy no longer includes a potential Colorado River water intake, the potential for adverse impacts to listed fish species is considered negligible.

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 CDFW (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; CDFW 2011a)
- Special Plant as defined by the CNDDB (CDFW 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)

Based on the floristic surveys conducted to date by PG&E (Section 2.4.6), there are four CNPS Rare Plants including the mousetail suncup (*Chylismia arenaria*), the spiny-haired blazing-star (*Mentzelia tricuspis*), the small-flowered androstephium (*Androstephium breviflorum*), and the hillside palo verde (*Parkinsonia microphylla*), in the project area. Figure 2.4-9 depicts the locations of these plants.

Figure 2.4-11 shows a map of ethnobotanically sensitive plants based on the 2011, 2012, and 2013 surveys. In response to a 60% comment (RTCs #83 DOI-34 and #312 DOI-141), a note was added to Figures 2.4-9 and 2.4-11 to state that "Tribes have stated that arrowweed is an ethnobotanically sensitive plant (June 2011). Arrowweed, however, is not included in Appendix PLA of the EIR. Arrowweed will be protected during construction as a mature plant under AES-1a." In addition, results from these surveys described above and associated maps are included in a report entitled *Topock Groundwater Remediation Project Revised Ethnobotany Survey Report* (CH2M HILL 2014e), which is included in Appendix A7 of this 90% BOD Report. During the 60% comment resolution period, DOI requested additional mapping of lycium and arrowweed and that the survey results be included in the 90% BOD Report (RTC #311 DOI-140). PG&E conducted the additional survey in December 2013, and the survey results are included in a report entitled *Supplemental Ethnobotanical Plant Surveys for the PG&E Topock Compressor Station* (CH2M HILL 2014f), also included in Appendix A7. Figure 2.4-11A shows a map of the additional plant locations identified during the December 2013 survey.

2.4.8 Cultural Resources

Environmental and cultural/historical resources and other tribal concerns are being considered and protected by the PA (BLM 2010), EIR MMRP (DTSC 2011c), CHPMP (BLM 2012), and Cultural Impact Mitigation Program (CIMP) (PG&E 2014). Cultural resources in the area will affect design, construction and implementation of the final groundwater remedy. In compliance with the EIR MMRP CUL-1a-3c, monitoring events have been conducted annually with participation from Tribes, BLM, and PG&E. Annual monitoring occurred on October 26, 2011, November 5-7, 2012, and December 2-11, 2013. 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 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 be prepared and submitted to DTSC shortly after submission of the 90% design.
- 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 90% 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, http://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 prepared an Access Plan for the lands not under federal management, taking into consideration the information in the BLM Access Plan. The Plan is included in the appendix to the Construction/Remedial Action Work 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 whether a potential exists for buried historical and archaeological resources. The geoarcheaological investigations were completed on June 4 to 9, 2012, and the results are summarized in a report titled *Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, AZ, and San Bernardino County, CA* (Brady and Associates 2014) (note that this report contains sensitive cultural resources information and is not included in this 90% BOD Report). The report presents results from the geoarchaeological assessment of the project area, and ranks locations where sediments have the highest, intermediate, lowest, or no potential to contain buried archaeological resources (Maps 2A and 2B). As discussed at the August 20, 2013 Topock Project Tribal Monthly Update (TMU) and 60% comment resolution meetings, this ranking is relative rather than absolute – higher potential does not mean that archaeological materials are likely to be encountered, but rather that the stratigraphic unit with this designation is more capable of containing buried archaeological materials than other units. Therefore, the potential ranking only represents relative probability and does not predict actual locations of buried archaeological materials. Section 3.2 of the Draft Geoarchaeological Assessment presents recommendations to avoid potential impacts to buried archaeological or historical sites during design/construction.
- The EIR mitigation measure CUL-1a-8 requires that a Cultural Impact Mitigation Program be developed in coordination with Interested Tribes and the federal agencies with land management responsibilities in the project area. PG&E started work on the CIMP in May 2011, in coordination with Interested Tribes during face–to-face meetings or teleconference calls held once per month. On July 8, 2013, PG&E provided a preliminary draft CIMP (including the IM-3 Decommissioning Plan) to Interested Tribes. Tribes provided comments on the draft CIMP in October 2013. PG&E reviewed and discussed select comments and responses with the Tribes during the March and April 2014 TMUs. At DTSC's and Tribes' request, the CIMP (PG&E 2014) was submitted on May 1, 2014, in advance of the 90% design.
  - 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 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 was revised to incorporate comments and resubmitted to DTSC in a report entitled *Paleontological Resources Management Plan: MMRP CUL-3* on February 28, 2014

(Parus 2014) (see Appendix A9). The report identifies the potential for paleontological resources to exist at the Topock remedy site and determines whether paleontological monitoring would be necessary during remedy implementation.

2.4.9 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. In response to 60% BOD comment (RTC #317), the 60% responses to comments on Appendix A8 was inserted at the end of Appendix A8 in this 90% BOD Report.

The CIMP noise protocol (CUL-1a-8h) outlines protocols and procedures for the appropriate methods, consistent with NOISE-3, to reduce auditory impacts. The proper implementation of these protocols will ensure compliance with mitigation measure CUL-1a-8h by PG&E and all contractors during the construction, operations and maintenance, and decommissioning phases. However, implementation of these protocols would not reduce noise impacts to a less-than-significant level in the Topock Cultural Area, as the EIR found noise impacts in that area would be significant and unavoidable.

TABLE 2.2-1
Summary Statistics of Groundwater Sampling Results for COCs, COPCs, and In-situ Byproducts, July 1997 through December 2013
Groundwater Remedy Basis of Design Report
Pre-Final (90%) 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	230	5,294	3,294	62.2	794	22,000	31.8	88	103	1,994 / 5,294 (37.7%)	10	117	137	2,685 / 5,294 (50.7%)
Chromium (total)	228	5,362	3,599	67.1	798	25,600	34.1	92	109	1,988 / 5,362 (37.1%)	50	85	100	1,900 / 5,362 (35.4%)
Arsenic	203	1,691	1,354	80.1	6.6	157	24.3	4	22	70 / 1,691 (4.1%)	10	32	57	260 / 1,691 (15.4%)
Iron	213	1,778	612	34.4	900	230,000	3930	12	19	80 / 1,778 (4.5%)	300	55	59	278 / 1,778 (15.6%)
Manganese	213	2,182	1,155	52.9	296	9,260	1320	11	27	91 / 2,182 (4.2%)	50	165	151	833 / 2,182 (38.2%)
Molybdenum	155	1,551	1,474	95.0	34.7	301	36.3	47	80	508 / 1,551 (32.8%)	---	---	---	--- ---
Selenium	146	1,308	637	48.7	7.0	180	10.3	13	28	176 / 1,308 (13.5%)	50	2	4	30 / 1,308 (2.3%)
Nitrate (as nitrogen)	218	1,620	877	54.1	3.9	200	5.03	42	62	321 / 1,620 (19.8%)	10	25	36	160 / 1,620 (9.9%)

Notes:

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

[2] Site background concentration is the 95% upper tolerance limit (UTL) of the elevated percentile from the Steps 3 and 4 Groundwater Background Study Report (CH2M HILL, 2009f), see Table 3-1. Number of Exceedances is the number of times each parameter was detected above the background concentration.

[3] Chemical-specific applicable or relevant and appropriate requirements (ARARs) listed are the most stringent drinking water standard from regulatory standards.

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

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

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

TABLE 2.2-2

Summary Statistics of Groundwater Sampling Results for Other Title 22 Metals and General Chemistry, July 1997 through December 2013

Groundwater Remedy Basis of Design Report

Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

	Results Summary for RFI/RI Wells					
Parameter	**Number of Wells Sampled**	**Number of Primary Samples**	**Number of Detects**	**Detection Frequency %**	**Average Concentration**	**Maximum Concentration**
Other Title 22 Metals						
Antimony	117	782	18	2.3	3.5	155
Barium	157	974	748	76.8	106	5,300
Beryllium	117	772	24	3.1	0.81	8.8
Cadmium	117	772	1	0.1	1.2	10.5
Cobalt	117	772	25	3.2	1.8	10
Copper	143	1,529	473	30.9	9.4	640
Lead	133	883	67	7.6	3.4	76
Mercury	117	778	3	0.4	0.12	0.4
Molybdenum	155	1,551	1,474	95.0	34.7	301
Nickel	143	1,529	533	34.9	9.6	500
Silver	117	772	126	16.3	2.9	87.3
Thallium	117	772	19	2.5	1.8	5.3
Vanadium	133	871	507	58.2	13.1	326
Zinc	143	1,524	886	58.1	55.4	2,200
General Chemistry						
Alkalinity, bicarb as CaCO3	220	1,789	1,774	99.2	149	1,500
Alkalinity, carb as CaCO3	220	1,804	31	1.7	2.8	210
Alkalinity, hydroxide	146	921	9	1.0	2.9	110
Alkalinity, total as CaCO3	213	1,784	1,783	99.9	149	1,500
Ammonia	32	96	67	69.8	2.9	180
Ammonia as nitrogen	173	1,109	260	23.4	0.43	12.3
Bicarbonate	5	5	5	100	66.4	79
Carbonate	80	81	1	1.2	2.6	12
Deuterium	165	687	687	100	-73	-37
Dissolved organic carbon	31	56	32	57.1	3.1	27.8
Dissolved oxygen	1	1	1	100	3.3	3.3
Electric Conductance	7	12	12	100	255	320
Hardness, total as CaCO3	2	2	2	100	103	105
Iodide	31	62	13	21.0	1.2	12.9

TABLE 2.2-2

Summary Statistics of Groundwater Sampling Results for Other Title 22 Metals and General Chemistry, July 1997 through December 2013

Groundwater Remedy Basis of Design Report

Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

	Results Summary for RFI/RI Wells					
Parameter	**Number of Wells Sampled**	**Number of Primary Samples**	**Number of Detects**	**Detection Frequency %**	**Average Concentration**	**Maximum Concentration**
General Chemistry						
Methylene Blue Active Subst.	2	2	ND	ND	ND	ND
Orthophosphate	137	287	15	5.2	0.33	1.35
Orthophosphate	3	8	ND	ND	ND	ND
Oxidation reduction potential	38	338	338	100	229	529
Oxygen 18	165	687	687	100	-9.5	-2.7
Perchlorate	26	41	ND	ND	ND	ND
pH	140	1,978	1,978	100	7.7	12.62
Phosphate	38	123	103	83.7	0.57	33.8
Silica	109	146	146	100	19.9	38.8
Soluble silica	82	165	164	99.4	23.7	54.4
Specific conductance	188	3,900	3,900	100	9,539	65,300
Sulfide	119	272	17	6.3	0.56	4
Total dissolved solids	212	1,616	1,616	100	5,043	46,200
Total Kjeldahl Nitrogen	74	125	22	17.6	0.56	13
Total organic carbon	206	747	394	52.7	3.1	58
Total phosphorus as P	3	3	ND	ND	ND	ND
Total suspended solids	66	162	81	50.0	16.6	280
Turbidity	48	449	277	61.7	2.2	99.4

Notes:

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
Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

	Units	Upper Tolerance Limit (UTL)[1]	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] 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, 2009f).

µg/L = micrograms per liter

mg/L = milligrams per liter.

TABLE 2.3-2
Concentrations in Injection Area Monitoring Wells and Summary Statistics, July 1997 through December 2013
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Injection Area Monitoring Wells	Selenium (µg/L)					Molybdenum (µg/L)					Nitrate as N (mg/L)					Manganese (µg/L)					Fluoride (mg/L)				
	Min	Max Detected	Mean	Pct Detect	Count	Min	Max Detected	Mean	Pct Detect	Count	Min	Max Detected	Mean	Pct Detect	Count	Min	Max Detected	Mean	Pct Detect	Count	Min	Max Detected	Mean	Pct Detect	Count
CW-01D	2.17	5.2	5.05	25.0%	16	5.0001	51.8	21.3	87.5%	16	0.566	3.78	2.52	100.0%	20	0.2501	172	31.0	15.4%	13	0.951	4.98	2.48	95.0%	20
CW-01M	0.5001	3.5	4.69	18.8%	16	5.0001	24.4	16.9	87.5%	16	0.832	3.14	2.24	100.0%	20	0.2501	5.09	6.6	7.1%	14	1.61	3.78	2.37	100.0%	20
CW-02D	2	3.2	4.95	17.6%	17	5.0001	73.2	33.9	94.1%	17	0.2501	3.9	2.13	95.0%	20	0.2501	332	49.1	15.4%	13	0.982	7.26	3.75	95.0%	20
CW-02M	0.5001	2.4	4.49	5.9%	17	16.6	29.2	22.6	100.0%	17	0.703	3.6	1.81	100.0%	20	0.2501	1.19	6.4	7.1%	14	2.3	3.64	2.89	95.0%	20
CW-03D	0.5001	3.3	4.84	11.8%	17	14.4	94.3	46.0	100.0%	17	0.2501	3.6	1.97	95.0%	20	0.2501	810	133.5	30.8%	13	0.2501	6.77	4.38	90.0%	20
CW-03M	0.5001	1.6	4.54	6.3%	16	15.4	37.8	22.2	100.0%	16	0.594	5.98	1.39	100.0%	20	0.2501	54.1	10.7	15.4%	13	2.22	3.58	2.77	95.0%	20
CW-04D	0.5001	5.3	4.83	18.8%	16	19	44.2	31.4	100.0%	16	0.188	3.5	1.66	95.0%	20	0.2501	308	64.1	38.5%	13	1.01	5.01	3.51	95.0%	20
CW-04M	1.04	1.9	4.63	18.8%	16	5.0001	31	11.1	75.0%	16	0.0501	2.8	1.72	95.0%	20	0.2501	15.2	7.8	7.7%	13	1.5	2.42	1.93	95.0%	20
MW-13	2.5001	3.96	3.23	50.0%	2	6.9	17	9.8	100.0%	5	0.95	4.8	3.78	100.0%	14	0.2501	210	22.0	25.0%	12	0.45	1.5	1.14	100.0%	6
MW-14	3.65	4.26	3.96	100.0%	2	6.7	25	12.1	83.3%	6	1.1	6.4	4.59	100.0%	15	0.2501	240	26.5	30.8%	13	1.8	3.2	2.33	100.0%	6
MW-15	4.58	4.58	4.58	100.0%	1	9.6	30	16.6	100.0%	4	0.72	9.73	4.42	100.0%	13	0.2501	580	57.8	36.4%	11	0.4	1.3	0.79	100.0%	6
MW-35-060	0.74	1.19	1.02	80.0%	10	8.3	10	8.8	100.0%	10	1.1901	11.4	2.49	94.1%	17	0.2501	30	4.2	6.7%	15	1.5	1.92	1.72	100.0%	3
MW-35-135	1.1	1.3	1.24	66.7%	6	20.9	28	23.8	100.0%	6	1.3701	3	2.42	92.3%	13	0.2501	230	26.5	30.0%	10	0.2501	1.92	1.31	75.0%	4
MW-37S	1.37	1.37	1.37	100.0%	1	19.9	19.9	19.9	100.0%	1	0.8701	1.9	1.47	90.0%	10	0.2501	220	27.9	11.1%	9	2.15	2.4	2.28	100.0%	2
MW-40S	2.2	7.37	3.79	100.0%	4	7.1	11	8.9	100.0%	4	3.7	6.6	4.90	100.0%	8	0.2501	1.38	3.6	16.7%	6	2.4	2.55	2.48	100.0%	2
MW-41D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2501	0.549	0.85	20.0%	10	51.1	101	69.9	100.0%	8	0.2501	ND	1.38	0.0%	2
MW-41M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5001	0.72	0.83	44.4%	9	0.2501	ND	4.4	0.0%	7	2.5001	ND	2.50	0.0%	1
MW-41S	0.61	0.83	0.72	100.0%	2	16	17	16.5	100.0%	2	1.25	1.6	1.36	100.0%	10	0.2501	ND	4.4	0.0%	7	1.86	4.6	3.23	100.0%	2
OW-01D	0.5001	3.5	3.42	15.0%	20	5.0001	51.8	21.3	89.3%	28	0.252	3.7	2.35	100.0%	28	0.2501	378	142.3	50.0%	14	0.2501	3.91	2.19	96.4%	28
OW-01M	0.5001	5.2	3.46	21.1%	19	2.5001	27	13.5	82.1%	28	0.892	6.49	2.65	100.0%	28	0.2501	1.07	11.3	7.1%	14	0.693	2.56	1.91	100.0%	28
OW-01S	1.9	5.9	3.58	18.8%	16	2.5001	27.3	9.4	71.4%	28	1.68	4.5	3.00	100.0%	30	1.21	1.66	13.7	22.2%	9	1.38	2.74	2.19	100.0%	30
OW-02D	0.5001	17.1	4.31	26.3%	19	5.0001	66.5	17.8	92.6%	27	0.0501	7.57	2.98	96.3%	27	0.2501	390	77.3	25.0%	12	0.2501	2.38	1.82	96.3%	27
OW-02M	0.5001	6.5	3.43	16.7%	18	5.0001	35.3	15.1	88.5%	26	0.574	7.16	2.87	100.0%	27	0.2501	44.2	13.2	9.1%	11	0.2501	4.81	2.02	96.3%	27
OW-02S	2.5001	6.8	3.96	25.0%	16	26.6	89.3	39.6	100.0%	28	3.05	7.75	4.13	100.0%	30	0.5001	131	25.3	22.2%	9	3.5	5.49	4.60	100.0%	30
OW-05D	0.5001	2.46	4.46	11.1%	18	5.0001	83.8	26.7	92.3%	26	0.151	5.99	2.51	100.0%	27	0.5001	371	100.7	45.5%	11	0.2501	4.56	2.12	96.3%	27
OW-05M	0.5001	18.6	5.21	16.7%	18	5.0001	50.1	21.6	96.2%	26	0.51	8.15	2.43	100.0%	27	0.5001	19	13.4	18.2%	11	0.2501	3.97	2.31	96.3%	27
OW-05S	2.5001	2.94	3.44	17.6%	17	12.8	29.6	20.6	100.0%	29	1.74	7.67	3.63	100.0%	31	0.5001	6.47	13.0	20.0%	10	1.69	2.82	2.28	100.0%	31

Notes:
Concentrations ending in 0.0001 represent non-detects at an assigned concentration of half the reporting limit for the purpose of calculating mean values for each well
ND = not detected in any sample from the indicated well
NA = not analyzed in the indicated well

TABLE 2.4-1
Summary Statistics of Surface Water Sampling Results, July 1997 through December 2013
Groundwater Remedy Basis of Design Report
Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

	Hexavalent Chromium (µg/L)		Dissolved Chromium (µg/L)		Dissolved Arsenic (µg/L)		Dissolved Barium (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		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	---	1 \ 1	110	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	---	3 \ 4	143	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	---	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	---	0 \ 0	---
R63	0 \ 24	ND	1 \ 24	0.53	13 \ 13	2.4	1 \ 1	90.8	8 \ 13	3.8	0 \ 13	ND	1 \ 13	3.6	7 \ 13	4.5	1 \ 10	297	24 \ 24	930	24 \ 24	8.22
I-3	0 \ 70^	ND	7 \ 71	3.1	0 \ 0	---	4 \ 5	150	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	---	0 \ 0	---
NR-1	0 \ 48	ND	1 \ 49	0.61	0 \ 0	---	1 \ 1	140	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	---	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	---	0 \ 0	---	18 \ 18	1000	17 \ 17	8.22
R-19	0 \ 29	ND	0 \ 29	ND	13 \ 13	2.4	1 \ 1	96.3	7 \ 13	2.7	0 \ 13	ND	1 \ 13	3.6	7 \ 13	4.3	0 \ 10	ND	29 \ 29	928	29 \ 29	8.26
R-19-B	0 \ 2	ND	0 \ 2	ND	0 \ 0	---	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	---	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	---	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	---	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	---	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	---	0 \ 0	---	35 \ 35	974	35 \ 35	8.23
R-27	0 \ 70^	ND	6 \ 71	2.7	0 \ 0	---	0 \ 1	ND	0 \ 3	ND	0 \ 3	ND	0 \ 0	---	0 \ 0	---	4 \ 18	320	35 \ 35	960	34 \ 34	8.20
R-28	0 \ 95^	ND	7 \ 96	2.5	13 \ 13	2.4	1 \ 2	172	7 \ 16	49.0	0 \ 16	ND	1 \ 13	3.6	8 \ 14	4.4	6 \ 36	491	63 \ 63	977	62 \ 62	8.25
RRB	0 \ 90^	ND	8 \ 91	2.4	13 \ 13	2.5	2 \ 2	147	10 \ 14	34.8	3 \ 13	14.0	1 \ 13	3.6	8 \ 14	4.5	0 \ 10	ND	61 \ 61	1140	60 \ 60	8.07
Seasonal Wetlands	0 \ 8	ND	0 \ 8	ND	0 \ 0	---	1 \ 1	120	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 \ 26	ND	0 \ 26	ND	13 \ 13	2.5	1 \ 1	92.7	7 \ 13	2.4	0 \ 13	ND	1 \ 13	3.6	7 \ 13	4.6	0 \ 10	ND	26 \ 26	923	26 \ 26	8.18
C-CON	0 \ 123	ND	0 \ 123	ND	26 \ 26	2.5	2 \ 2	99.6	16 \ 26	2.4	0 \ 26	ND	0 \ 26	ND	14 \ 26	4.5	0 \ 20	ND	95 \ 95	970	95 \ 95	8.23
C-I-3	0 \ 123	ND	0 \ 123	ND	26 \ 26	2.4	2 \ 2	89.4	14 \ 26	2.5	0 \ 26	ND	2 \ 26	3.6	14 \ 26	4.6	5 \ 23	317	95 \ 95	952	95 \ 95	8.24
C-MAR	0 \ 85	ND	0 \ 85	ND	24 \ 24	2.6	1 \ 1	101	22 \ 24	22.8	10 \ 24	46.2	2 \ 24	3.6	13 \ 24	4.5	1 \ 21	328	68 \ 68	1090	68 \ 68	7.92
C-NR1	0 \ 123	ND	0 \ 123	ND	26 \ 26	2.4	2 \ 2	97.0	16 \ 26	2.5	1 \ 26	10.6	0 \ 26	ND	14 \ 26	4.4	1 \ 20	295	95 \ 95	966	95 \ 95	8.29
C-NR3	0 \ 123	ND	0 \ 123	ND	26 \ 26	2.4	2 \ 2	96.1	16 \ 26	2.5	1 \ 26	10.5	0 \ 26	ND	14 \ 26	4.6	0 \ 20	ND	95 \ 95	967	95 \ 95	8.28
C-NR4	0 \ 123	ND	0 \ 123	ND	26 \ 26	2.3	2 \ 2	93.7	16 \ 26	2.4	1 \ 26	10.6	0 \ 26	ND	14 \ 26	4.3	3 \ 20	586	95 \ 95	964	95 \ 95	8.27
C-R22	1 \ 74	0.11	0 \ 74	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	3 \ 3	538	39 \ 39	1000	39 \ 39	8.25
C-R22a	0 \ 55	ND	0 \ 55	ND	26 \ 26	2.4	2 \ 2	92.5	14 \ 26	2.7	0 \ 26	ND	2 \ 26	3.6	14 \ 26	4.5	0 \ 20	ND	55 \ 55	927	55 \ 55	8.24
C-R27	0 \ 118	ND	0 \ 118	ND	26 \ 26	2.5	2 \ 2	91.9	14 \ 26	2.6	0 \ 26	ND	2 \ 26	3.6	14 \ 26	4.6	3 \ 23	287	91 \ 91	953	91 \ 91	8.24
C-TAZ	0 \ 120	ND	0 \ 123	ND	26 \ 26	2.4	2 \ 2	89.8	13 \ 26	2.4	1 \ 26	10.4	2 \ 26	3.6	14 \ 26	4.5	4 \ 23	311	95 \ 95	956	95 \ 95	8.26
Other Surface Water Monitoring Locations																						
SW2	0 \ 24	ND	0 \ 24	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	24 \ 24	951	24 \ 24	7.72
SW1	1 \ 32	0.1	0 \ 32	ND	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	0 \ 0	---	30 \ 30	984	30 \ 30	7.72

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 A1 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.

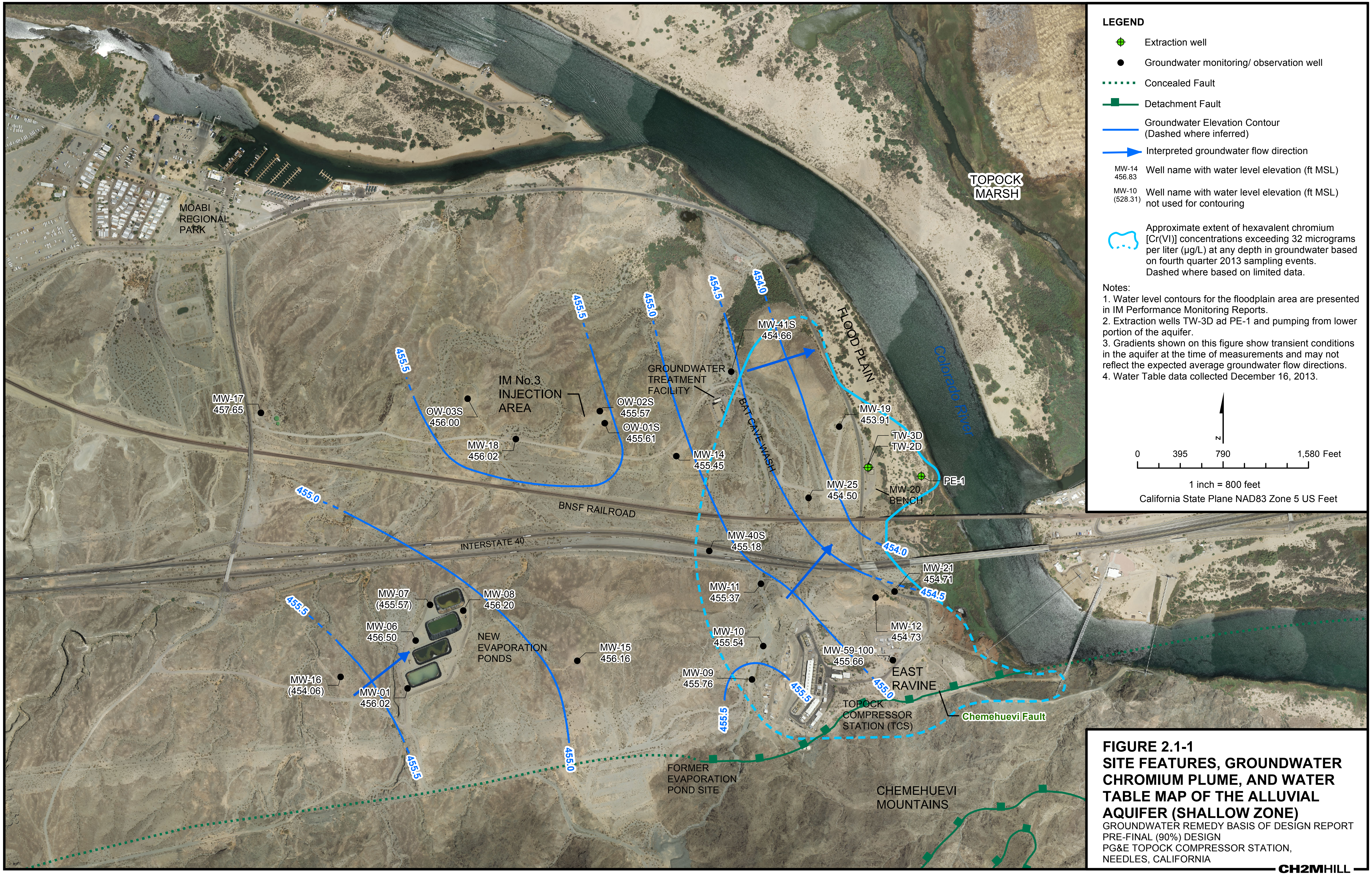


FIGURE 2.1-1
SITE FEATURES, GROUNDWATER CHROMIUM PLUME, AND WATER TABLE MAP OF THE ALLUVIAL AQUIFER (SHALLOW ZONE)
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

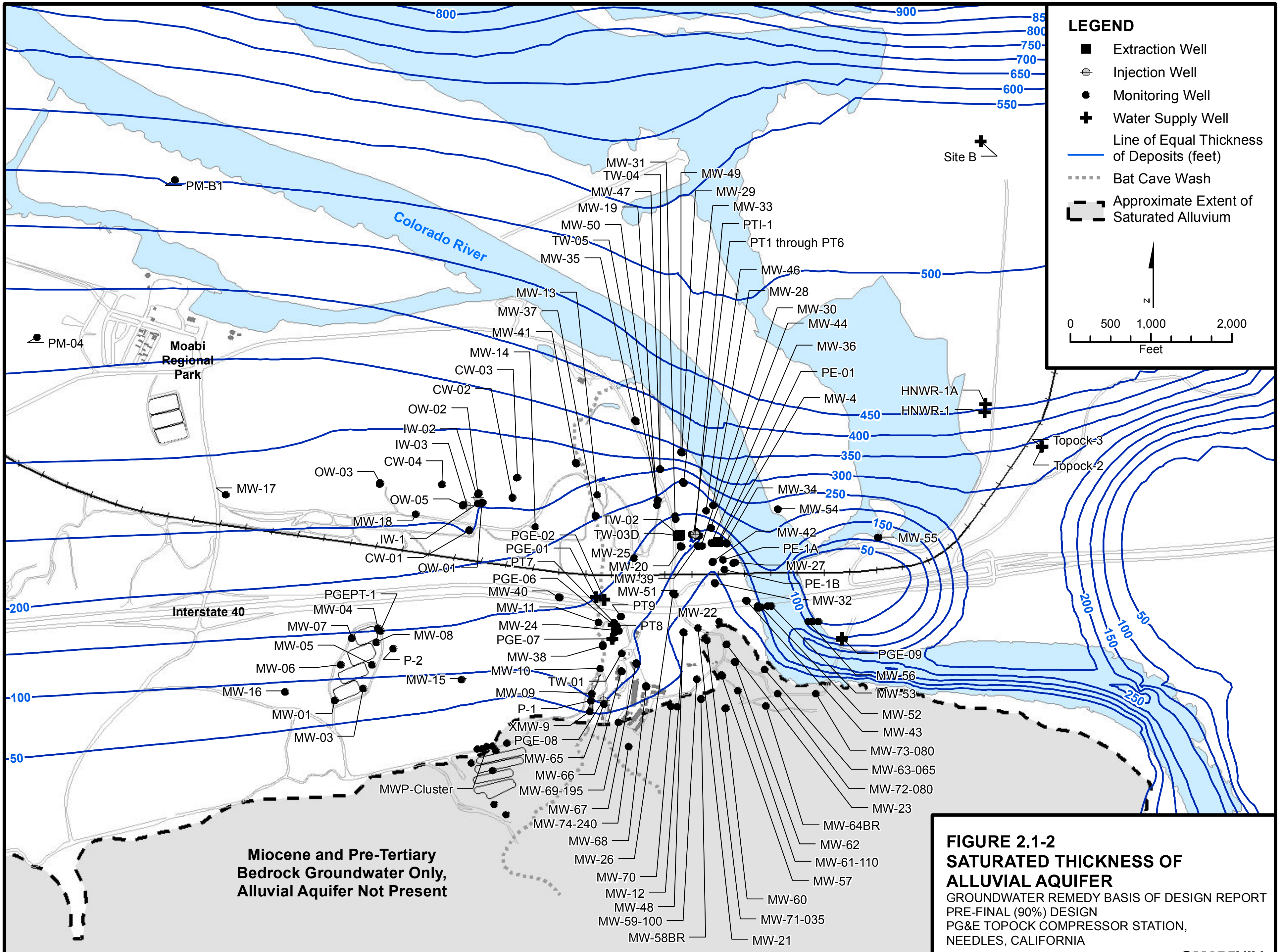


FIGURE 2.1-2
SATURATED THICKNESS OF ALLUVIAL AQUIFER
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG212_SaturatedThickness_AA.mxdDate Saved: 7/10/2014 9:45:24 AM

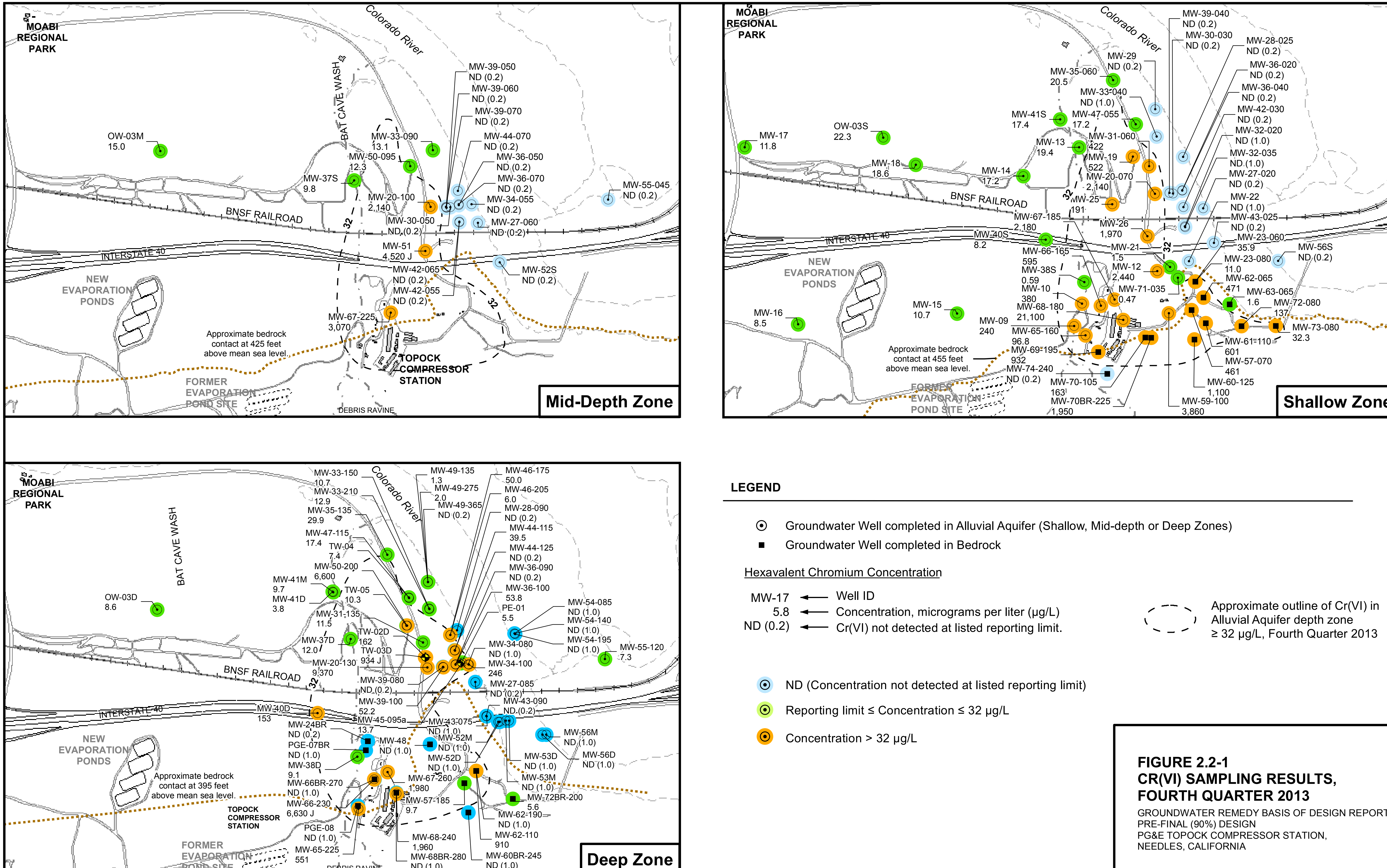
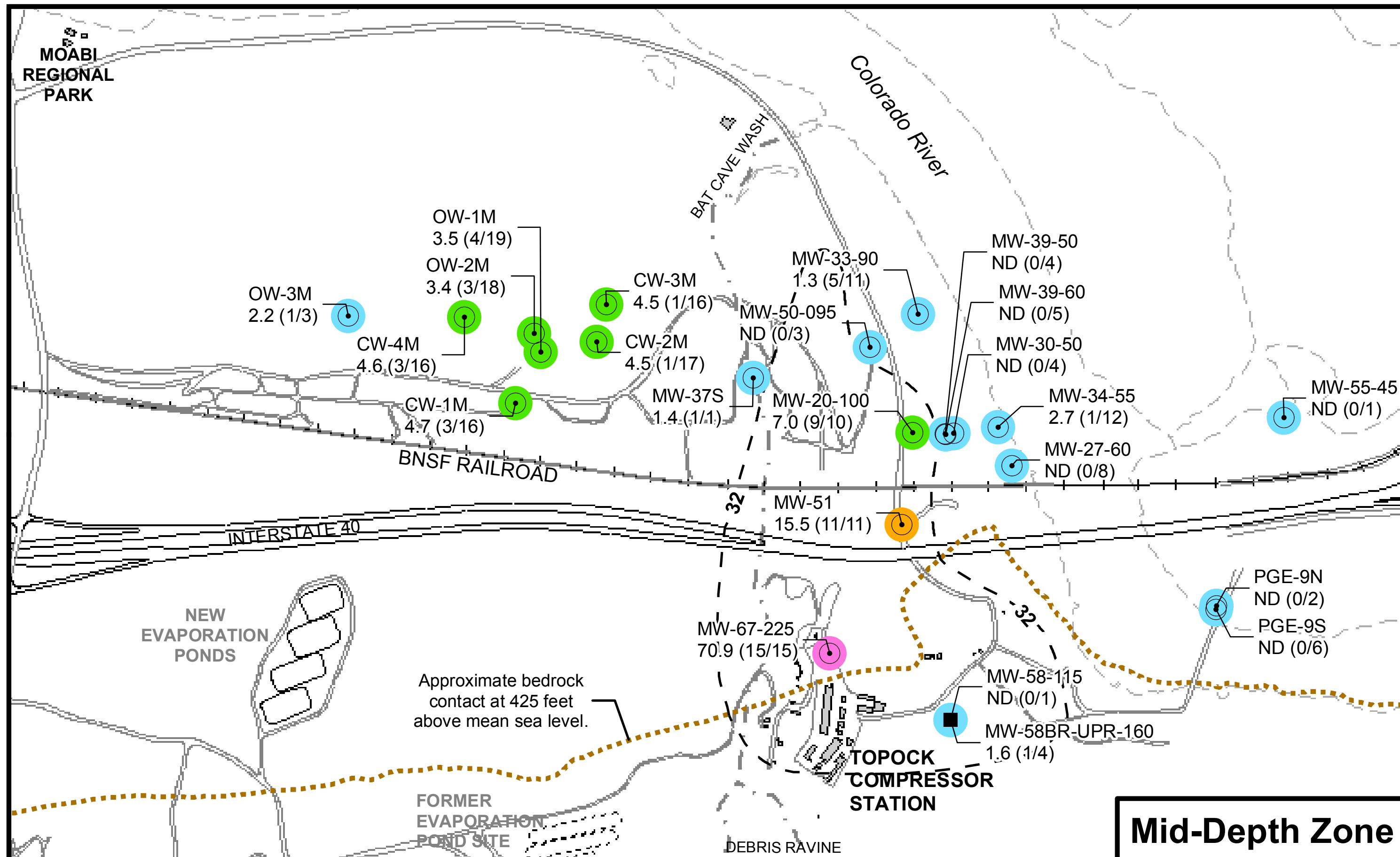
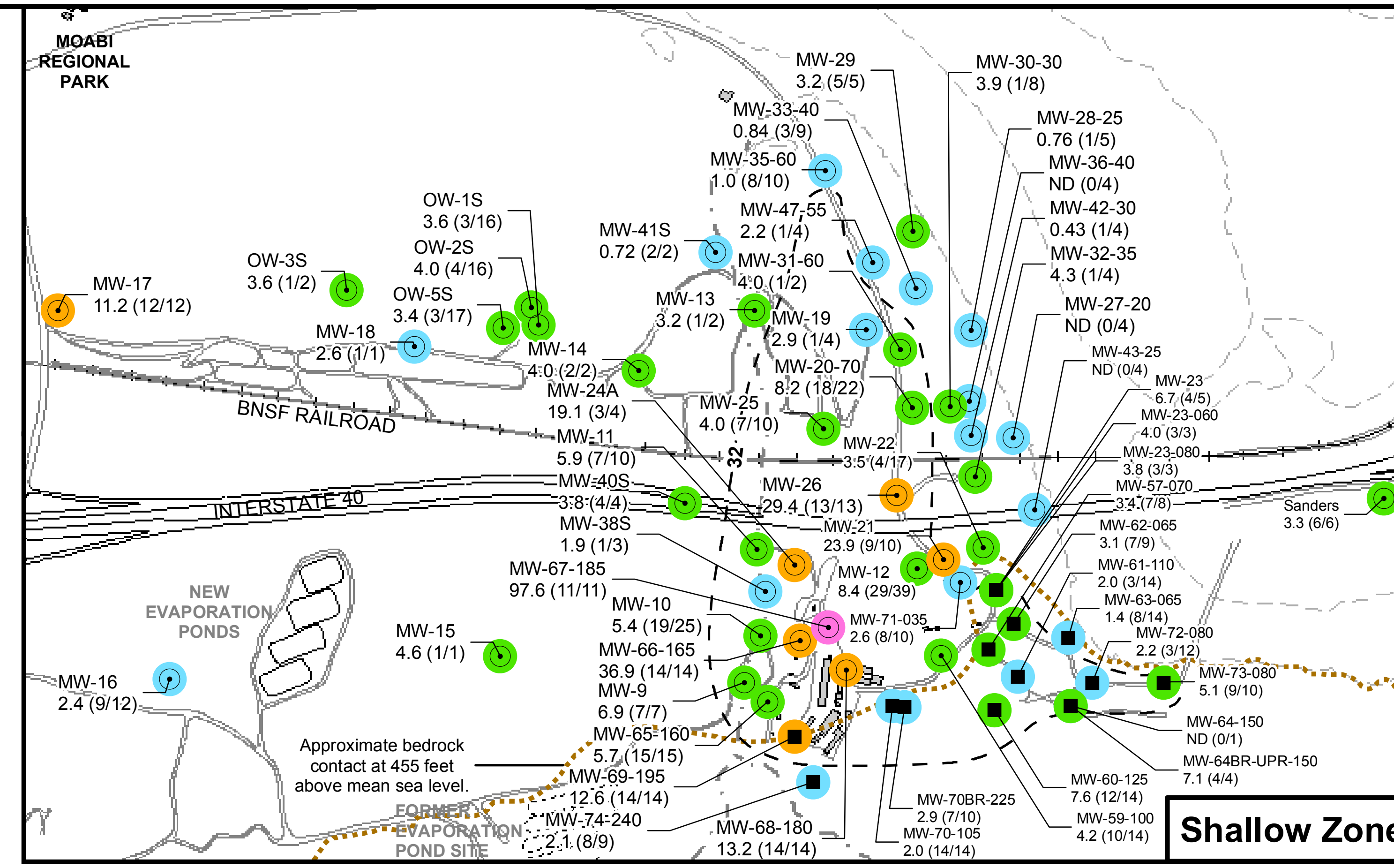


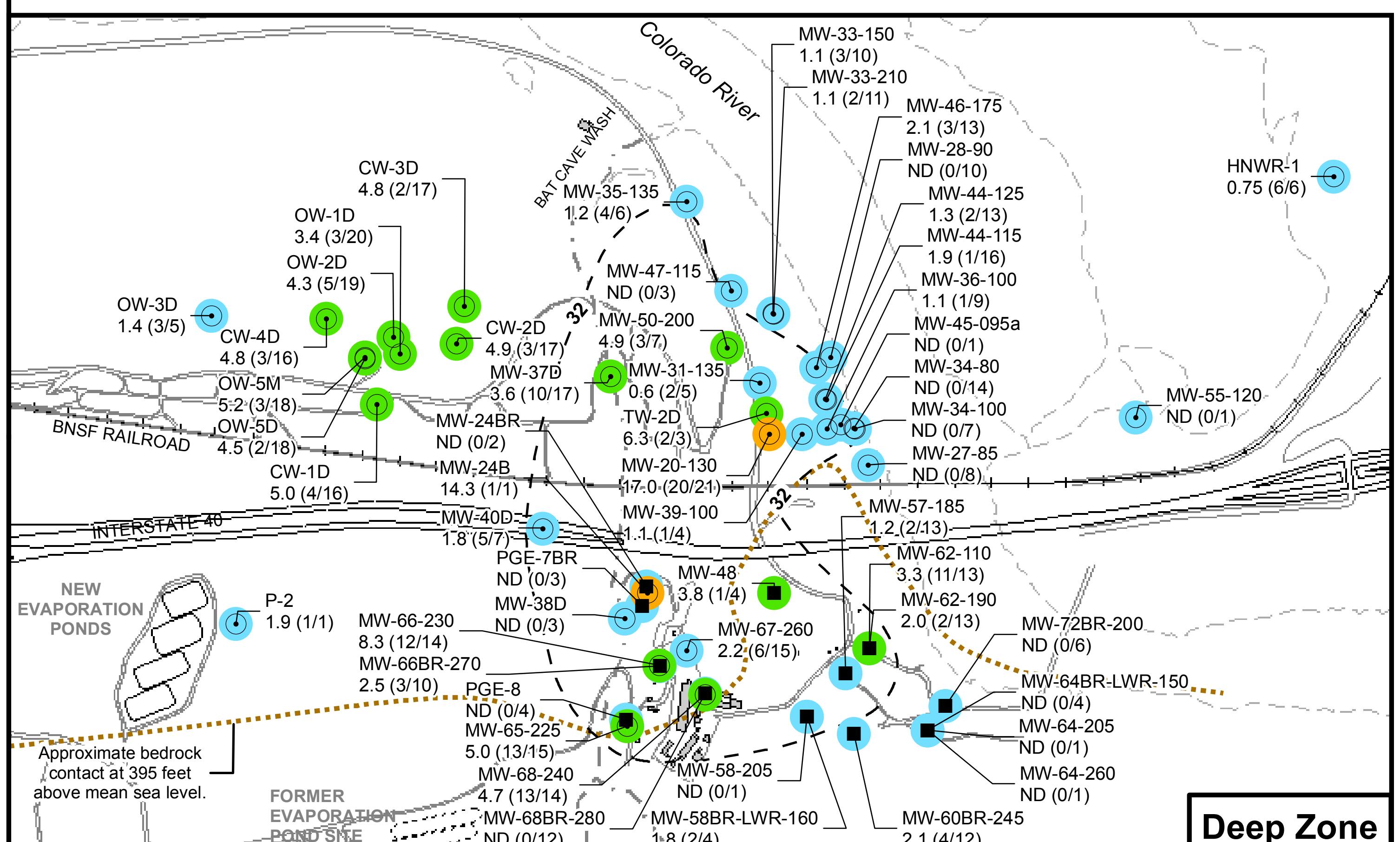
FIGURE 2.2-1
CR(VI) SAMPLING RESULTS, FOURTH QUARTER 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO D:\PROJECTS\TOPOCK\MAPFILES\2014\CMS\90PERCENTDESIGN\SAMPLING\FIG2_2-1_METALSDIST_CR6.MXD BRYANK 6/6/2014 2:12:50 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

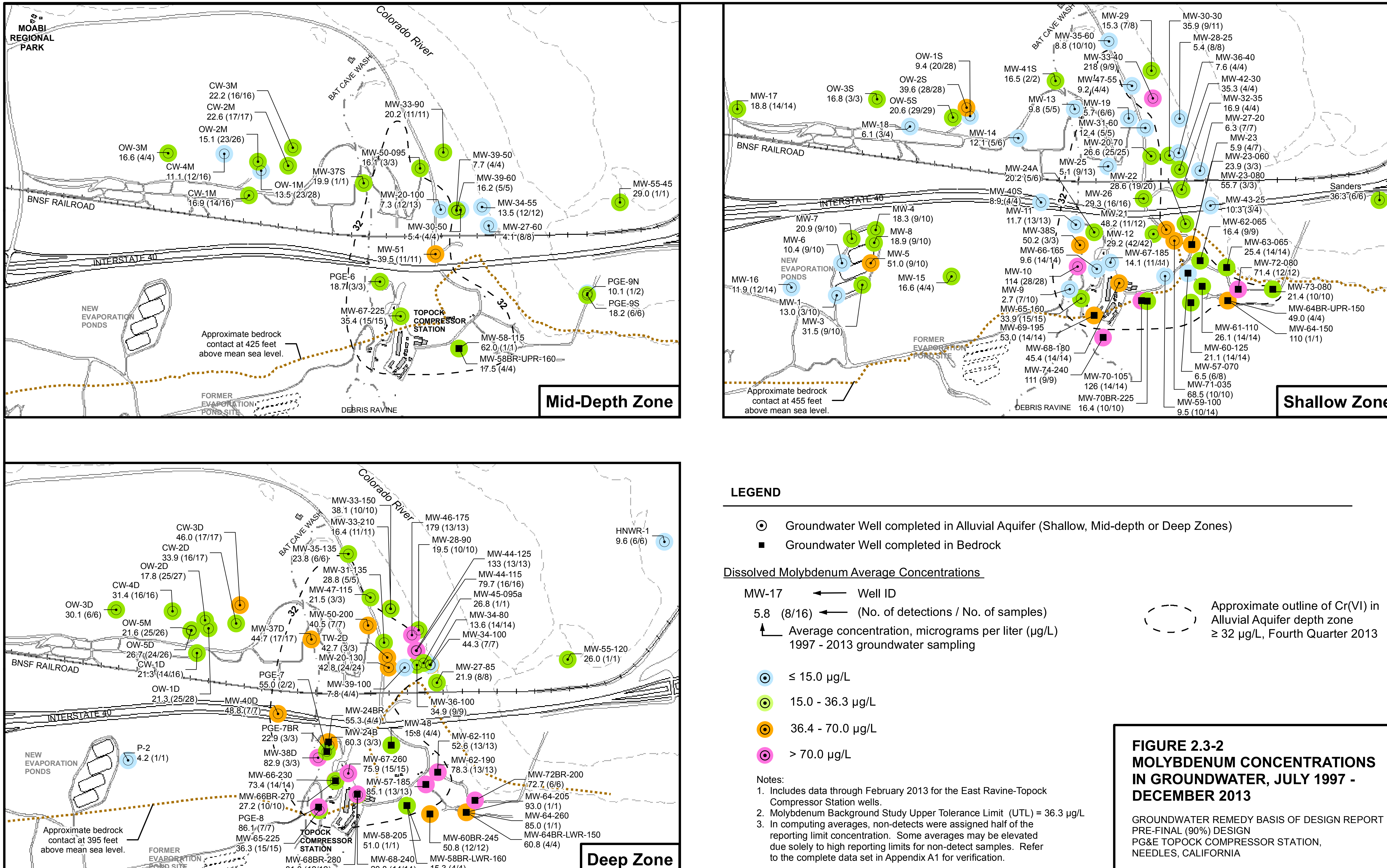
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2011

- ≤ 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 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (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 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 - 2013 groundwater sampling

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

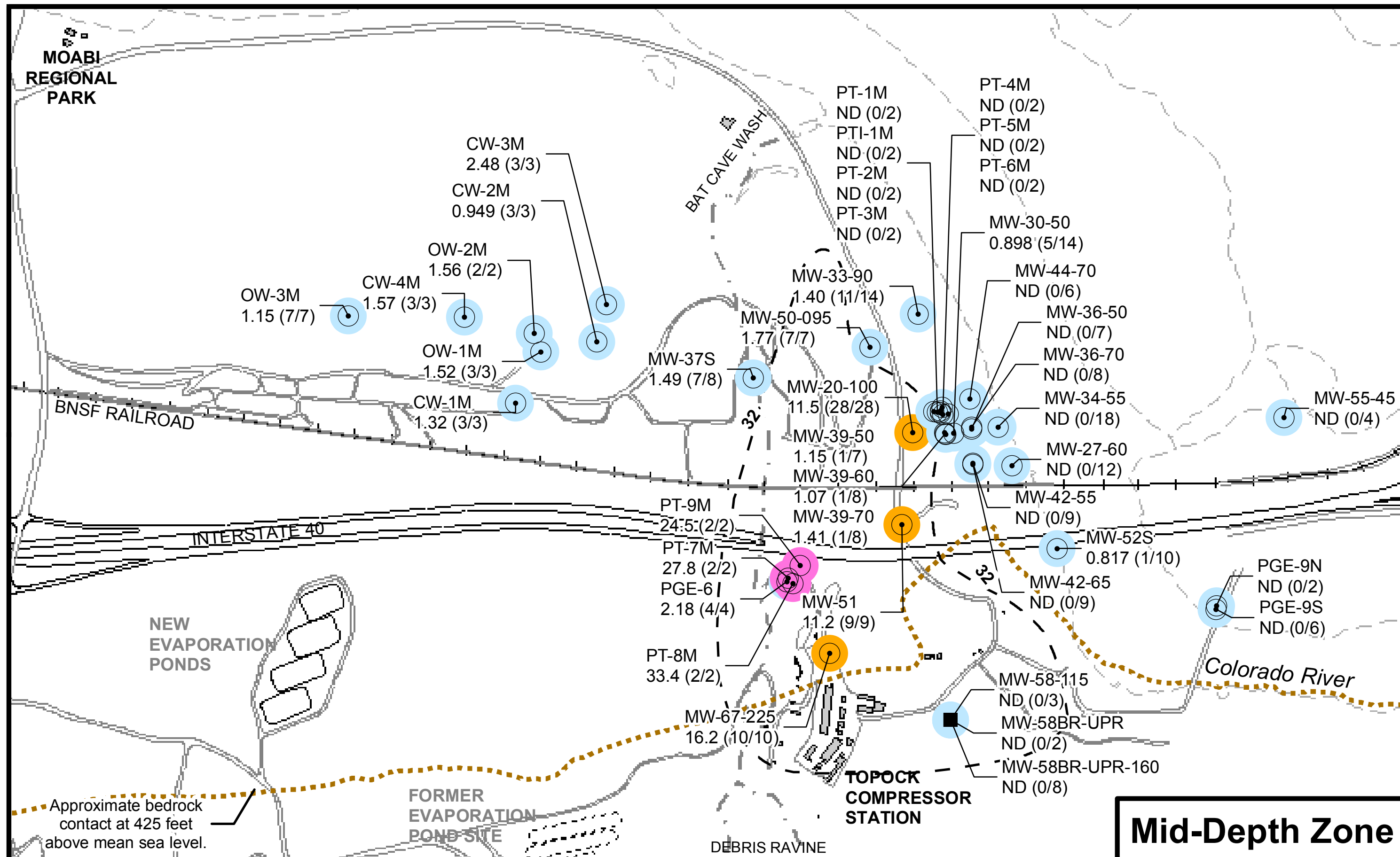
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2013

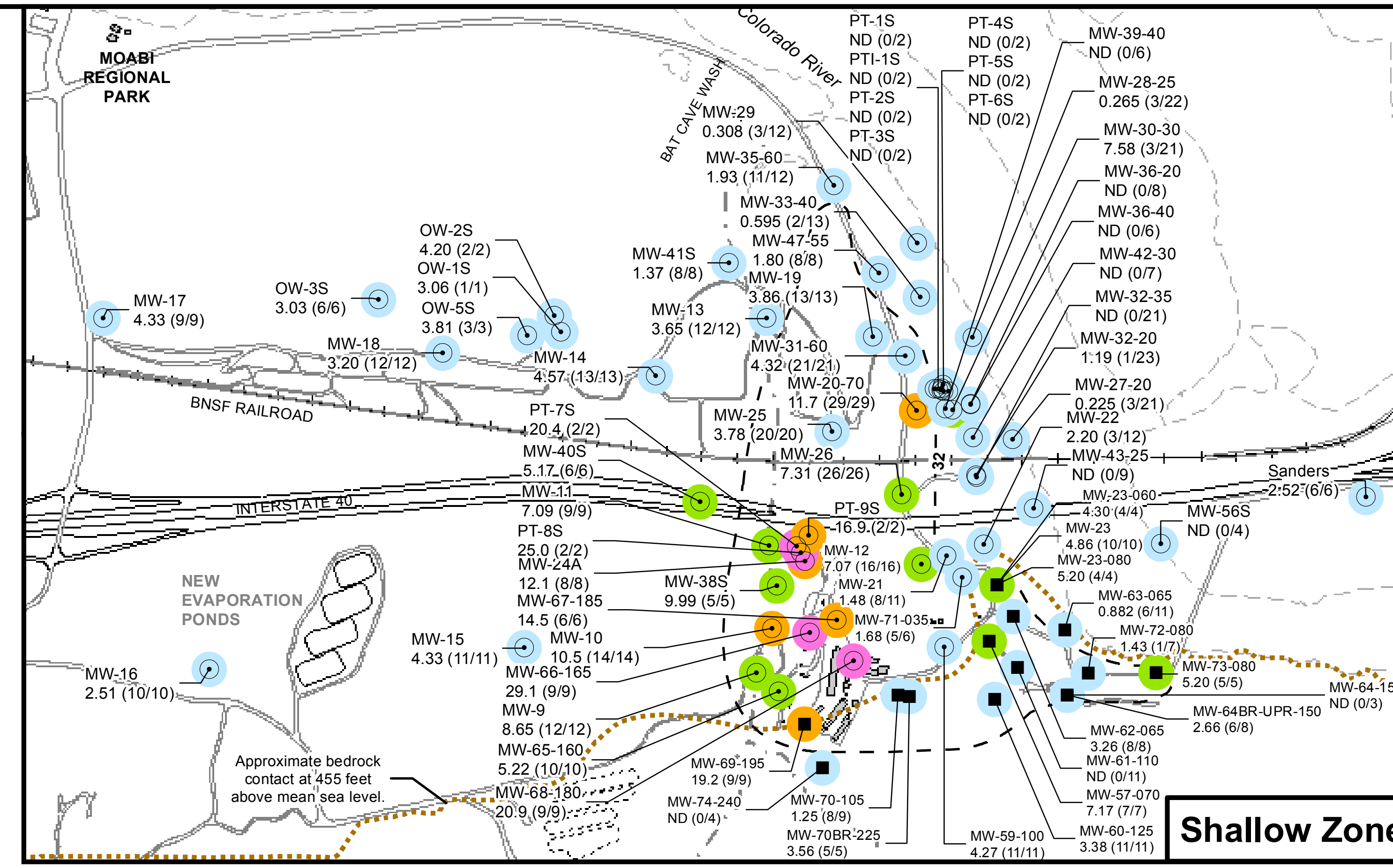
Notes:
1. Includes data through February 2013 for the East Ravine-Topock Compressor Station wells.
2. Molybdenum Background Study Upper Tolerance Limit (UTL) = 36.3 µg/L
3. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated due solely to high reporting limits for non-detect samples. Refer to the complete data set in Appendix A1 for verification.

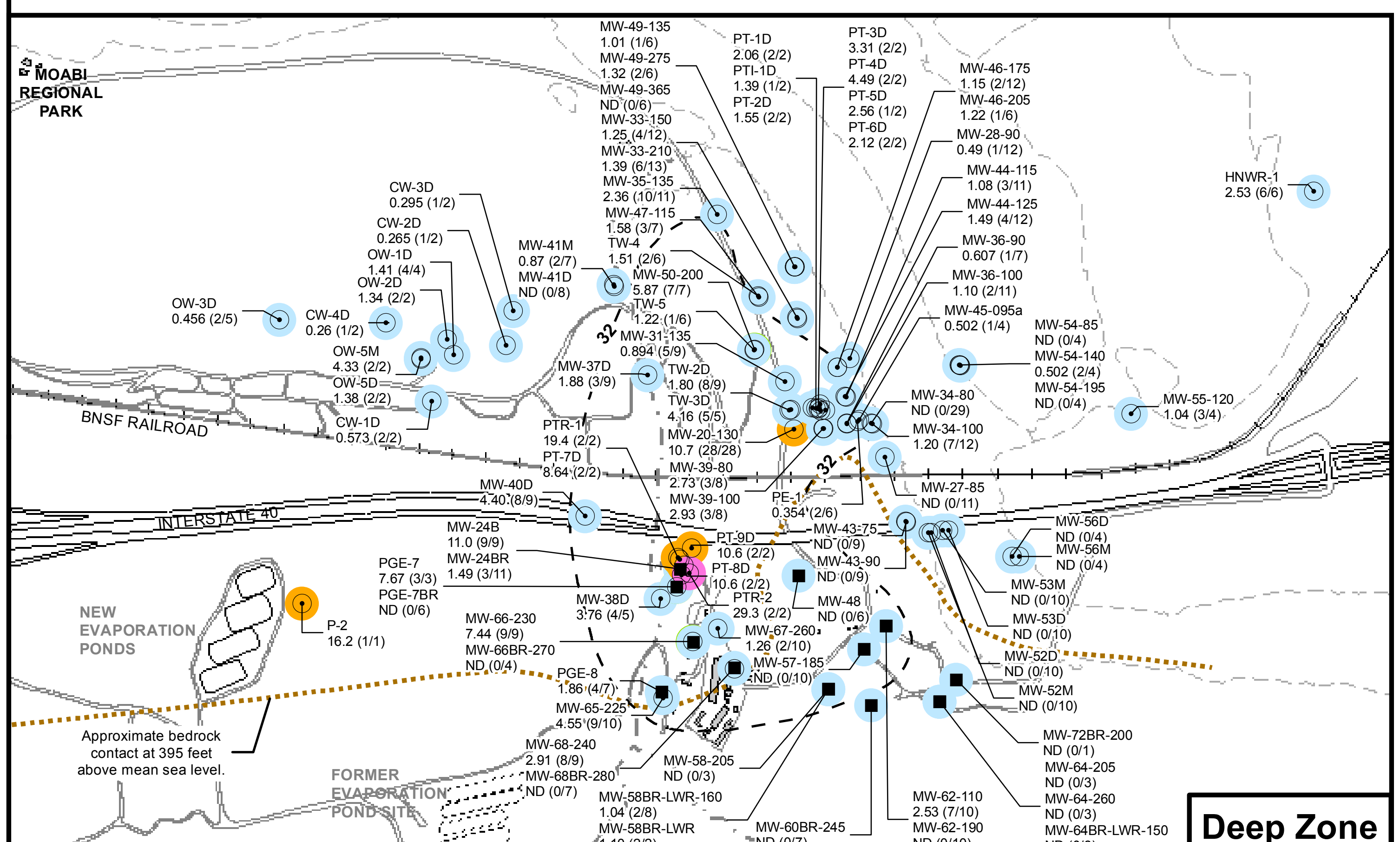
FIGURE 2.3-2
MOLYBDENUM CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO D:\PROJECTS\TOPOCK\MAPFILES\2014\CMS\90PERCENTDESIGN\SAMPLING\FIG2_3-2_METALSDIST_MOD.MXD BRYANK 6/6/2014 2:19:33 PM







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 - 2013 groundwater sampling

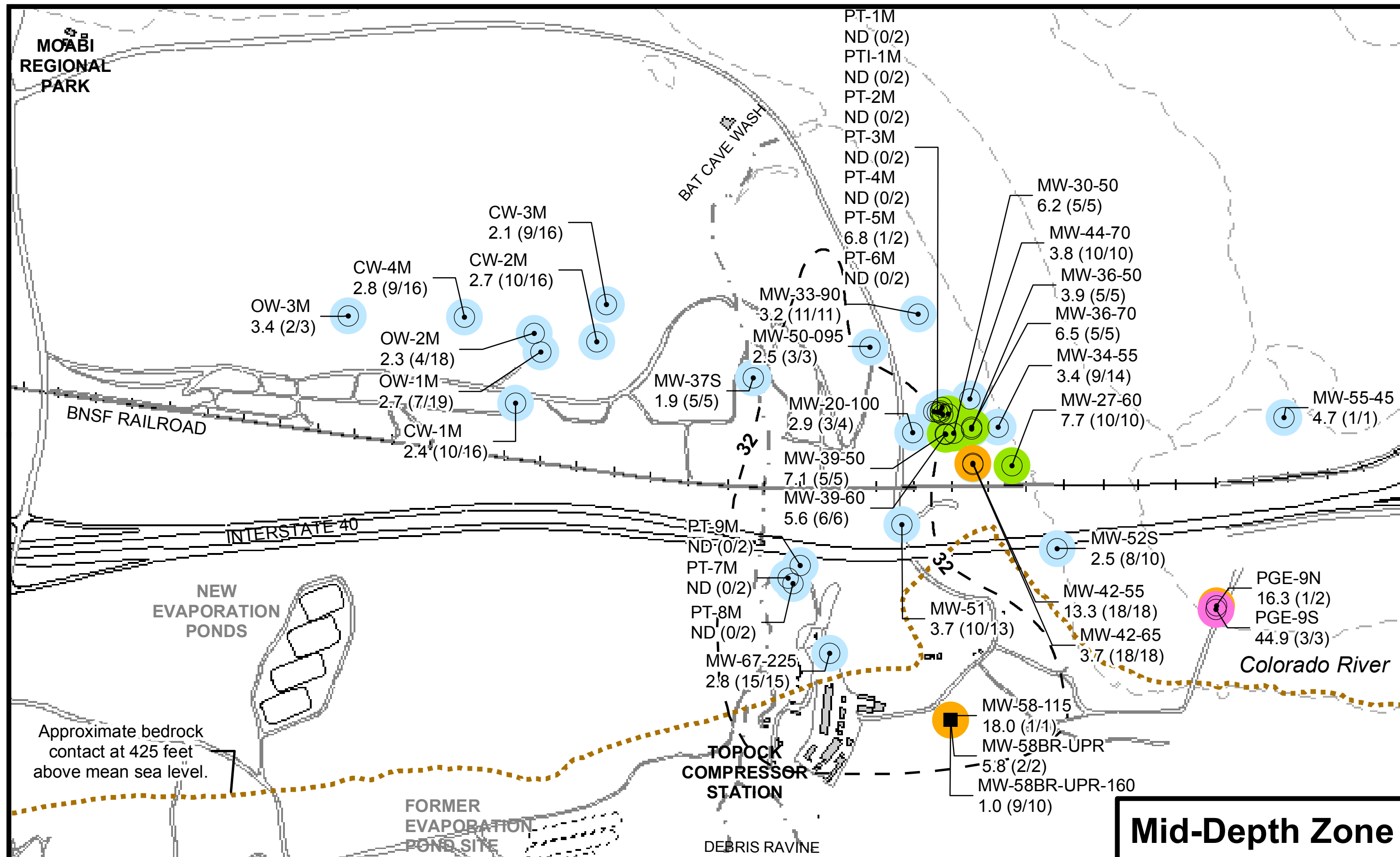
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 μg/L, Fourth Quarter 2013

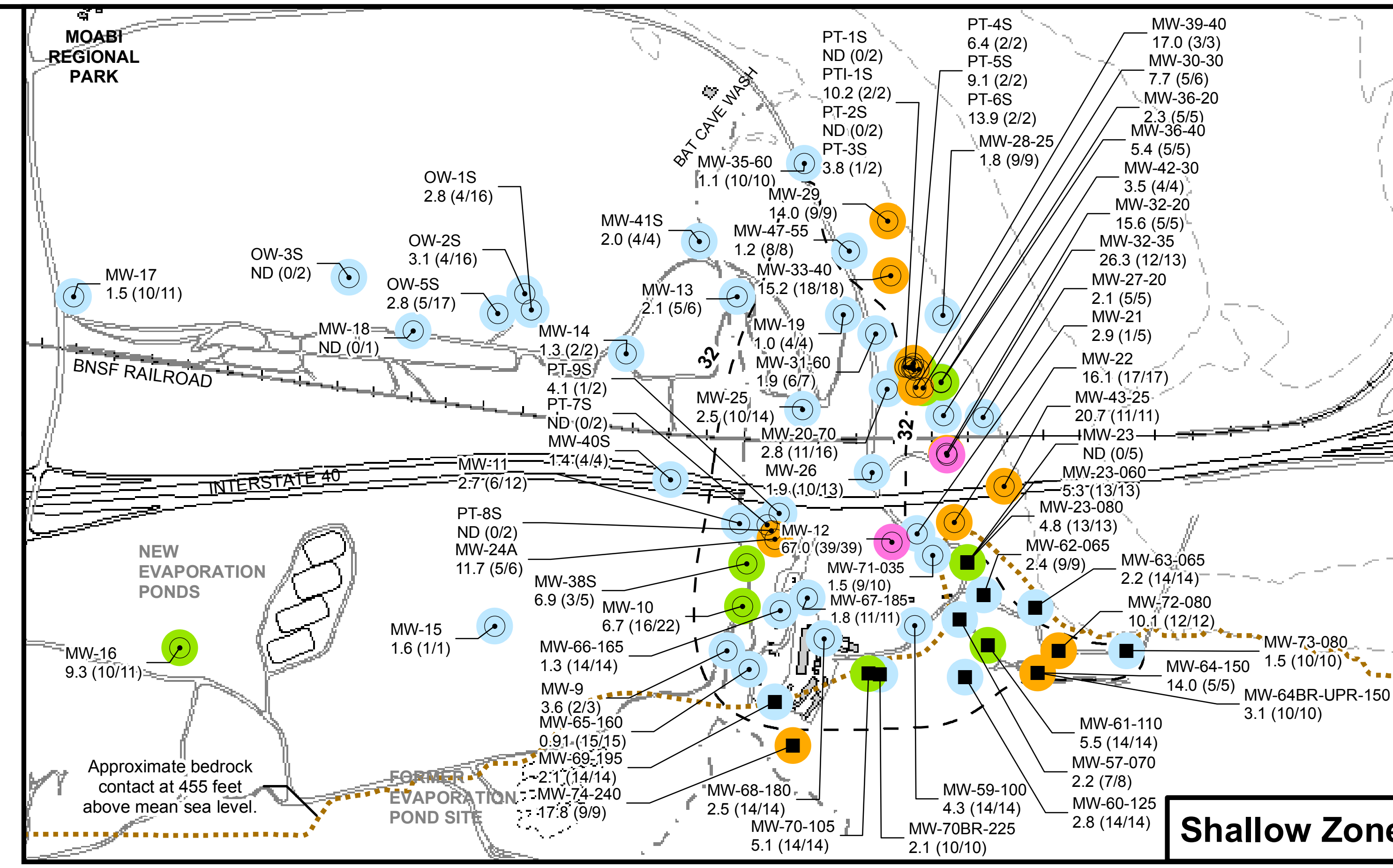
- ≤ 5.03 mg/L
- 5.03 - 10.0 mg/L
- 10.1 - 19.9 mg/L
- > 19.9 mg/L

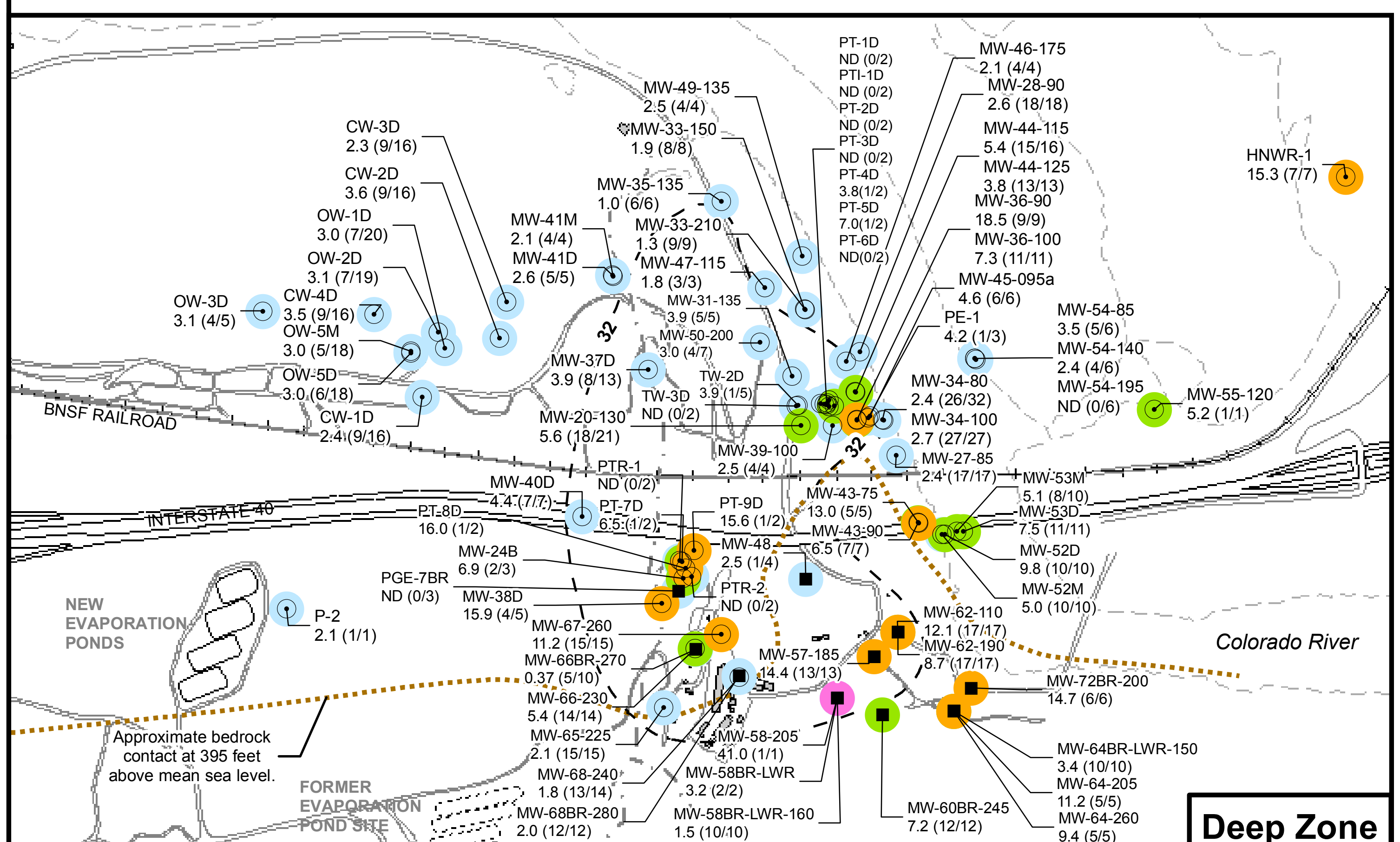
Notes:
1. Includes data through February 2013 for the East Ravine-Topock Compressor Station wells.
2. Nitrate Background Study Upper Tolerance Limit (UTL) = 5.03 mg/L
3. Nitrate applicable or relevant and appropriate requirement (ARAR) = 10.0 mg/L
4. In computing averages, non-detects were assigned half 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 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) 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 - 2013 groundwater sampling

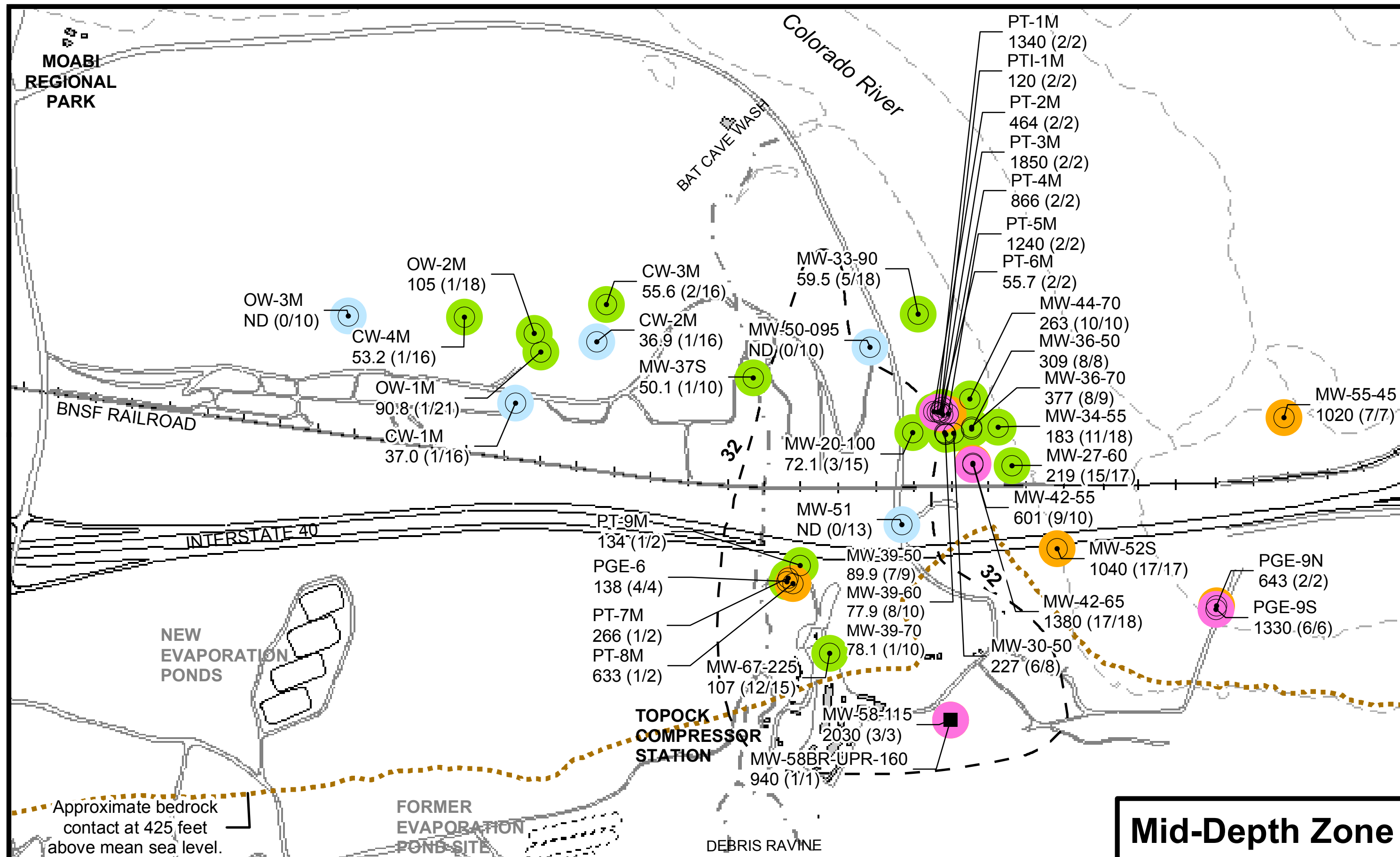
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2013

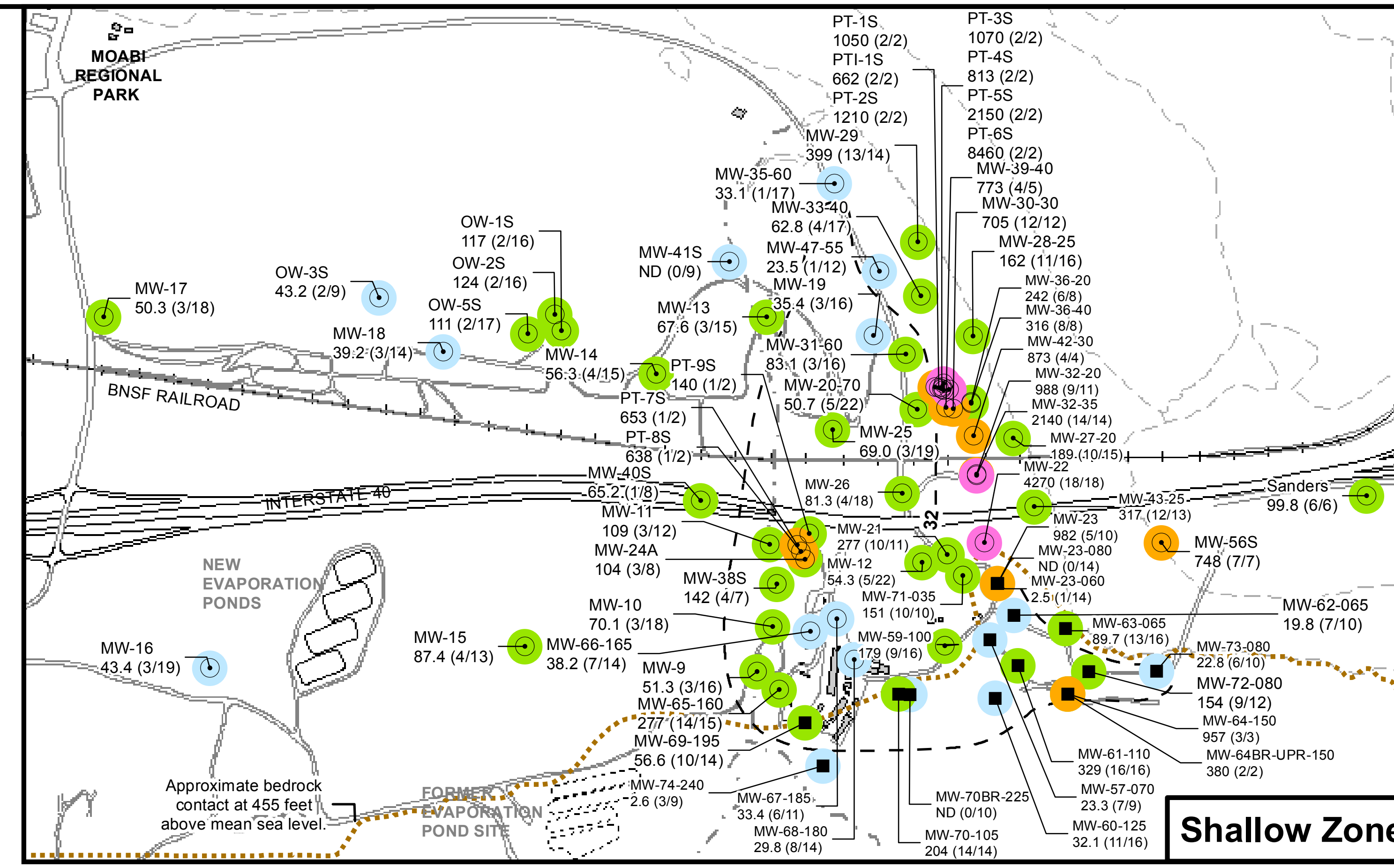
- ≤ 5.0 µg/L (or not detected [ND])
- 5.0 - 10.0 µg/L
- 10.1 - 24.3 µg/L
- > 24.3 µg/L

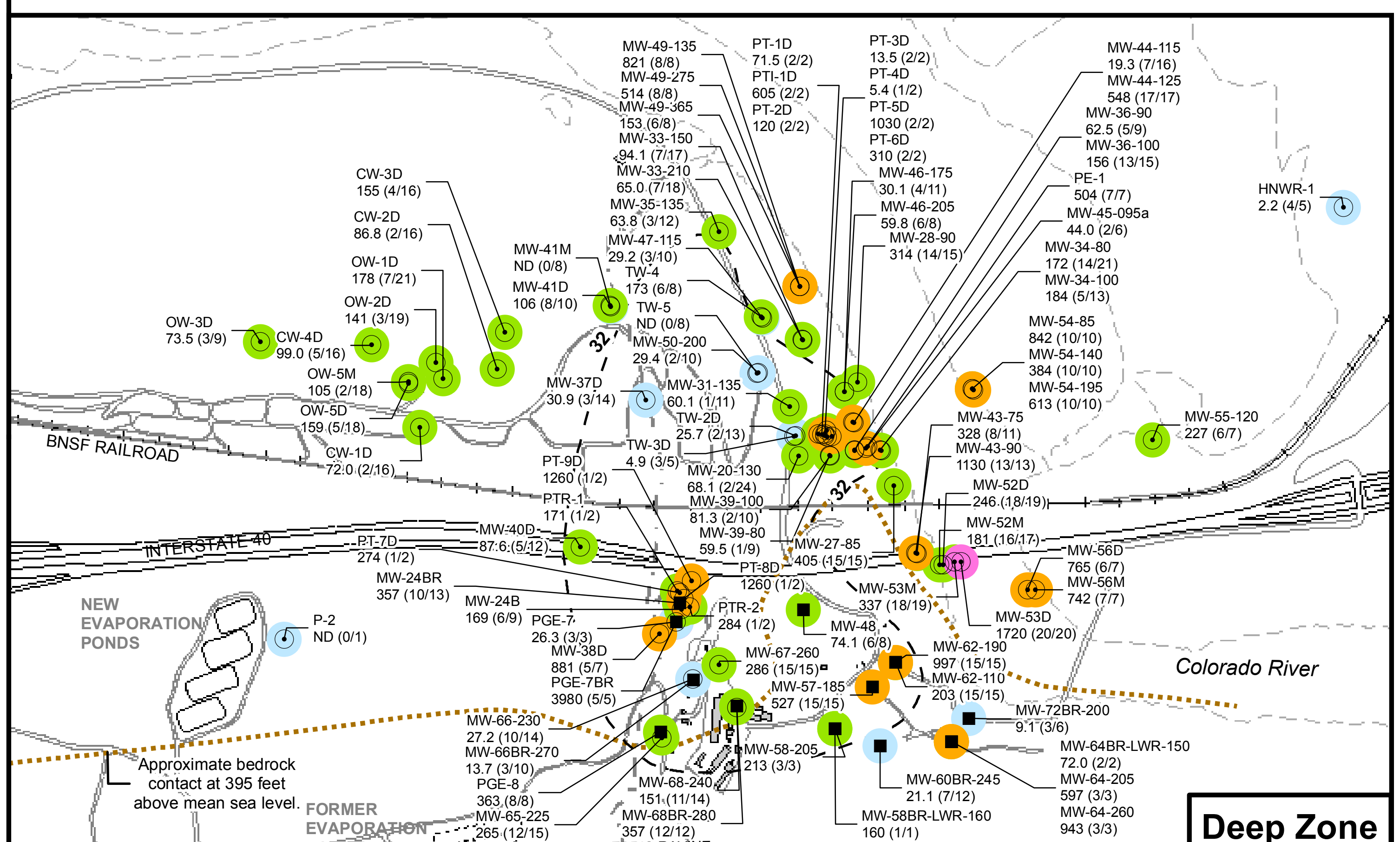
Notes:
1. Includes data through February 2013 for the East Ravine-Topock Compressor Station wells.
2. Arsenic Background Study Upper Tolerance Limit (UTL) = 24.3 µg/L
3. Arsenic applicable or relevant and appropriate requirement (ARAR) = 10.0 µg/L
4. In computing averages, non-detects were assigned half 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 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) 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 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 - 2013 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2013

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

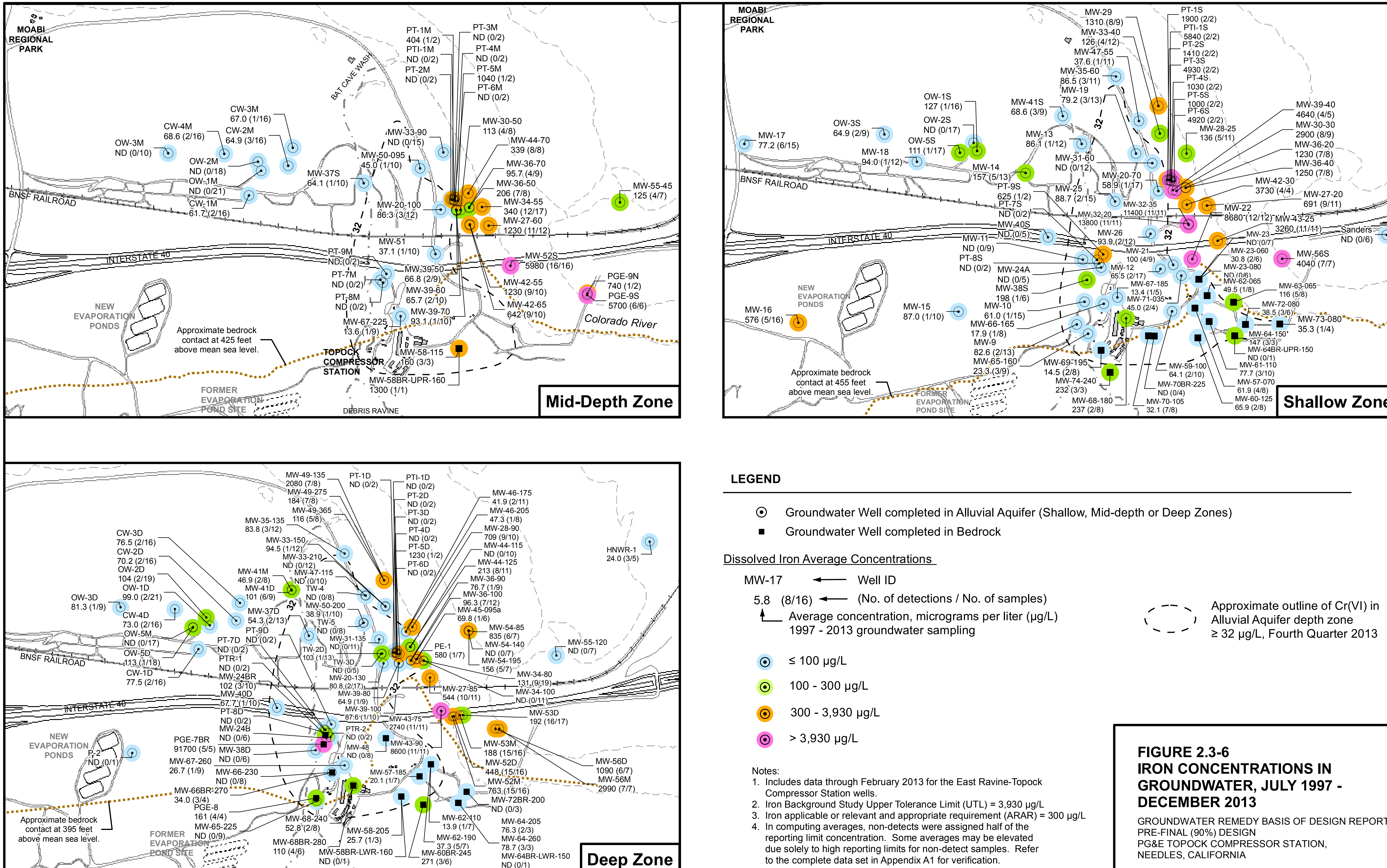
Notes:

1. Includes data through February 2013 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 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO D:\PROJECTS\TOPOCK\MAPFILES\2014\CMS\90PERCENTDESIGN\SAMPLING\FIG2_3-5_METALSDIST_MN.MXD BRYANK 6/6/2014 2:28:56 PM



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 - 2013 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2013

≤ 100 µg/L

100 - 300 µg/L

300 - 3,930 µg/L

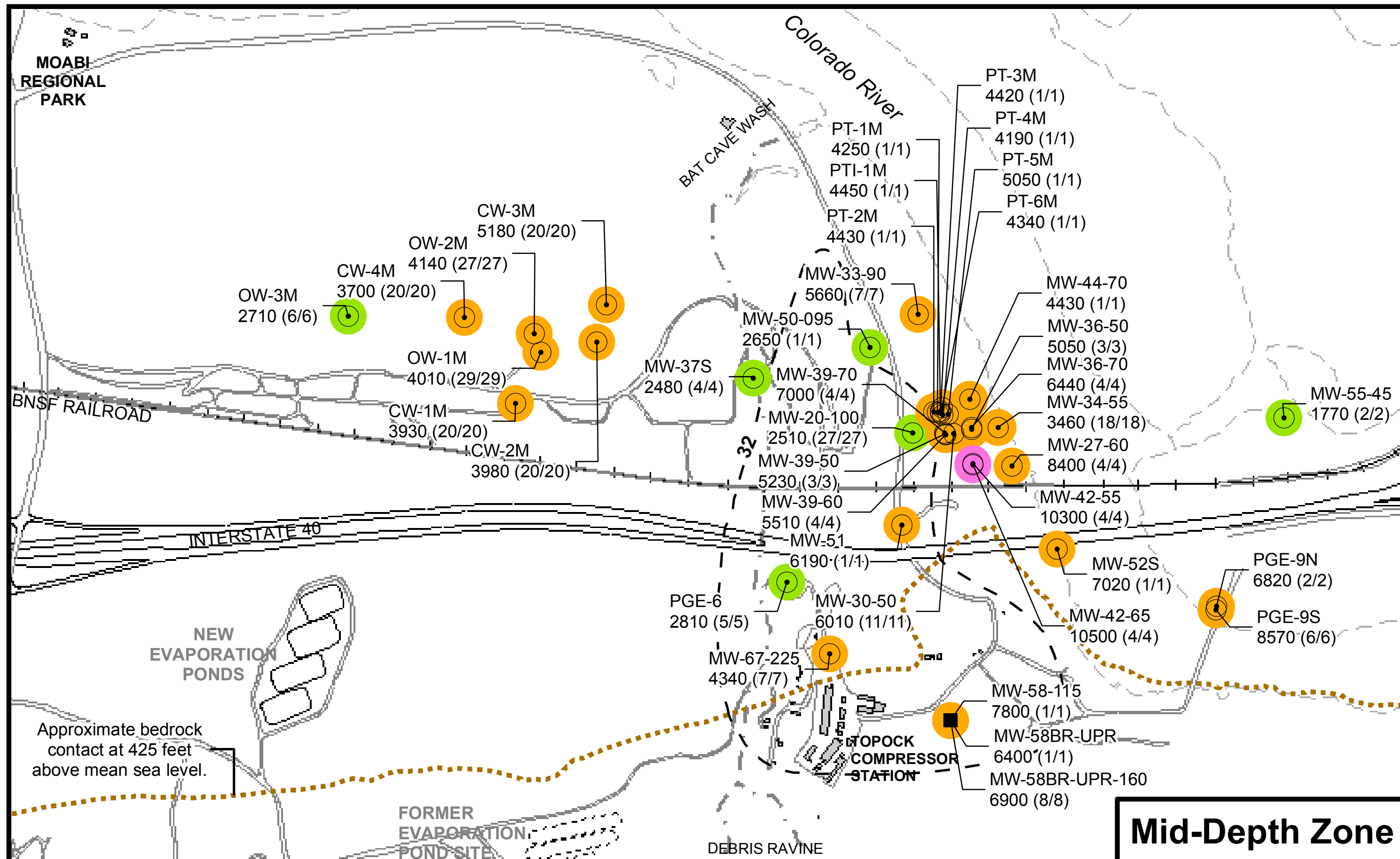
> 3,930 µg/L

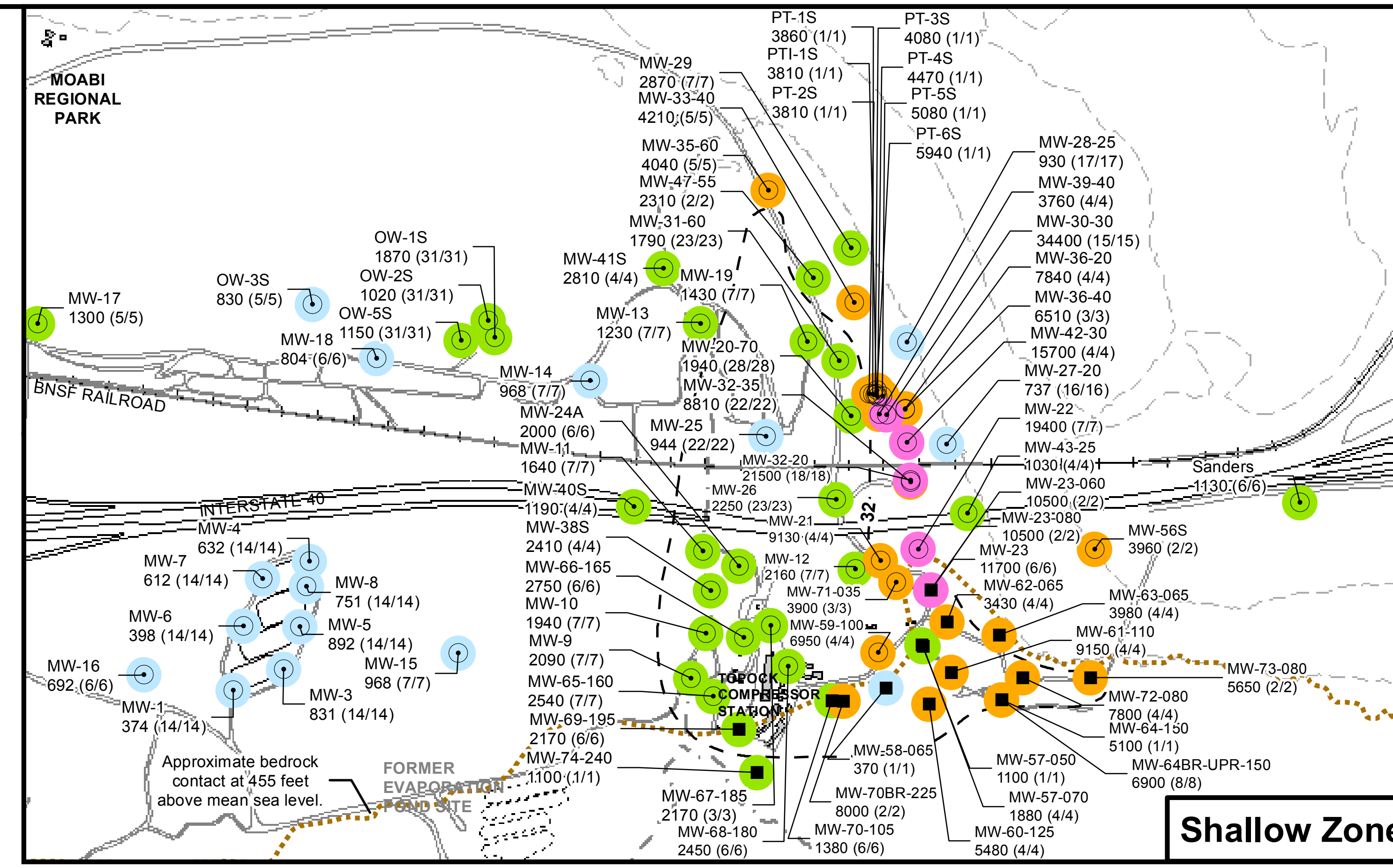
Notes:
1. Includes data through February 2013 for the East Ravine-Topock Compressor Station wells.
2. Iron Background Study Upper Tolerance Limit (UTL) = 3,930 µg/L
3. Iron applicable or relevant and appropriate requirement (ARAR) = 300 µg/L
4. In computing averages, non-detects were assigned half of 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.

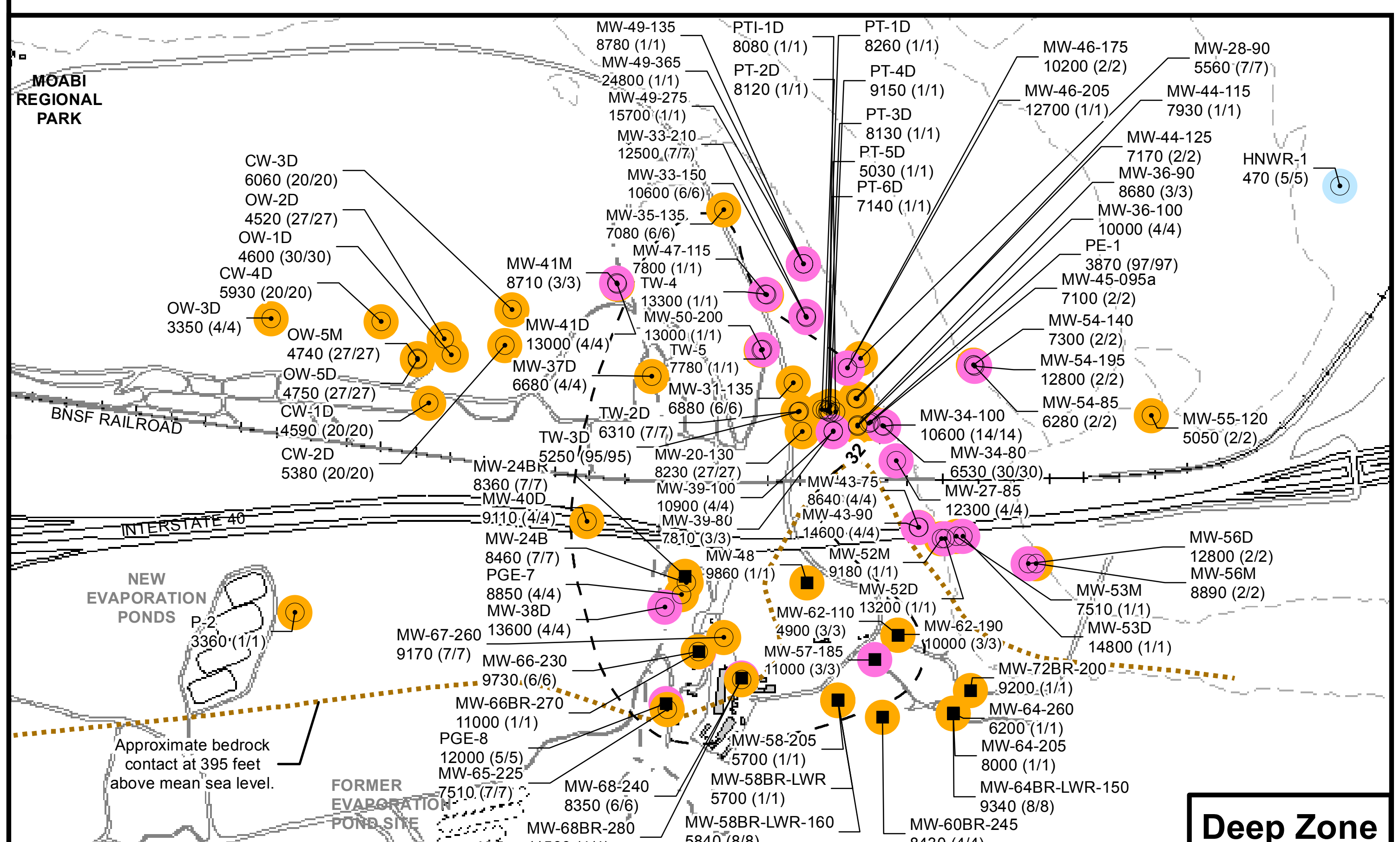
FIGURE 2.3-6
IRON CONCENTRATIONS IN GROUNDWATER, JULY 1997 - DECEMBER 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

E2 D:\PROJECTS\TOPOCK\MAPFILES\2014\CMS\90PERCENTDESIGN\SAMPLING\FIG2_3-6_METALSDIST_FE.MXD BRYANK 6/6/2014 2:30:08 PM







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 - 2013 groundwater sampling

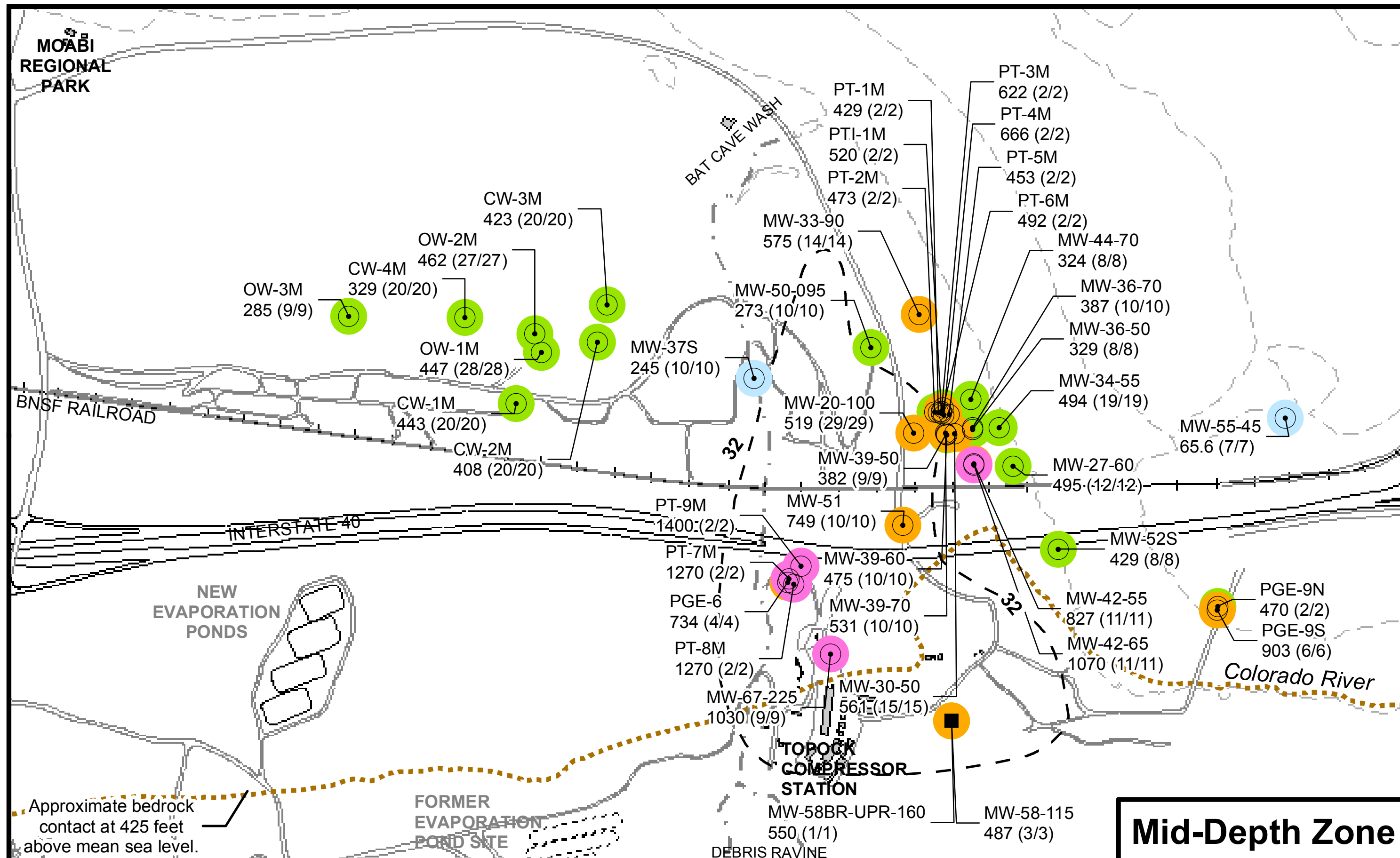
- ≤ 1,000 mg/L
- 1,000 - 3,000 mg/L
- 3,000 - 10,000 mg/L
- > 10,000 mg/L

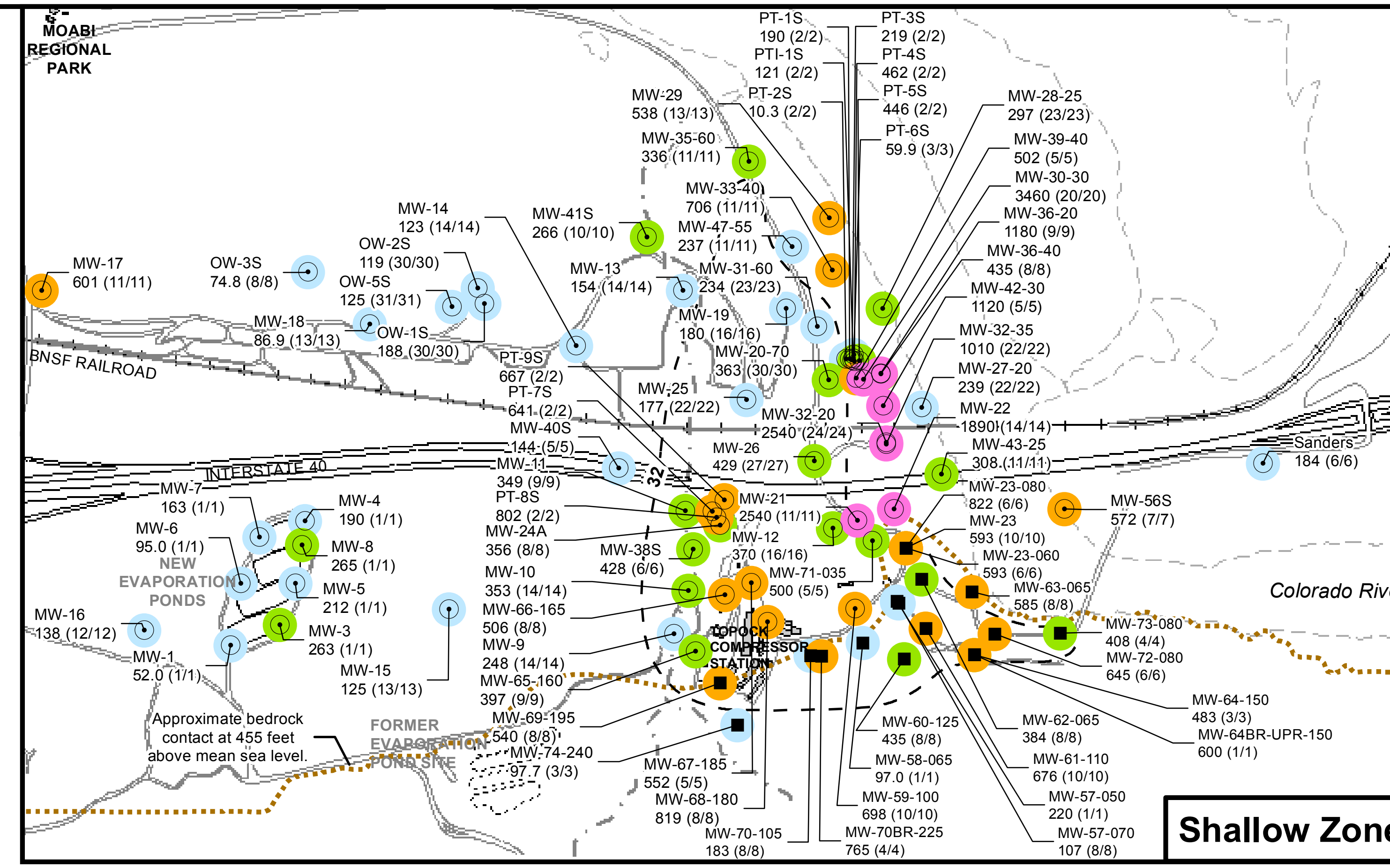
Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 µg/L, Fourth Quarter 2013

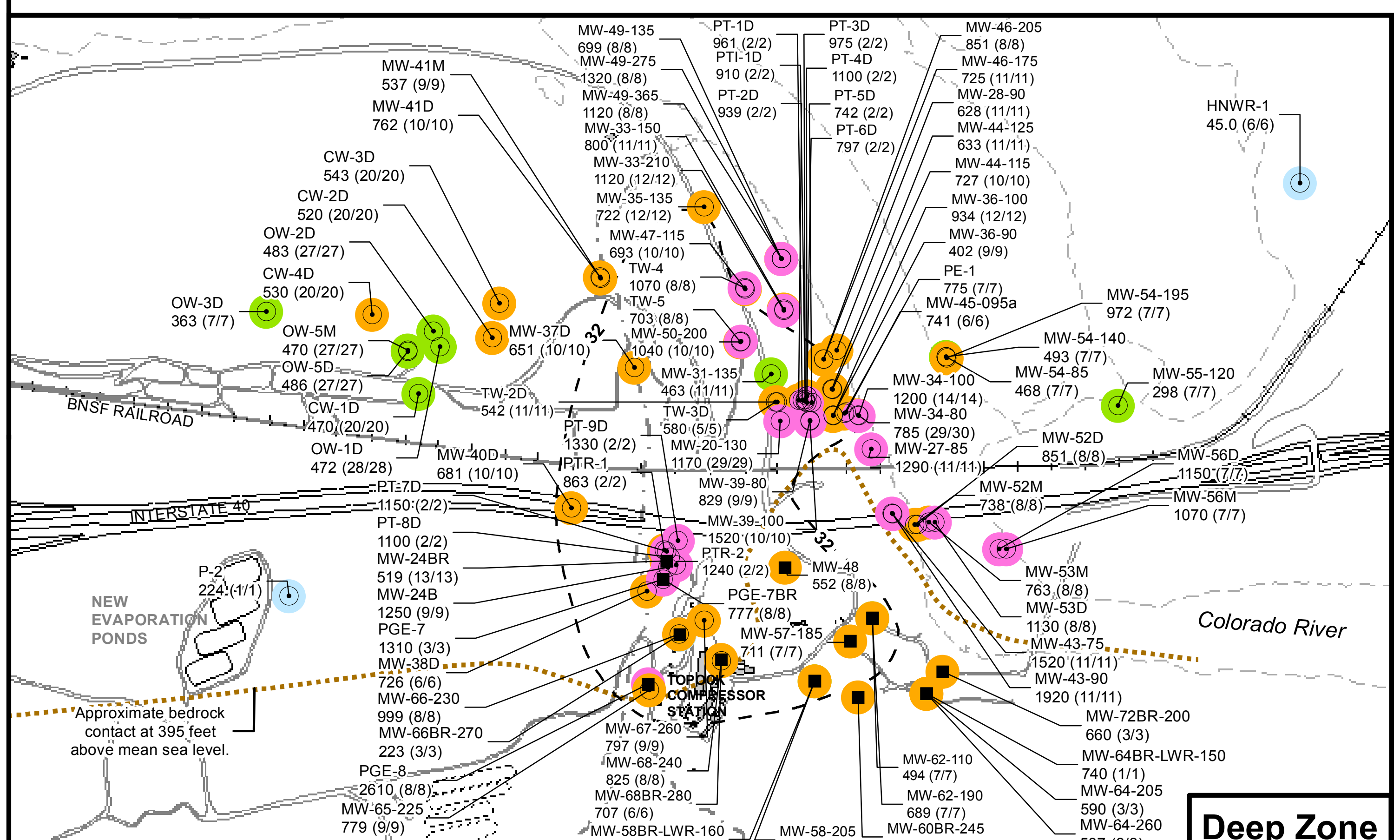
Notes:
1. Includes data through February 2013 for the East Ravine-Topock Compressor Station wells.
2. TDS applicable or relevant and appropriate requirement (ARAR) = 1,000 mg/L
3. In computing averages, non-detects were assigned half of the reporting limit concentration. Some averages may be elevated 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 2013
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

BAO D:\PROJECTS\TOPOCK\MAPFILES\2014\CMS\90PERCENTDESIGN\SAMPLING\FIG2_3-7_METALSDIST_TDS.MXD BRYANK 6/6/2014 2:31:07 PM







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 - 2013 groundwater sampling

Approximate outline of Cr(VI) in Alluvial Aquifer depth zone ≥ 32 μg/L, Fourth Quarter 2013

≤ 250 mg/L

250 - 500 mg/L

500 - 1,000 mg/L

> 1,000 mg/L

Notes:
1. Includes data through February 2013 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 2013

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

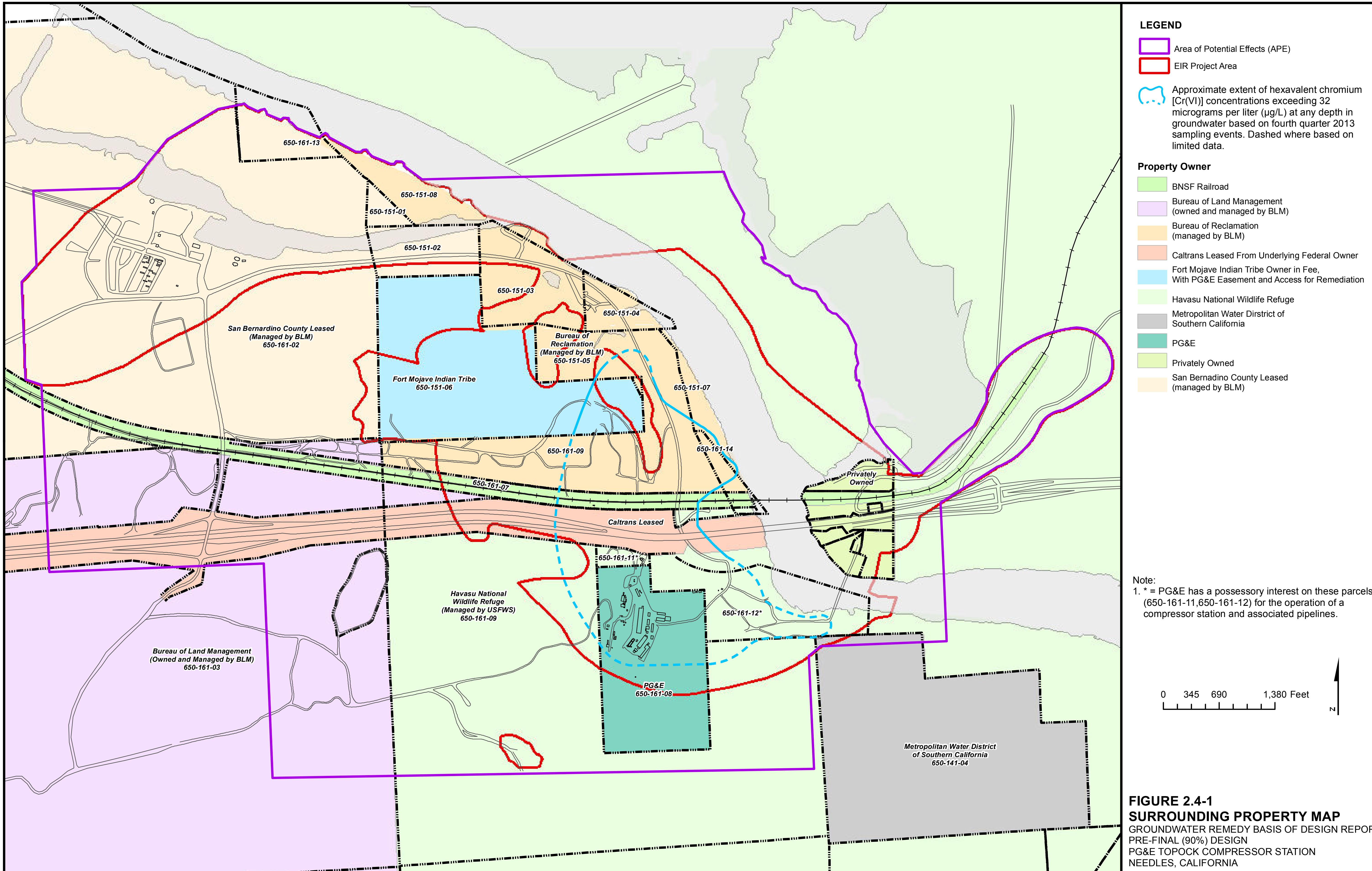
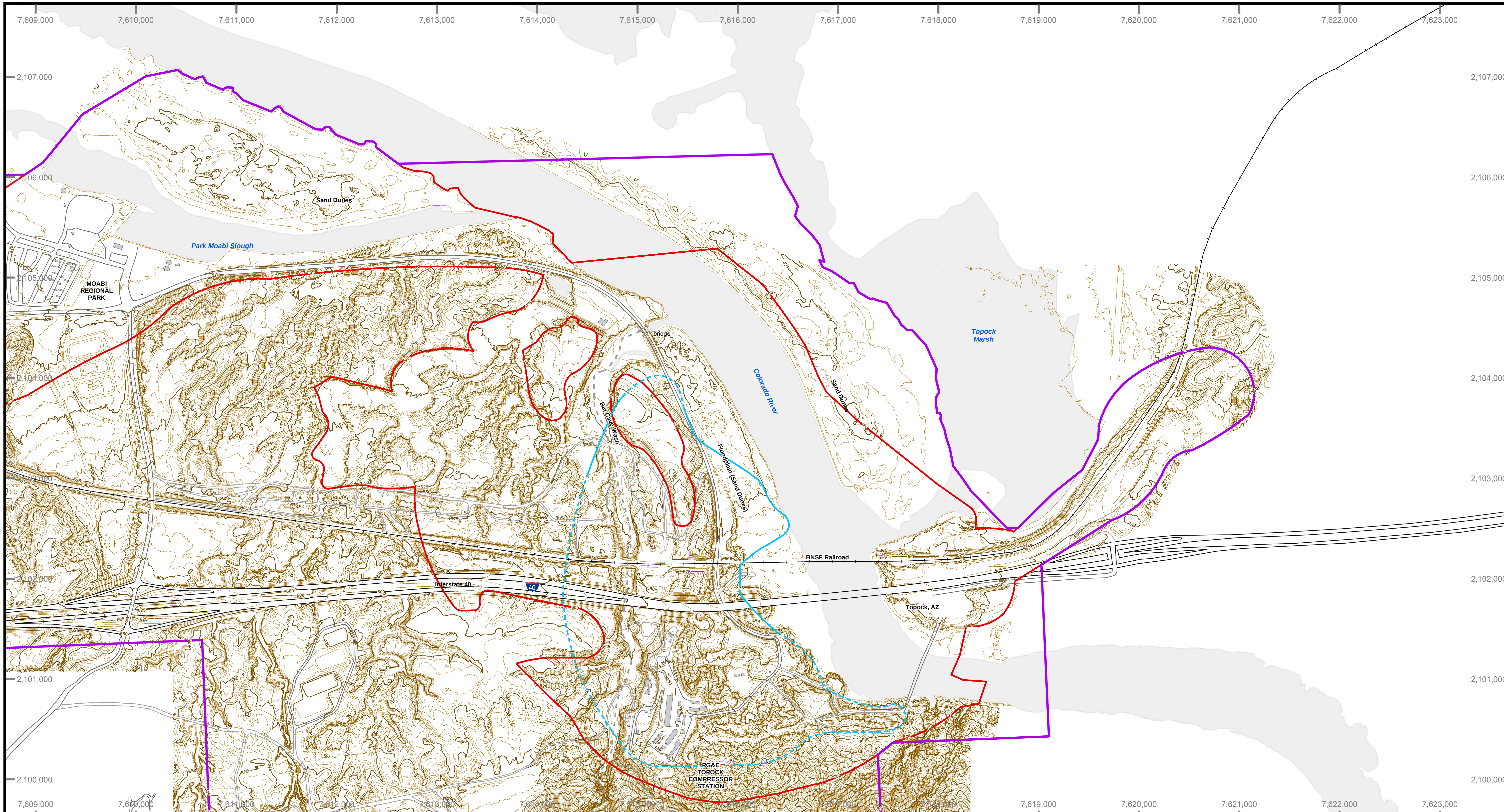


FIGURE 2.4-1
SURROUNDING PROPERTY MAP
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG241_SurroundingProp.mxd



LEGEND

- Area of Potential Effects (APE)
- EIR Project Area
- Topographic Contour 25-foot Interval
- Topographic Contour 5-foot Interval
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 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.

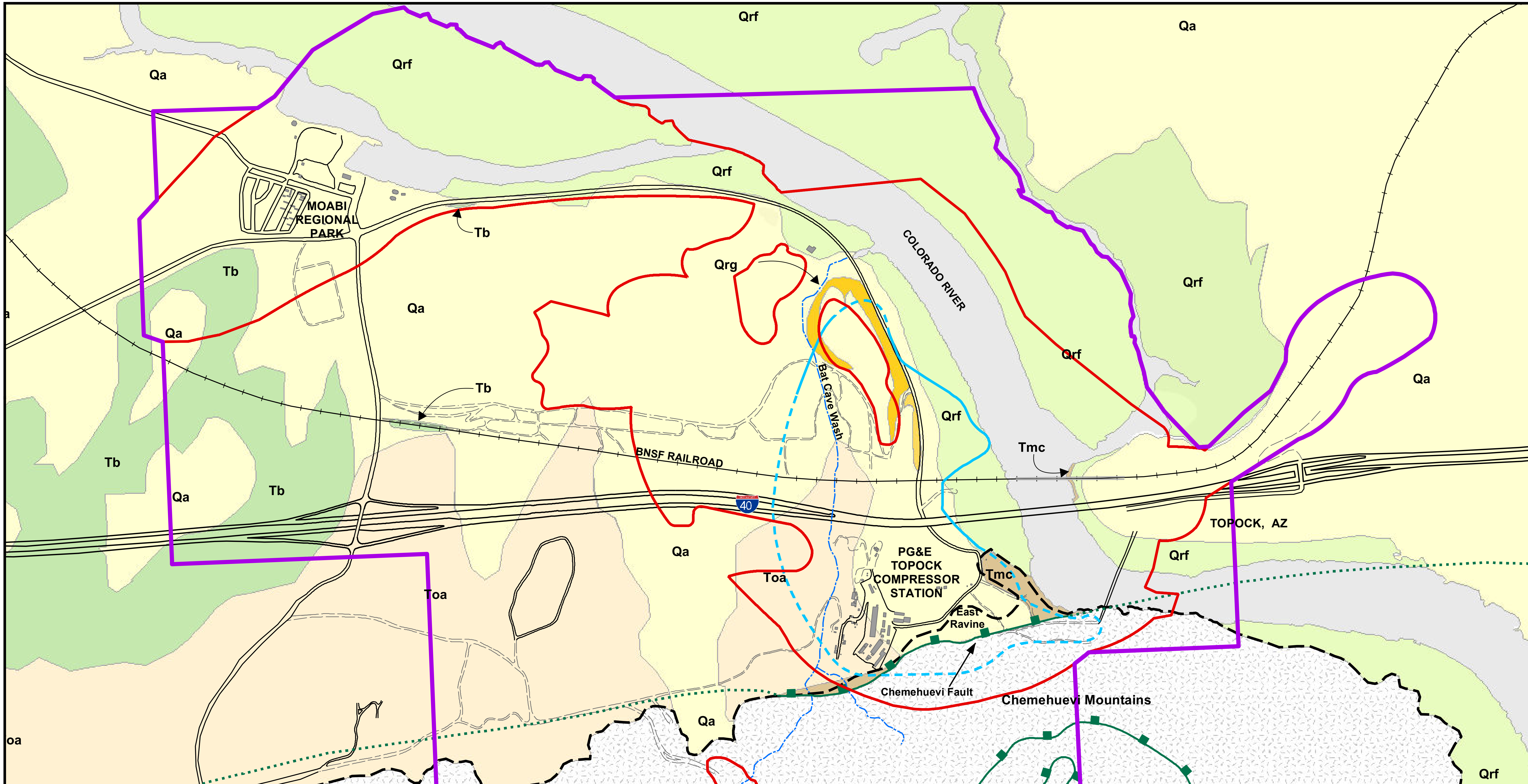
N

0 337.5 675 1,350 Feet

FIGURE 2.4-2
SITE TOPOGRAPHY
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG242_Site_Topography.mxd



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)

- Detachment Fault barbs on downthrown side
- Detachment Fault concealed
- 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 2013 sampling events. Dashed where based on limited data.

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).

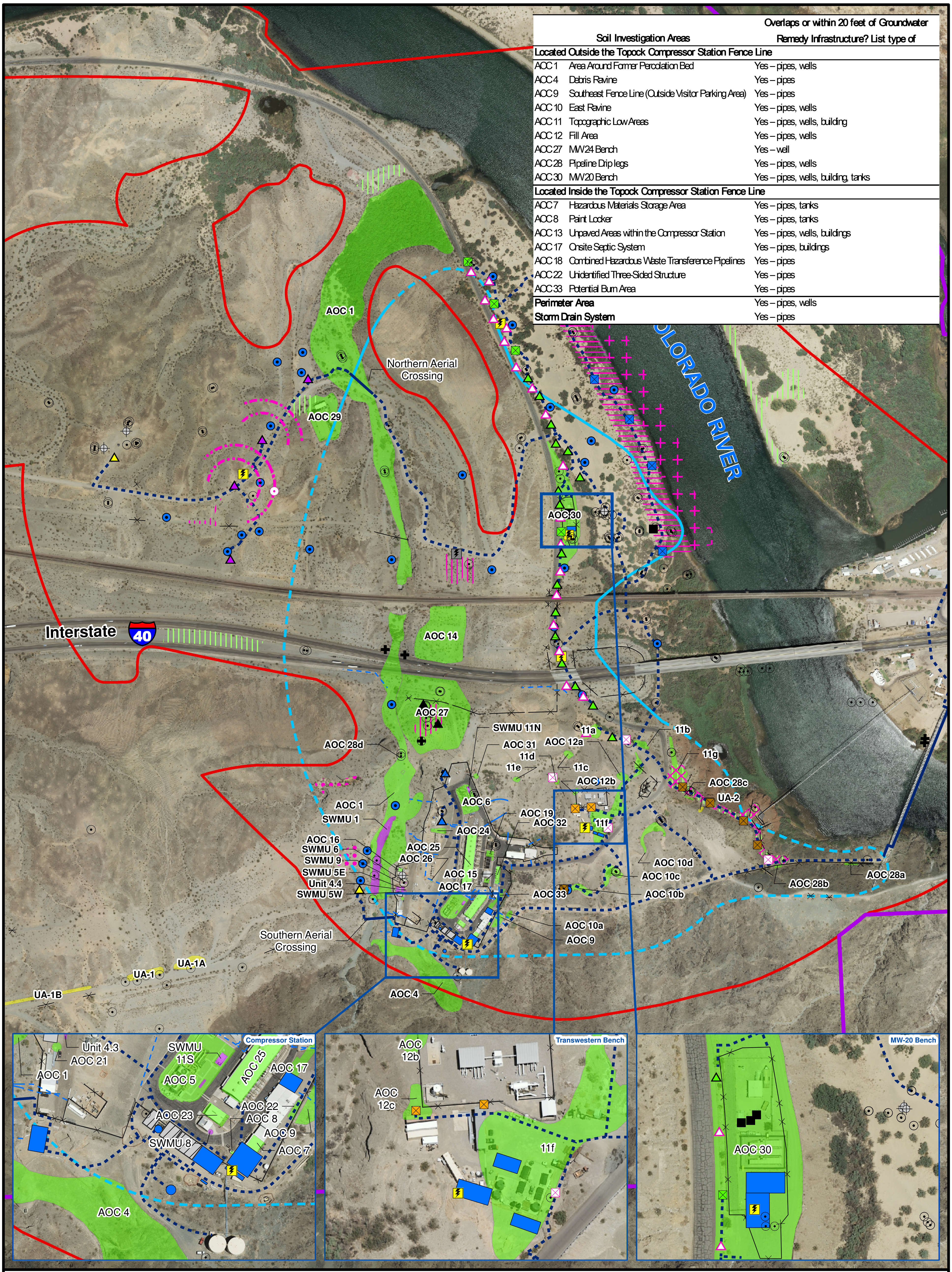
N

0 320 640 1,280
Feet

FIGURE 2.4-3
GEOLOGIC MAP
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

D:\Projects\Topock\MapFiles\2011\CMS\BOD\GeologicMap



Soil Investigation Areas		Overlaps or within 20 feet of Groundwater Remedy Infrastructure? List type of
Located Outside the Topock Compressor Station Fence Line		
AOC 1	Area Around Former Percolation Bed	Yes – pipes, wells
AOC 4	Debris Ravine	Yes – pipes
AOC 9	Southeast Fence Line (Outside Visitor Parking Area)	Yes – pipes
AOC 10	East Ravine	Yes – pipes, wells
AOC 11	Topographic Low Areas	Yes – pipes, wells, building
AOC 12	Fill Area	Yes – pipes, wells
AOC 27	MW-24 Bench	Yes – well
AOC 28	Pipeline Drip legs	Yes – pipes, wells
AOC 30	MW-20 Bench	Yes – pipes, wells, building, tanks
Located Inside the Topock Compressor Station Fence Line		
AOC 7	Hazardous Materials Storage Area	Yes – pipes, tanks
AOC 8	Paint Locker	Yes – pipes, tanks
AOC 13	Unpaved Areas within the Compressor Station	Yes – pipes, wells, buildings
AOC 17	Onsite Septic System	Yes – pipes, buildings
AOC 18	Combined Hazardous Waste Transference Pipelines	Yes – pipes
AOC 22	Unidentified Three-Sided Structure	Yes – pipes
AOC 33	Potential Burn Area	Yes – pipes
Perimeter Area		Yes – pipes, wells
Storm Drain System		Yes – pipes

LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well
- Water Supply Well

Provisional Wells:
- Extraction Well
- Injection Well
- Monitoring Well (MW-EE is a pending/future provisional monitoring wells)
- ARC for IRL-2 and IRL-3 Arsenic Monitoring Wells
- Area for East Ravine (ER) Wells (ER-7 to ER-11 and MW-T)
- Area for Potential Slant Well Screens
- Area for Inner Recirculation Loop (IRL) Wells
- Area for River Bank Extraction Wells (RB-6 to RB-9)
- Area for Monitoring Well (MW-V)

Planned Wells:
- Extraction, East Ravine
- Extraction, National Trails Highway (NTH) In-situ Reactive Zone (IRZ)
- Extraction, Riverbank
- Extraction, Transwestern Bench
- Injection, Freshwater
- Injection, Inner Recirculation Loop
- Injection, NTH IRZ
- Injection, Topock Compressor Station
- Remedy Monitoring Well
- Recirculation Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)

Transformers
- Planned Transformer
- Future Provisional Transformer

- Site Fence Boundary
- Stormwater Piping Below Ground
- Stormwater Piping Above Ground

Pipeline Corridor for Remedy
- Aboveground Pipe
- Underground Pipe/Conduit
- Area of Potential Effects (APE)
- EIR Project Area

Work Areas
- Solid Waste Management Unit (SWMU)
- Area of Concern (AOC)
- Other

Remedy Facilities
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

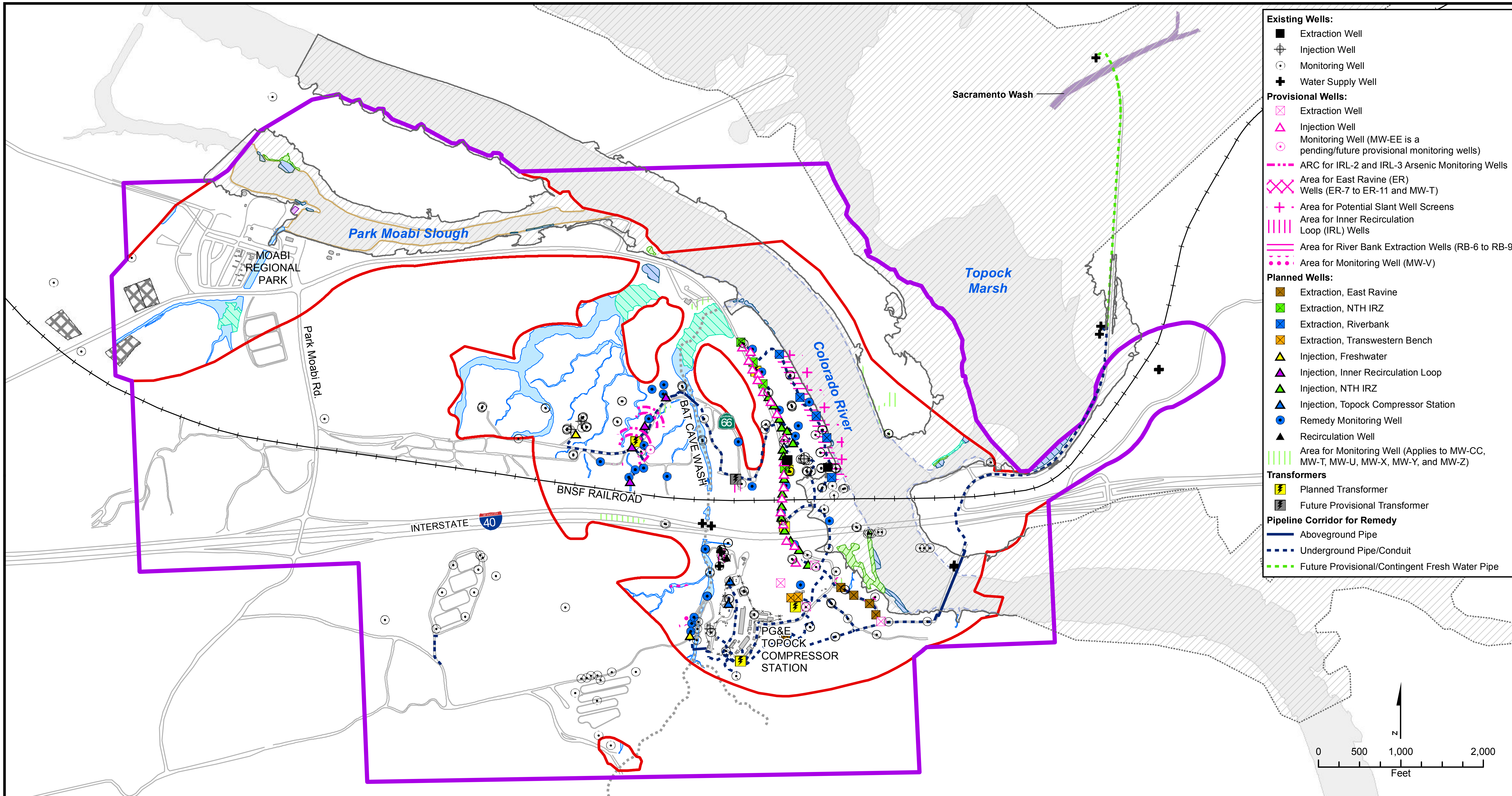
Notes:
1. All wells and remedy structure locations are approximate.
2. AOC 13 consists of the current and former unpaved areas within the fence line. AOC 18 consists of the hazardous waste transference pipelines and cooling tower blowdown pipelines.

N

0 550 Feet

FIGURE 2.4-4
MAP OF SOLID WASTE MANAGMENT UNITS (SWMUS) AND AREAS OF CONCERN (AOCS)
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL



LEGEND

- Compressor Station Fence Line
- Area of Potential Effects (APE)
- EIR Project Area
- Main Construction Yard/ Long-term Soil Storage
- 100yr. Floodplain*
- 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

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).

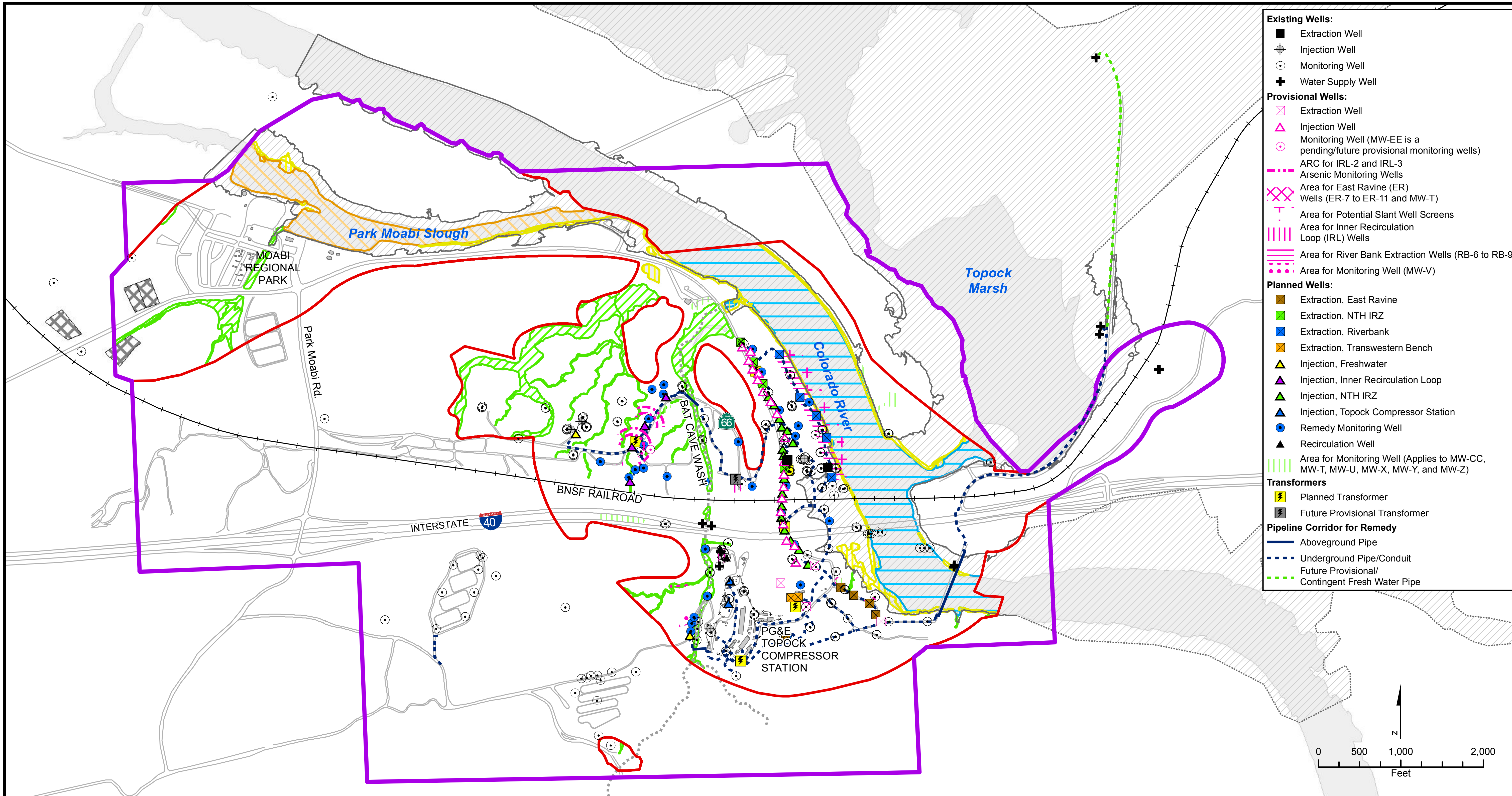
* Where the 100-year flood limit is dashed, this information is taken from the Flood Insurance Rate Map (FIRM) found on the Federal Emergency Management Agency (FEMA) website at http://www.msc.fema.gov. Map ID 04015C5650H and 04015C5675H, February 20, 2013.

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.

FIGURE 2.4-5
JURISDICTIONAL WATERS AND WETLANDS IN PROJECT AREA, 2013
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG245_USACE_Waters_Wetlands_2013.mxd



LEGEND

- Compressor Station Fence Line
- Area of Potential Effects (APE)
- EIR Project Area
- Main Construction Yard/ Long-term Soil Storage
- 100yr. Floodplain*

CDFW Jurisdiction Areas

- CDFW Ephemeral Stream
- CDFW Riparian
- Colorado River
- Park Moabi Slough

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).

* Where the 100-year flood limit is dashed, this information is taken from the Flood Insurance Rate Map (FIRM) found on the Federal Emergency Management Agency (FEMA) website at http://www.msc.fema.gov. Map ID 04015C5650H and 04015C5675H, February 20, 2013.

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.

FIGURE 2.4-5A
JURISDICTIONAL WATERS OF THE STATE AND WETLANDS IN PROJECT AREA, 2013
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG245A_CDFW_USACE_Waters_Wetlands_2013_CA.mxd

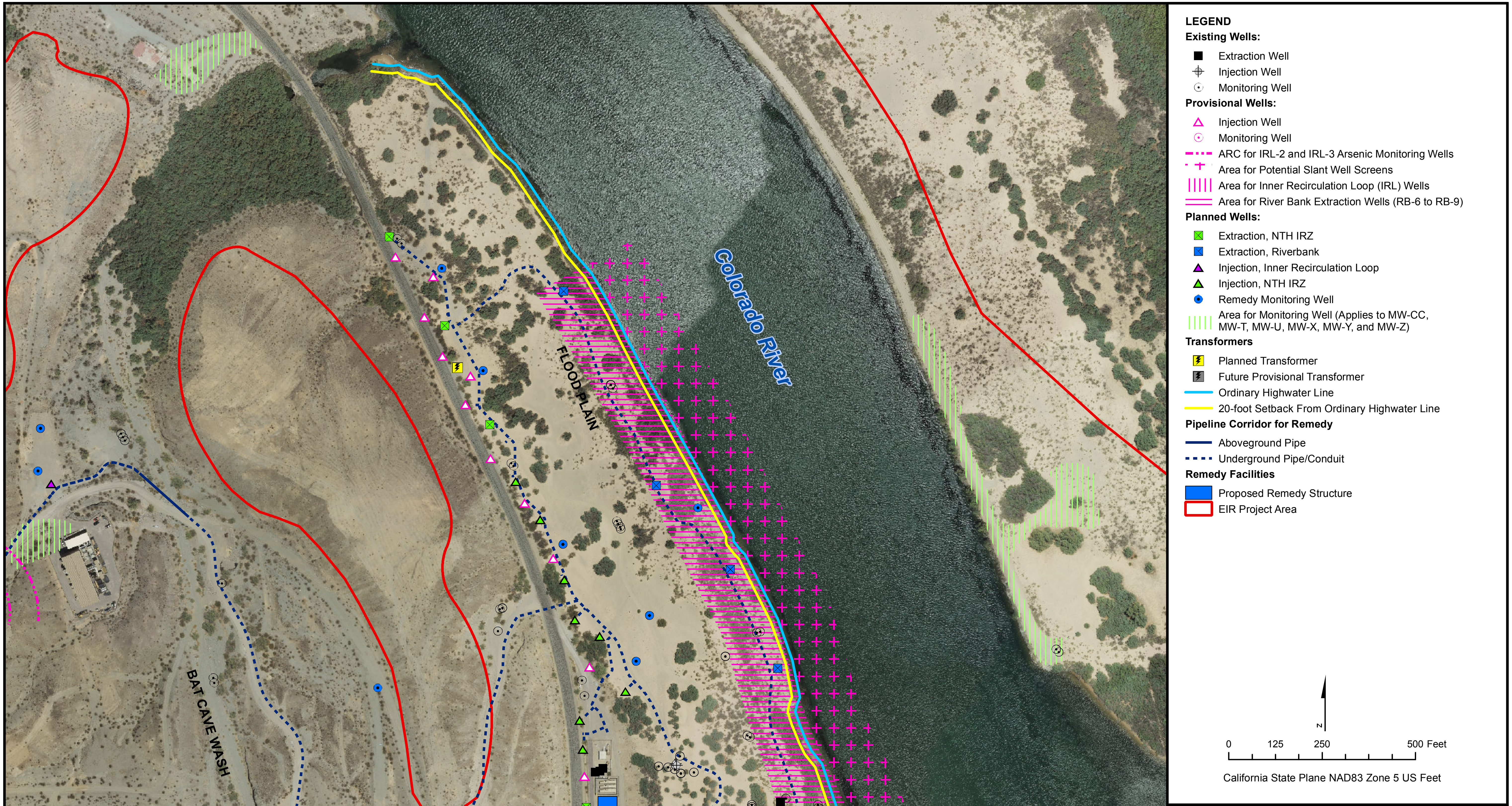


FIGURE 2.4-6
ORDINARY HIGH WATER MARK AND 20-FOOT SETBACK REQUIREMENTS ALONG RIVERBANK (EIR MITIGATION MEASURE AES-2A)
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG246_HighWaterLine_2013.mxd Date Saved: 8/26/2014 9:57:21 AM

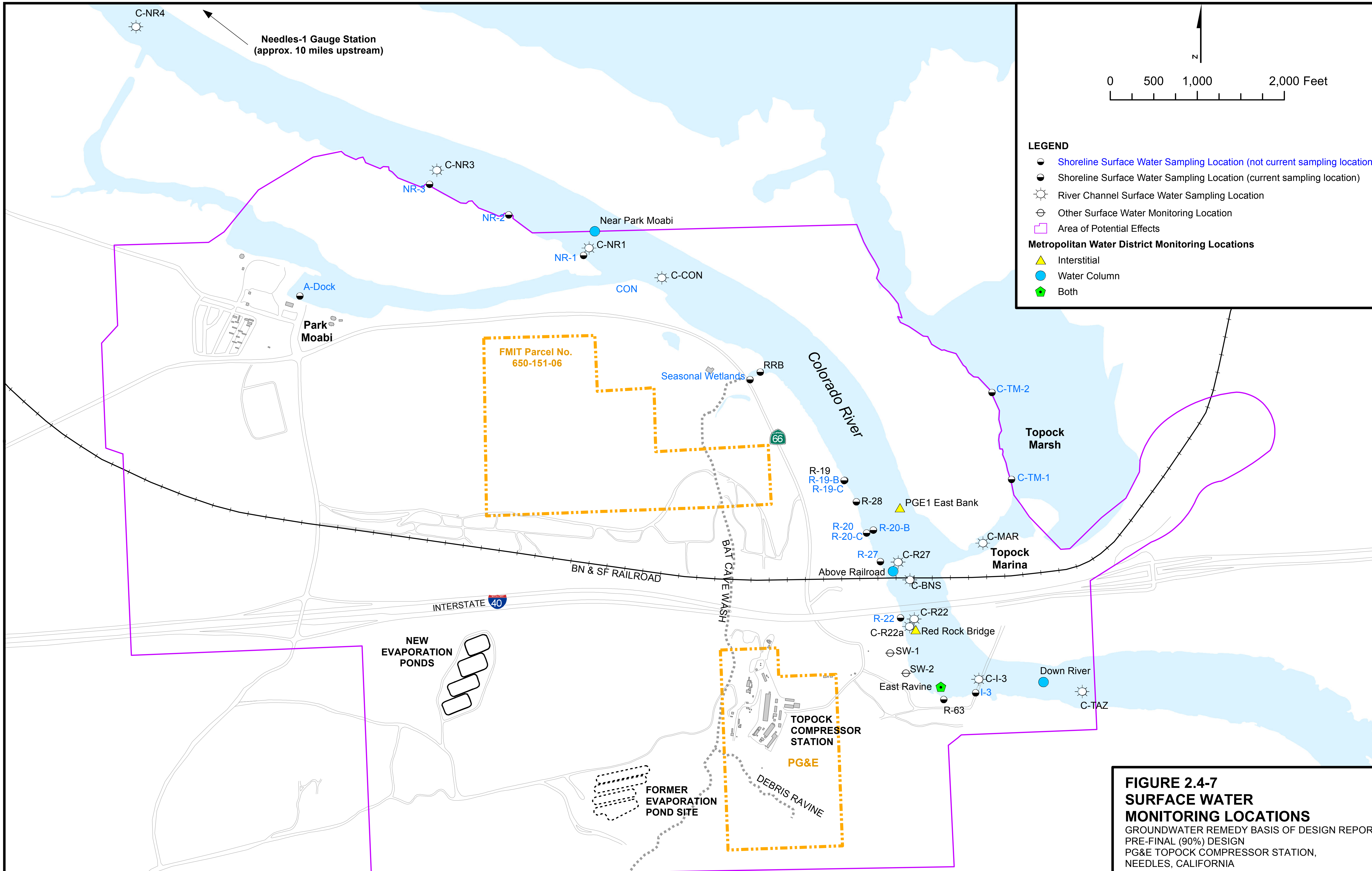


FIGURE 2.4-7
SURFACE WATER MONITORING LOCATIONS
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2014\CMS\DESIGN90\FIG247_SURFACEWATERMONLOCS.MXD ECLARK1 7/14/2014 10:57:07 AM

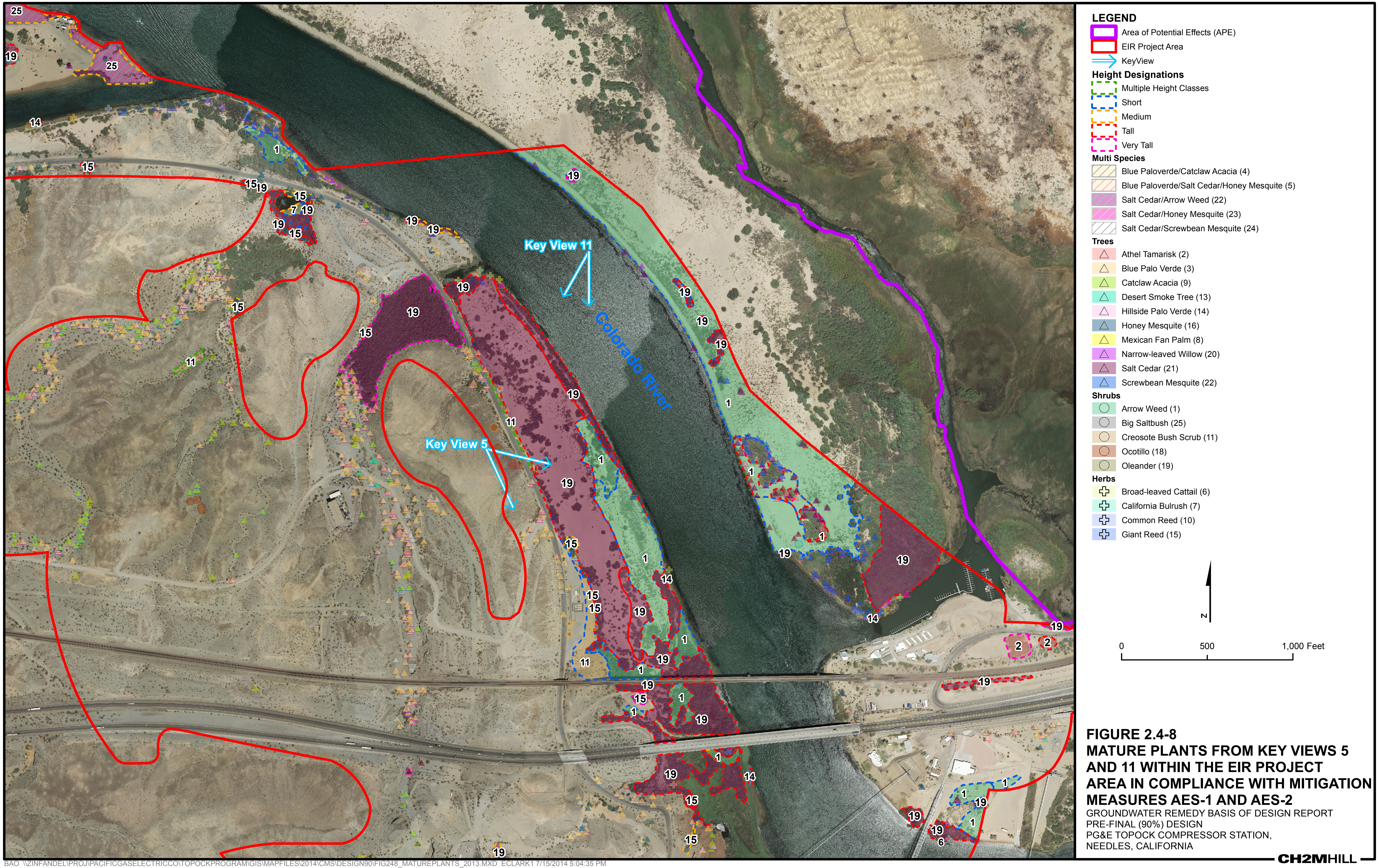
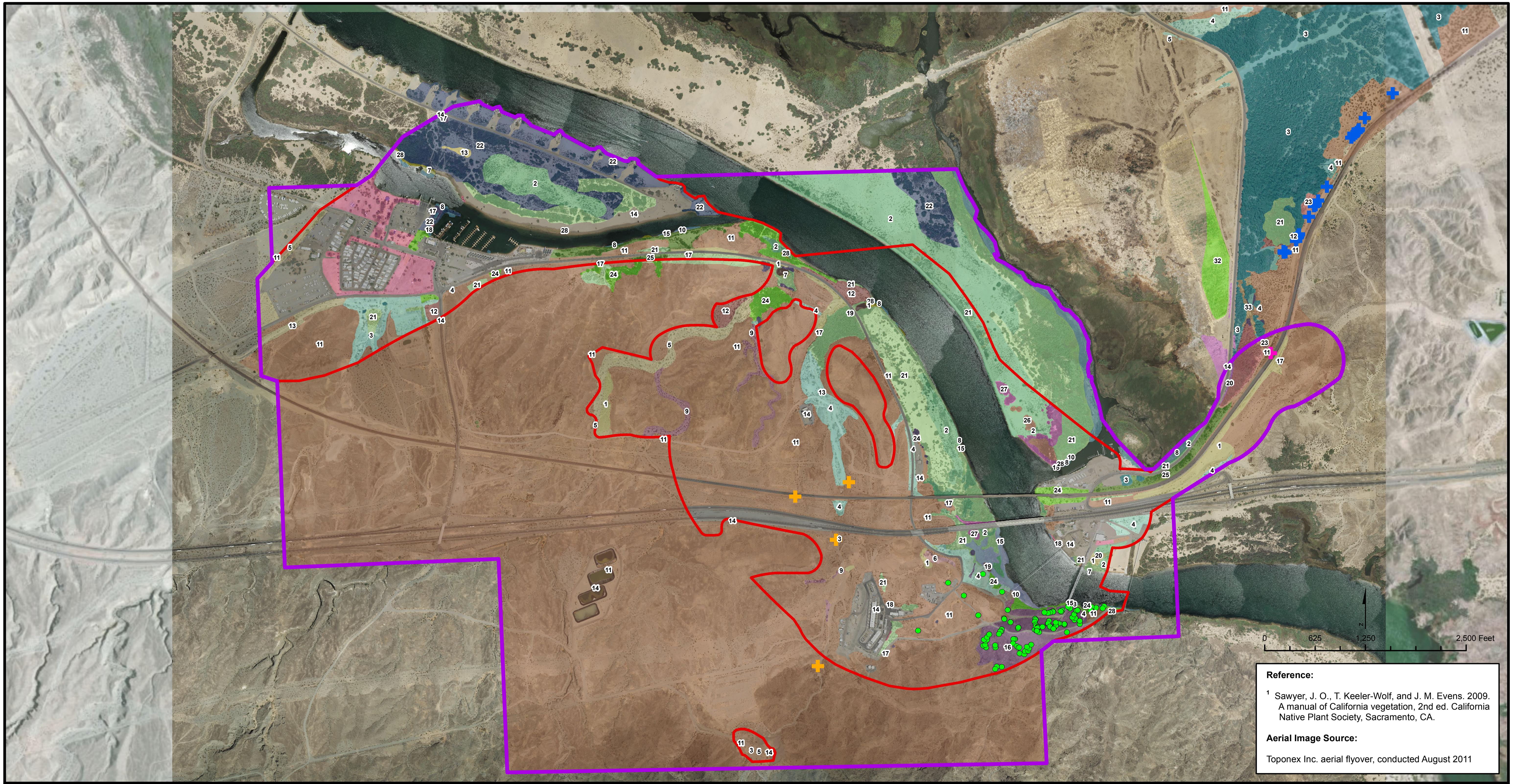


FIGURE 2.4-8
MATURE PLANTS FROM KEY VIEWS 5 AND 11 WITHIN THE EIR PROJECT AREA IN COMPLIANCE WITH MITIGATION MEASURES AES-1 AND AES-2

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL



Reference:

[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

- EIR Project Area
- Area of Potential Effects (APE)

California Rare Plant Ranked Species (CNPS, 2011)

- Mousetail suncup (*Chylismia arenaria*)
- Spiny-haired blazing-star (*Mentzelia tricuspis*)*
- Small-flowered androstephium (*Androstephium breviflorum*)
- Hillside palo verde

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

Vegetation Area Types

- 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]
- Restoration Area [32]
- Bush Seepweed Scrub [33]

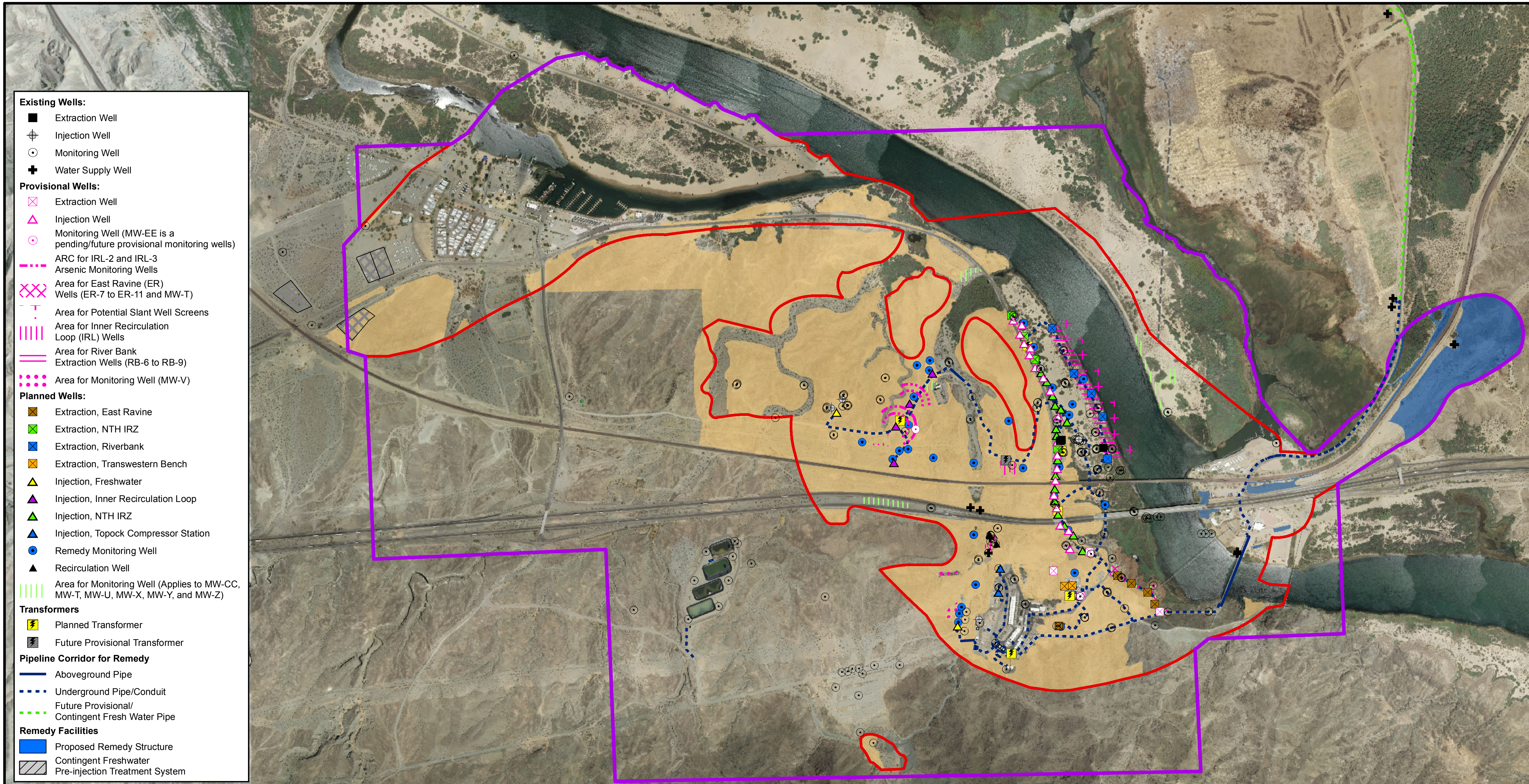
** Tribes have stated that Arrow weed is an ethnobotanical sensitive plant (June 2011). Arrow weed however is not in the Appendix PLA of the FEIR. Arrow weed will be protected during construction as a mature plant under AES-1a.

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
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG249_VegCommunities_2013.mxd Date Saved: 7/17/2014 12:42:35 PM



LEGEND

EIR Project Area
Area of Potential Effects (APE)
Main Construction Yard/Long-term Soil Storage

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.

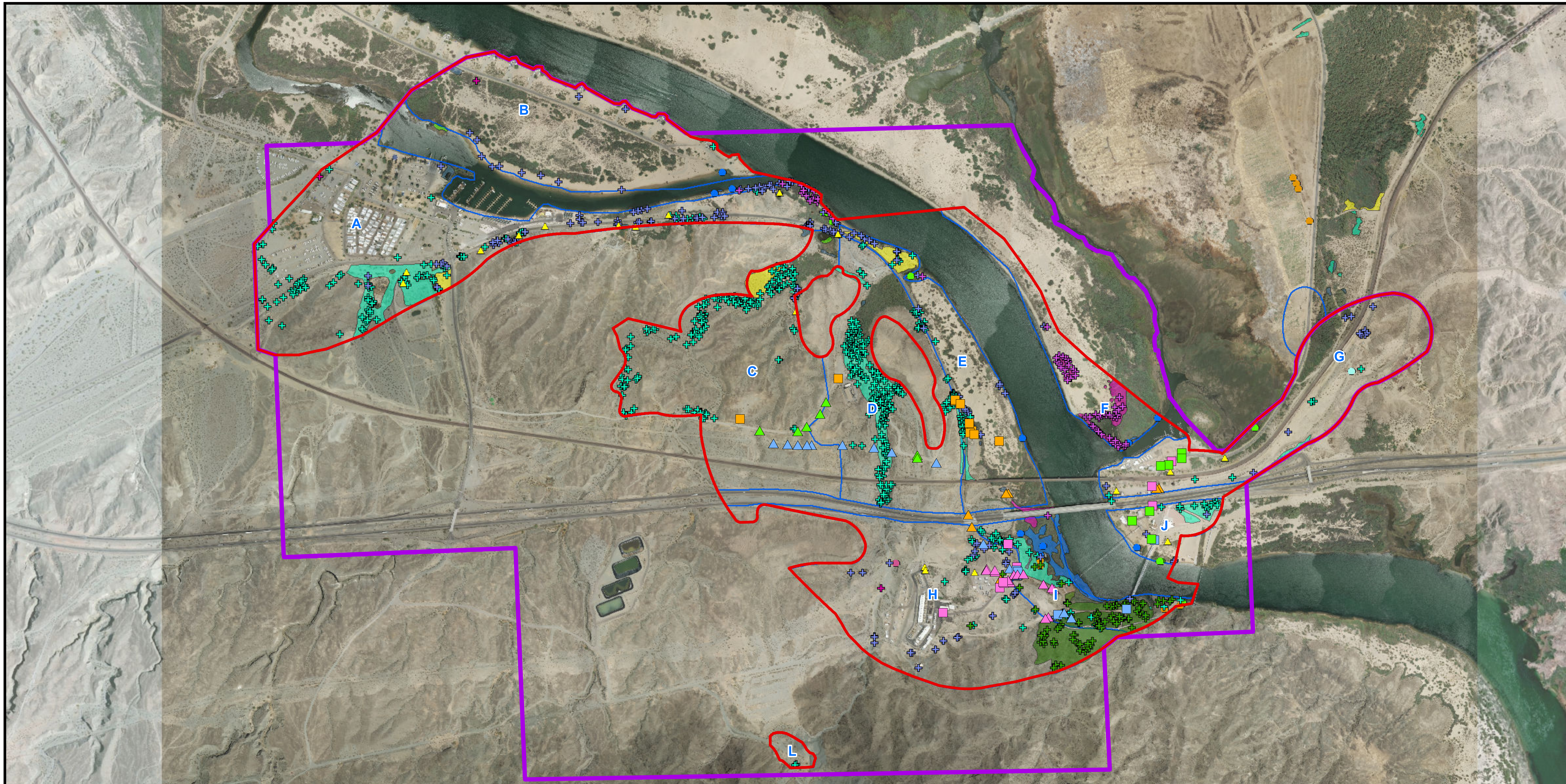
N

0 650 1,300 2,600 Feet

FIGURE 2.4-10
HABITATS OF DESERT TORTOISE SPECIES, IN COMPLIANCE WITH MITIGATION MEASURES BIO-2B
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG2410_DT_Habitat_2013.mxd Date Saved: 8/26/2014 10:05:51 AM



LEGEND

- EIR Project Area
- Area of Potential Effects (APE)
- Survey Segment

0 600 1,200 2,400
Feet

N

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

Note:
Tribes have stated that Arrow weed is an ethnobotanical sensitive plant (June 2011). Arrow weed however is not in the Appendix PLA of the FEIR. Arrow weed will be protected during construction as a mature plant under AES-1a.

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 H, I, L
Desert Tobacco	*Nicotiana obtusifolia*	G
Desert Lilly	*Hesperocallis undulata*	D,H
Chia	*Salvia columbariae*	A,C

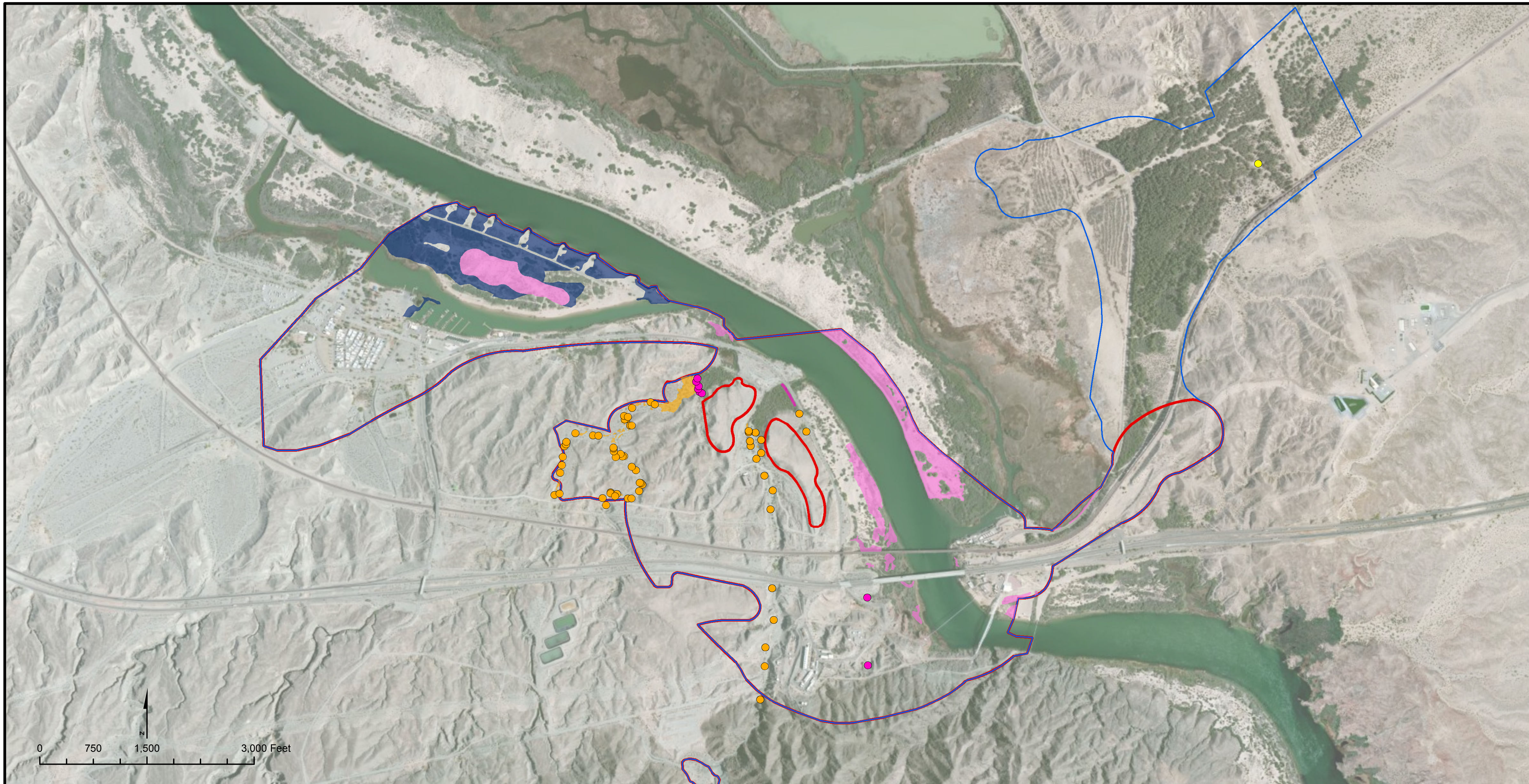
Trees

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
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG2411_EthnoBio_2013.mxd Date Saved: 8/18/2014 10:41:59 PM



LEGEND

Vegetation Survey Area

EIR Project Area

Arrow Weed (MCV2: Arrow weed thickets)[2]

Salt Cedar/Arrow Weed (MCV2: Tamarisk/Arrow weed thickets)[22]

Anderson's desert thorn (*Lycium andersonii*)

Peach Thorn (*Lycium cooperi*)

Arrowweed (*Pluchea sericea*)

Anderson's desert thorn (*Lycium andersonii*)

Arrowweed (Pluchea sericea)

FIGURE 2.4-11A
ADDITIONAL ETHNOBOTANICAL PLANT LOCATIONS
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2014\CMS\DESIGN90\FIG2411A_ADDL_ETHNOBOT_PLANT.MXD ECLARK1 7/14/2014 12:15:47 PM

SECTION 3
Design Basis and Assumptions

This section presents the design basis and assumptions for the remedy, along with the uncertainties at this pre-final (90%) 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, monitoring wells, freshwater supply, remedy-produced water management, power supply, and other supporting systems are also discussed below. In conjunction with the design basis and assumptions, key O&M provisions considered in the design of each major system are also presented in this section. The design criteria for all remedy components and select engineering calculations are presented in Appendix C. The engineering drawings and the equipment list are included in Appendix D, and the specifications are provided in Appendix E. Figures ES-4A through 4D in the Executive Summary show the overall system layout in California (including TCS evaporation ponds and Moabi Regional Park) and Arizona.

Please refer to Volume 1, Operation and Maintenance Plan, of the O&M Manual (Appendix L of this BOD, presented under separate cover) for operating and maintenance procedures of the remedy components and support systems, and Volume 2, Sampling and Monitoring Plan, for plans to collect samples and monitor system performance.

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[3]). Additional modeling efforts completed since the 60% design submittal include an update of the regional groundwater flow model ("the regional flow model") and groundwater flow submodel to reflect hydrogeology encountered at Site B and HNWR-1A in the vicinity of HNWR-1; an update of the initial hexavalent chromium and manganese distributions utilizing data collected through December 31, 2013; simulation of arsenic associated with the freshwater supply utilized for upland injection; and update of remedy well locations. 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, 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). 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 by minimizing the difference between observed and simulated calibration targets. 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 (CH2M HILL 2009d) to incorporate findings from investigations conducted in the East Ravine area (see Appendix E in CH2M HILL

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

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. In 2014, the regional flow model was updated to reflect the hydrogeology encountered at Site B and HNWR-1A in the vicinity of HNWR-1. The remedy well locations were also updated to reflect the most recent locations based on site walks and engineering constraints.

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 Section 4 of Appendix B. The groundwater flow submodel honors the hydraulic conductivity distribution and boundary conditions (i.e., simulated groundwater heads and fluxes) extracted from the 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 (Zheng 1990) at S.S. Papadopulos & Associates, Inc. for the Robert S. Kerr Environmental Research Laboratory of the U.S. Environmental Protection Agency (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:

- Initial Cr(VI) and manganese concentration distributions and freshwater arsenic concentrations based on data collected through December 31, 2013.
- Mobile and Immobile Porosity: affecting the groundwater flow velocity and solute 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 byproducts 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 Section 6.2 of 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 to evaluate the relative impact on the simulated solute transport model results with respect to Cr(VI), manganese, and arsenic. A table summarizing relative sensitivities of each of the selected parameters/conditions evaluated using the groundwater flow and solute transport model is provided as Table 10.1 in Appendix B.

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, Section 5. 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 Section 5 of 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 Section 5 of 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, Section 5. 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, Section 8.

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 ES-4A shows the locations of the remediation wells.

Potential well locations were carefully selected by first avoiding culturally or otherwise sensitive areas to minimize impact to the extent possible; delineated areas were closely evaluated, and site walks were conducted with Agencies and Tribes to review and adjust the general well locations. Precise well locations will be confirmed in the field prior to construction. 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. Boundary conditions 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), and reinjection destinations. Solute transport model parameters were also adjusted including carbon amendment injection concentrations, carbon decay rates, Cr(VI) partition coefficient, manganese generation/attenuation rates, and arsenic generation/attenuation rates. Threshold optimization criteria included the following:

- Minimize Cr(VI) remedial timeframe;
- Minimize infrastructure; and
- Minimize the impact of potential byproducts.

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. A summary of the optimization criteria used to guide design and operational strategy of each remedial component is also provided in Appendix B as Table 6.4-1, and a table summarizing relative sensitivities of each of the selected parameters/conditions evaluated using the model is provided as Table 10.1 in Appendix B.

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 Inner Recirculation Loop Injection Wells (Figure 3.1-5)
- Cross-section E-E’ features the TCS Injection Wells (Figure 3.1-6)
- Cross-section F-F’ features the Freshwater Injection Wells (Figure 3.1-7)

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

3.1.5 Model Update Procedures

During remedy well installation and testing, after system start-up, and during remedy operation, data will be collected and analyzed to ensure that the groundwater flow, geochemical, and solute transport models do not differ significantly from the conceptual site model with respect to the hydrogeologic characterization or remedy performance. If there are significant differences, the groundwater flow model, geochemical model, and/or the solute transport model will be updated and recalibrated. This will allow the models to be used as predictive tools to evaluate performance and assist in guiding the operation of the remedial system. This section describes specific update procedures and data needs.

3.1.5.1 Well Installation and Testing

During the remedy well construction and testing period, the groundwater flow and solute transport model will be updated annually if the data collected suggest that updates are needed; as a result, the model may be updated prior to remedy startup to evaluate potential impacts of data collected during construction on the currently proposed base remedy design performance. The model update schedule will allow data from multiple wells to be considered and integrated into the groundwater flow and solute transport model on a wider areal basis rather than on a well-by-well basis. Data collected during the well installation and testing period will focus on specific hydrogeologic data and Cr(VI) data. These data will be utilized to update and recalibrate the regional flow model. The regional flow model recalibration will involve adjustments to model parameters, structure, and boundary conditions, as necessary, to reduce the difference between the average observed and simulated water levels and hydraulic gradients. Groundwater flow model updates could include updates to the simulated geologic structure, hydraulic conductivity, and vertical hydraulic conductivity. Upon completion of the regional flow model update, the submodel extents will be extracted from the regional flow model for use with the solute transport model. The solute transport model will be updated with the available Cr(VI) data to reflect updated initial plume conditions. The groundwater flow and solute transport submodel will then be utilized to rerun the initial baseline remedy to see if there are any concerns with the simulated Cr(VI) transport projections and remediation design. At this point, recommendations for changes in planned operational conditions, adjustments in the remedial design, and/or the potential need for provisional wells may be considered.

Specific hydrogeologic data include lithologic data, saturated aquifer thickness, and transmissivity/hydraulic conductivity. More detail regarding the data (hydrogeologic data and Cr[VI] distribution data) to be collected and the potential effects of each parameter on remedy and model operations is provided in Appendix B, Section 12.1.

3.1.5.2 Remedy Start-up and Operation

Data collected during remedy start-up and operation will focus on injection and extraction rates, observed hydraulic responses (water levels, hydraulic gradients, potentiometric surfaces), Cr(VI) concentrations, arsenic concentrations, manganese concentrations, and TOC distribution. Based on these data, the regional flow model will be updated to reflect the actual pumping rates attained during remedy start-up and the observed response in groundwater flow and solute transport. To evaluate remedy performance, the groundwater flow and solute transport model simulations will be compared against observed hydraulic and analytical data annually during the estimated one- to two-year system start-up period, or at minimum after the first year of start-up and at the end of start-up, as well as after each five years of remedy operation, as needed. The models will be updated if significant deviations between observed and simulated data exist so that the model can be further utilized as a predictive tool to evaluate remedy timeframes.

The following parameters can potentially be refined in the groundwater flow and solute transport model based on the aforementioned data to be collected during remedy start-up and operation: hydraulic conductivity/transmissivity, riverbed conductance, Cr(VI) distribution, Cr(VI) sorption, TOC degradation rate, byproduct generation, and byproduct sorption. Details regarding how collected data may be used to adjust these model parameters are provided in Appendix B, Section 12.2.

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.
- 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. The specifications provided in the following sections represent a level of detail appropriate for the 90 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 ES-4A)
- 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 ES-4A), 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 ES-4A) may also be installed and activated dependent on the monitored performance of the NTH IRZ over time, and flexibility will be retained to adjust the locations of provisional wells in the future as the remedial program evolves; provisional well locations will be discussed with the stakeholders prior to implementation; criteria for installation and activation of the provisional wells are provided in Appendix L, the O&M Manual, Volume 2, Section 2.2.1
- 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.

EXHIBIT 3.2-1
NATIONAL TRAILS HIGHWAY IN-SITU REACTIVE ZONE (NTH IRZ) ENGINEERING DESIGN ELEMENTS AND FEATURES
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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 the central portion of the NTH IRZ	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.

3.2.1.1 Description of NTH IRZ

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 for the NTH IRZ system (note the carbon substrate amendment is not anticipated to have a significant impact on the cumulative injection rate). Various recirculation system designs were discussed in the CMS/FS (CH2M HILL 2009d) 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 ES-4A). 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, Section 3.3. 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 the central portion of the NTH IRZ—will allow for adequate lateral dispersion of organic carbon while minimizing the potential for the extraction of carbon substrate or treated water (i.e., the threshold optimization criterion of minimizing the Cr[VI] remedial timeframe has been met; see also Section 3.1.4).

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 ES-4A, 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, Sections 6.4.1 and 10.1 for more detail). The NTH IRZ Extraction Wells were designed to generate sufficient flow rate to support the NTH IRZ Injection Wells.

NTH IRZ Extraction Well Layout

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 minimize 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 O&M Manual, Volume 2, Section 2.2.1).

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.

NTH IRZ Extraction Flow Rate

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).

NTH IRZ Extraction Well Details

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 supported by the information given on the borehole logs. 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m) (presented under separate cover).

Appendix C, Attachment D 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, Attachment D.

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 wells configured as extraction wells will be connected to a groundwater conveyance header (Appendix D, M-04-03 and 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.

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 ES-4A, 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 Well Layout

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 ES-4A). Although results of the modeling effort indicated that injection at the 16 NTH IRZ Injection Well locations/clusters resulted in effective remediation (i.e., the Cr[VI] simulations indicated that Cr[VI] treatment through the NTH IRZ was complete without breakthrough, while predicted byproduct generation, migration, and attenuation were limited to levels consistent with the current conditions of the reducing rind) 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 ES-4A) 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 the O&M Manual, Volume 2, Section 2.2.1.

NTH IRZ Injection Flow Rate

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.

NTH IRZ Injection Well Details

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 supported by the information given on the borehole logs. 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m). 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 Remedy Supervisory Control and Data Acquisition (SCADA) system human/machine interface (HMI) or operator interface terminals (OITs) (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 and a backflush return header (Appendix D, M-04-05 through M-04-09). 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 (Drawings I-06-01 and I-06-02) 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) are shown on engineering drawings (C-06-03) provided in Appendix D (see also Appendix C, Section C.5).

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.

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. In addition, portable tanks may be used with provisional wells in the future for treatment of recalcitrant zones. 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.

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 TOC in the amended water pumped to the NTH IRZ injection wells

Based on ISPT results, summarized in Section 3 of Appendix B, a sustained TOC concentration between 10 and 50 mg/L is sufficient to establish chromium reducing conditions. The injection concentration of 100 mg/L carbon is based on the results of solute transport modeling, which indicate that the injection of 100 mg/L carbon achieves the distribution of 10 to 15 mg/L of TOC in the zones between injection wells that is necessary to achieve a complete IRZ (see Appendix B, Sections 6.4.1 and 10.2).

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 lateral distribution of organic carbon. 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, Section 10.2 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 backwash system will be conveyed to the Remedy-produced Water Conditioning Plant (see Section 3.4). Backwash water from the IRZ and Inner Recirculation Loop Injection Wells will be transferred to the MW-20 Bench backwash collection tank prior to being transferred to the Remedy-produced Water Conditioning Plant. Inner Recirculation Loop injection wells may also have the backwash water pumped directly to the Remedy-produced Water Conditioning Plant by remotely actuating a valve allowing the water to bypass the backwash collection tank. The backwash rate was chosen based on experience gained from the operation of aquifer storage and recovery systems. The backwashing strategy is based on IRZ well maintenance evaluations conducted at the PG&E Hinkley Compressor Station site (Appendix F). 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 the O&M Manual, Volume 1, Section 4.

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 the O&M Manual, Volume 1, Section 4.

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 be removed from the well during rehabilitation, and any residual Cr(III) not removed 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 the O&M Manual, Volume 1, Section 4.

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, Section 3.

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 Upland ISPT was designed with two recirculation wells (PTR-1 and PTR-2) located approximately 140 feet apart. Each well was screened in two depth intervals (shallow and deep). Pilot test injections were performed by injecting into one of the two screened intervals at each well and extracting from the other interval—i.e., each dual-screened well was used for both injection and extraction. Approximately 38,000 gallons of reagent were injected over the course of six months. By injecting and extracting at different depths, the goal was to create a depth-dependent forced gradient laterally between the two wells. However, the result was that a substantial portion of the injected solution was re-extracted by the same well (from the opposing depth interval)—i.e., it "short-circuited" vertically, limiting lateral (horizontal) distribution of carbon away from the wells. This point is discussed in detail in Section 3.2 of Appendix B, and a conceptual illustration of the short-circuiting is provided as Figure 4 in the Upland Reductive Zone ISPT Final Completion Report (PG&E 2009). In general, 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). As discussed in Section 3.2.1.1, Description of NTH IRZ, short-circuiting was addressed in the design by not using dual-screen wells with injection and extraction intervals within a single location. Each NTH IRZ well will be used exclusively for either injection or extraction at any given time, eliminating the possibility of vertical short-circuiting.

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). The O&M Manual, Volume 2, Section 2.2 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 O&M Manual, Volume 2, Section 2.2 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 (Volume 3, Section 2.1) and may include the installation of additional injection and/or extraction wells. The need for and location of additional injection and/or extraction wells will be evaluated and considered as operational data is collected and system performance evaluated.

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. 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 ES-4A)
- 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 ES-4A)
- Up to four provisional River Bank Extraction Wells (RB-6 through RB-9, to be located within the approximate area shown in Figure ES-4A) and three provisional Inner Recirculation Loop Injection Wells (IRL-5 through IRL-7; see Figure ES-4A) may also be installed and activated dependent on the monitored performance of the remedy over time, and flexibility will be retained to adjust the locations of provisional wells in the future as the remedial program evolves; provisional well locations will be discussed with the stakeholders prior to implementation; criteria for installation and activation of the provisional wells are provided in the O&M Manual, Volume 2, Section 2.2.2
- 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.

EXHIBIT 3.2-2
INNER RECIRCULATION LOOP ENGINEERING DESIGN ELEMENTS AND FEATURES
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Design Criteria	Value	Notes
River Bank Extraction Wells – Number/Layout	5 wells (at 5 locations), up to 4 provisional wells (at 4 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.
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) 0 – 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 150 gpm of freshwater for the minimum flow or 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.

3.2.2.1 Description

River Bank Extraction Wells

Four of the River Bank Extraction Wells (shown on Figure ES-4A) are planned to be operated initially, although flexibility will be provided to operate any and all River Bank Extraction Wells at any given time based on the need to control potential migration of Cr(VI) located downgradient of the NTH IRZ, control byproduct migration, and enhance hydraulic gradients to accelerate the remediation timeframe, while simultaneously minimizing the effects of the river bank extraction on development and distribution of the NTH IRZ reducing zone and minimizing the impact to 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. Volume 2, Section 2.2.2 of the O&M Manual provides further detail regarding the process monitoring data that may trigger modifications to the operation of the River Bank Extraction Wells.

River Bank Extraction Flow Rate

Modeling indicated that a total average extraction flow rate of 150 gpm, with operation of four of the River Bank Extraction Wells, was adequate to provide the intended Cr(VI) and byproduct migration control. However, significant capacity and system flexibility were built into the design of the river bank extraction system. The expected total average extraction flow rate of the River Bank Extraction Wells is 150 gpm, although flexibility will be provided to increase this flow rate to 500 gpm (see Table 3.2-2). The 500 gpm maximum was determined by increasing the nominal flow rate by more than a factor of three to provide adequate conservativeness to account for uncertainty in flows (i.e., in the event that the regional volumetric flow rates are up to three times higher than anticipated). Flexibility was also built into the design to decrease the extraction flow rate (e.g., during later stages of the remedial operation when floodplain Cr[VI] concentrations are reduced and byproducts are shown to be within the anticipated ranges) based on monitored remedy performance. The nominal extraction flow rate will range from approximately 25 to 50 gpm per well at approximately 350 ft w.c. TDH.

Provisional wells 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 River Bank Extraction Wells will depend on operational data, process monitoring data, and the success of less intrusive system adjustments. Detailed decision criteria for increasing the number of River Bank Extraction Wells are provided in the O&M Manual, Volume 2, Section 2.2.2.

River Bank Extraction Well Details

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 (see Appendix L, Volume 2, Section 2.2.2 for additional detail on triggers for shallow groundwater extraction). 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 supported by the information given on the borehole logs. 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m).

Attachment D of 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. 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-05-04).

Inner Recirculation Loop Injection Wells

Water injected via the Inner Recirculation Loop Injection Wells (see Figure ES-4A) 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).

Inner Recirculation Loop Injection Well Layout and Flow Rate

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) to the lower two-thirds of the saturated interval, while fresh water is injected at the two southern wells (IRL-3 and IRL-4). However, the final design of the Inner Recirculation Loop Injection Wells 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) at each well to minimize potential water quality impacts. Note that groundwater captured by the River Bank Extraction Wells will not be injected into the shallow screens (upper approximately one-third of the saturated interval) at IRL-1 and IRL-2 or at IRL-3 or IRL-4 without pre-approval from the agencies. All groundwater extracted from the River Bank Extraction Wells will be re-injected into one or more of the Inner Recirculation Loop Injection Wells. Total flow to the Inner Recirculation Loop Injection Wells will be supplemented with flow from the freshwater supply system, as needed. The anticipated nominal injection flow rate per well will range from 75 to 200 gpm (see Table 3.2-2).

Future provisional well IRL-5 may be located in the area between IRL-3 and IRL-4 to provide additional eastward hydraulic push along the western edge of the Cr(VI) plume (Figure ES-4A). In addition, future provisional wells IRL-6 and IRL-7, shown in the current central portion of the chromium plume (Figure ES-4A), were included as “late time” remediation wells that are intended to accelerate the remediation process once eastward migration of the plume has occurred. However, the need for installation and activation of these provisional wells will depend on operational and monitoring data, and earlier start-up may be determined to be necessary. Decision criteria for increasing the number of IRL Injection Wells are provided in the O&M Manual, Volume 2, Section 2.2.2.

Inner Recirculation Loop Injection Well Details

Inner Recirculation Loop Injection Wells will be constructed using up to 12-inch nominal diameter well casing. IRL-1 and IRL-2 will be installed as dual-screen wells with the shallow screen (upper one-third of the saturated interval) separated from the deep screen (lower two-thirds of the saturated interval) with a pneumatic packer. IRL-3 and IRL-4 will be installed with both a shallow screen (upper two-thirds of the saturated interval) and deep screen (lower one-third of the saturated interval), and will be designed to accommodate a pneumatic packer for potential future isolation of the shallow and deep screened intervals. However, under the pre-final nominal scenario, only freshwater will be injected into IRL-3 and IRL-4, and the shallow and deep screens in these wells will not be isolated. 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 supported by the information given on the borehole logs. 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m). Attachment D of 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, pressure transducers (i.e., water level sensors), backflushing pumps and appurtenance piping, fittings, and controls/instrumentation (see Appendix D, Drawings M-05-02 and M-05-03). 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, drawings M-05-05 and M-05-08). 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 and/or the freshwater supply pipeline, and a backflush return header. The carbon-amended groundwater conveyance and backflush return headers will be routed to/from the carbon substrate amendment system located at the MW-20 Bench. The freshwater supply pipeline will be routed from the freshwater supply well in Arizona (see Section 3.3). Similar to the NTH IRZ Injection Wells, the Inner Recirculation Loop Injection Well design will also include manual addition ports to accommodate the potential use of portable tanks (5- to 1,000-gallon capacity) for the direct injection of carbon substrate solution at the wellheads.

Organic Carbon Dosing and Delivery Strategy

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. Uncertainties in field implementation could potentially include variations in local geochemistry (e.g., dissolved oxygen, nitrate) or microbial ecology (e.g., carbon consumption by sulfate reducers or methanogens) that would require additional TOC injection to develop the appropriate reducing conditions. This uncertainty will be mitigated through monitoring of Inner Recirculation Loop injection dose response wells and making TOC dosing adjustments accordingly as specified in the O&M Manual, Volume 2, Section 2.2.2.

Injections will be timed to allow for adequate dispersion of the injectate away from the well. Adequate dispersion is demonstrated by the development of reducing conditions between the injection wells thus establishing a complete barrier to ensure that Cr(VI) in groundwater is effectively reduced to below 32 µg/L. This will be evaluated by monitoring TOC concentrations, Cr(VI) concentrations, and reducing conditions at Inner Recirculation Loop injection dose response and downgradient monitoring wells (see the O&M Manual, Volume 2, Section 2.2.2).

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). Backwash water from the Inner Recirculation Loop Injection Wells will be transferred to the MW-20 Bench backwash collection tank prior to being transferred to the Remedy-produced Water Conditioning Plant. Inner Recirculation Loop injection wells may also have the backwash water pumped directly to the Remedy-produced Water Conditioning Plant by remotely actuating a valve allowing the water to bypass the backwash collection tank. The backwash rate was chosen based on experience gained from the operation of aquifer storage and recovery systems. The backwashing strategy is based on IRZ well maintenance evaluations conducted at the PG&E Hinkley Compressor Station site (Appendix F). 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 the O&M Manual, Volume 1, Section 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 the O&M Manual, Volume 1, Section 4.

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, injection or extraction locations, 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 O&M Manual, Volume 2, Section 2.2.2 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 (Volume 3, Section 2.1) and may include the installation of additional injection and/or extraction wells. The need for and location of additional injection and/or extraction wells will be evaluated and considered as operational data is collected and system performance evaluated.

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., as depicted in Figure ES-4A, the two Transwestern Bench Extraction Wells, TWB-1 and TWB-2, and two provisional wells, TWB-3 and TWB-4) 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; and up to five additional provisional wells, ER-7 through ER-11, to be located within the approximate area shown in Figure ES-4A) to capture impacted groundwater from the alluvial deposits located downgradient of the TCS and from shallow bedrock in the East Ravine, respectively. Flexibility will be retained to adjust the locations of provisional wells in the future as the remedial program evolves, and provisional wells will be discussed with the stakeholders prior to implementation. Criteria for installation and activation of the provisional wells are provided in the O&M Manual, Volume 2, Section 2.2.3.

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 ES-4A).

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

3.2.3.1 Description

Transwestern Bench Extraction Wells

Transwestern Bench Extraction Well Layout and Flow Rate

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, Section 6.4. 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 the O&M Manual, Volume 2, Section 2.2.3.

Transwestern Bench Extraction Well Details

The Transwestern Bench Extraction Wells will be constructed using up to 12-inch nominal diameter well casing with one screened interval to target a specific interval 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 supported 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 interval of each injection well as shown on Table 3.2-3 is 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m).

EXHIBIT 3.2-3
TCS RECIRCULATION LOOP ENGINEERING DESIGN ELEMENTS AND FEATURES
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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), up to 6 provisional wells (at 6 locations), 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 lateral distribution of organic carbon; 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.

Attachment D of 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. 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). 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

East Ravine Extraction Flow Rate

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 well to recharge—before automatically restarting based on water level or electric current.

It is anticipated that the five 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). East Ravine Extraction Wells ER-1 through ER-4 are expected to be operated at nominal rates of 0.5 gpm each due to the low anticipated yield in the fractured bedrock. ER-6 is designed for operation at a nominal rate of 3 gpm due to the observation of a higher attainable yield at the MW-70BR-225 well, which will be converted into ER-6 during remedy construction. Given the variable nature of the fractured bedrock and the interconnectivity of these fractures, the actual yield of the East Ravine Extraction Wells will be evaluated during remedy operation and adjusted accordingly to obtain a maximum sustainable rate. Cycling of these wells is not anticipated to have a significant impact on their performance objective because hydraulic capture is expected to be minimal as the area in the vicinity of the bedrock wells dewaters. As the bedrock rebounds during an off-cycle, groundwater will collect in the East Ravine Extraction Wells; once the wells are turned back on, the water will be captured due to the slow groundwater velocities in this area.

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 East Ravine Extraction Wells 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 the O&M Manual, Volume 2, Section 2.2.3.

East Ravine Extraction Well Details

The East Ravine Extraction Wells located within bedrock will be constructed by drilling through any unconsolidated deposits and the weathered portion of the bedrock. Up to 6-inch nominal diameter carrier casing would be set to the top of competent bedrock, or a minimum of 20 feet bgs. Below the carrier casing depth drilling would proceed to the target depth and the well would consist of an open bedrock borehole (up to 5-inch diameter) beneath the casing. If the extraction wells penetrate intervals of poor rock quality, the borehole may be “sleeved” with well casing and/or screen to maintain borehole integrity during operation. If rock quality is so poor that fine-grained materials must be managed in the subsurface, then a conventional filter-packed screen might need to be installed. 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 interval of each extraction well as shown on Table 3.2-3 is 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m).

Attachment D of 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). 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

TCS Injection Well Flow Rate

Each of the two TCS Injection Wells will receive approximately 13.5 gpm of carbon-amended groundwater for a combined nominal injection flow rate of 27 gpm (see Table 3.2-3), and injections will be timed to allow for adequate lateral distribution of organic carbon. 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). Monitoring will be conducted to verify the model predictions, and lines of evidence that will be used to evaluate groundwater flow and plume control in the area west of the TCS Injection Wells will include trends in analytical data (e.g., chromium, byproducts, and potentially TOC) and comparison of groundwater elevation data/observed hydraulic gradients to model-predicted gradients. In addition, tracer testing may be implemented if other lines of evidence are inconclusive. Details of the monitoring program are provided in Volume 2 of the O&M Manual, Section 2.2.3. In addition, contingency measures in the event of various modes of remedy failure are summarized as part of O&M Manual Volume 3, Section 2.1.

TCS Injection Well Details

TCS Injection Wells will be constructed using up to 12-inch nominal diameter well casing with two discrete 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 supported 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. Field procedures and details on field decision-making are included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m).

Attachment D of 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-03-04 and M-03-05). 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 Remedy 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 and the East Ravine Extraction Wells. An existing concrete decontamination 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. The TCS 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 carbon substrate solution at the wellheads.

Groundwater extracted from the Transwestern Bench Extraction Wells and the East Ravine Extraction Wells may also be conveyed to the MW-20 Bench to potentially be injected into the NTH IRZ. Flexibility to re-direct the extracted water has been incorporated into the design to accommodate conditions that include, but are not limited to, the following:

- If TCS Injection Wells need to be slowed or turned off, re-direction to the NTH IRZ would allow Transwestern Bench and East Ravine extraction to continue
- If, at later times in the remedy operation, the TCS carbon injections are sufficiently successful such that the need for additional injection is reduced
- To supplement the carbon-amended NTH IRZ injection as needed to prevent breakthrough of the Cr(VI) plume and if TCS injection needs can be met at the same time

However, the primary destination of Transwestern Bench and East Ravine extracted groundwater will be the TCS Injection Wells for remediation of the chromium plume under the TCS.

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 O&M Manual, Volume 1, Section 4.

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.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 90% 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 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, extraction locations, 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. The O&M Manual, Volume 2, Section 2.2.3 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 the O&M Manual (Volume 3, Section 2.1) and may include the installation of additional injection and/or extraction wells. The need for and location of additional injection and/or extraction wells will be evaluated and considered as operational data are collected and system performance is evaluated.

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 Basis of Design Report/Pre-Final (90%) 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 hydrochloric, glycolic (hydroxyacetic), and phosphoric acids, sodium hydroxide, and hydrogen peroxide; 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. 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 the valves and fittings to allow for recirculation of maintenance solution in a closed loop through the NTH IRZ carbon-amended water, extracted groundwater, and/or backwash headers. 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 within the pipelines. The reagents used will be those categories of water treatment chemicals approved for use in drinking water systems. Chemical reagents under consideration for use in the CIP system include hydrochloric, glycolic (hydroxyacetic), and phosphoric acids; sodium hydroxide; and hydrogen peroxide. Ultimate selection of an effective reagent(s) will require bench-scale testing of actual scale deposits. Additional detail on the bench-scale testing is provided in the O&M

Manual, Volume 1, Section 5.1. 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 extracted groundwater/backwash 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

Routine access of cleanouts may not be practical in all locations within the NTH IRZ due to logistical and safety considerations caused by traffic, space limitations, etc. Installation of the CIP system will allow for routine maintenance of the NTH IRZ force mains while minimizing the implementation issues listed above.

3.2.4.3 Uncertainties and Assumptions

No significant fouling was 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 screens/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, East Ravine Extraction Wells, southernmost NTH IRZ Injection Wells), one well will be employed. Dual-screened injection wells (with the two screens separated by a pneumatic packer, as needed) will be employed if the saturated thickness exceeds approximately 50 to 100 feet (and two screens are therefore necessary to ensure targeted distribution of substrate in each zone) and/or injection into specific intervals is desired. An injection 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 approximately 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 supported 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. Final determination of the screened intervals will be made based on information collected in the field associated with drilling boreholes for the injection wells. Attachment D of Appendix C (Design Bulletin: Remediation Well Design and Field Construction Approach) provides a summary of potential field data collection tools and methodologies that may be utilized to enhance well design using location specific data.

- **Screen diameter.** In general, the remediation wells installed in the unconsolidated aquifer will be a minimum of 6 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 and may be of smaller diameter (potentially up to 5-inch diameter in the open borehole portion of the well) than the remediation wells installed in the unconsolidated aquifer. If an open borehole completion is used, a cemented surface casing will be installed in compliance with California well standards.
- **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 feet 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 feet may be schedule 80 polyvinyl chloride (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.
- **Well seals.** Well seals (placed between screen intervals and above the upper screen interval) will be comprised of neat cement. Neat cement will be installed via the tremie grout method. 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.
- **Well replacement.** Wells that cannot be restored to a condition that is satisfactory to fulfill the given well objective may require replacement. Additional information regarding well replacement is provided in the O&M Manual, Volume 1, Section 4.2.2.5. See Section .

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. Spare pipelines will also be provided 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. 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 along the in-situ remediation system pipe networks.

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. Injection well backflush and 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 the O&M Manual, Volume 2, Section 2;
- Select wells will be connected to more than one header (e.g., a spare header); 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. 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 planned supply of fresh water.

Since the submittal of the 60% design (CH2M HILL 2013k), PG&E has completed field implementation of the alternative freshwater sources evaluation and prepared two technical memoranda summarizing the results (CH2M HILL 2014b, 2014r). The following directions and decision related to freshwater supply for the groundwater remedy were also issued since the 60% design:

- SWRCB issued a decision letter to DTSC on November 20, 2013 on the use of Arizona water for flushing in the groundwater remedy. The letter provides the SWRCB's findings and conditions for allowing injection of naturally occurring arsenic above the MCL without pre-treatment, and also states that the arsenic water quality objective must be met within the earlier of 20 years after achieving the RAO for chromium or 20 years after ceasing injection of water containing naturally occurring arsenic above MCL.
- DTSC has provided direction in its comment on the 60% design (RTC #145 DTSC-50) that PG&E will include an arsenic pre-treatment contingency as part of the 90% design.
- DTSC and DOI have directed PG&E in a letter dated April 4, 2014 to first consider the use of the HNWR-1 well location, as opposed to Site B, for freshwater supply. In addition, DTSC and DOI concurred with PG&E's recommendation to install a new well at the HNWR-1 well location and to conduct additional hydraulic and water quality testing at the Site B well.

3.3.1 Freshwater Supply Sources

The CMS/FS (CH2M HILL 2009d) 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 was proposed for use in the 60% design. 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 approximately 20 years after injection ceases for 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 opened discussions of the need to treat for arsenic with the SWRCB.

In parallel, 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 Evaluation of Alternative Freshwater Sources (CH2M HILL 2012g). The Implementation Plan was revised and resubmitted on January 28, 2013 (CH2M HILL 2013a) 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. Two comment resolution meetings were held on May 14 and May 21, 2013. The Final Implementation Plan was issued on July 19, 2013 (redline version) and August 2, 2013 (clean version). Additional comments were received from one Tribe on the Final Plan. These comments were considered by DTSC and DOI prior to approving the Final Plan on September 4, 2013. Field work commenced in October 2013 and was completed in June 2014. Per DTSC's directive (DTSC 2012a), the freshwater details were to be incorporated into an addendum to the 60% design after completion of planned source water studies. However, due to the anticipated schedule to begin 90% design being close to the completion of freshwater evaluation, DTSC directed PG&E to eliminate the 60% addendum and to instead prepare a technical memorandum summarizing freshwater results and describing the piping and infrastructure associated with freshwater supply conceptually (see Handout 9B, Schedule Highlights and Summary of Key Schedule Changes, presented at the July 17, 2013 Consultative Working Group [CWG] Meeting).

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.

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. It is possible that the organic carbon might also need to be removed from the river water prior to injection, which is difficult to remove using conventional water treatment methods. 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 in 2012 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.

The detailed 2012 evaluation and analysis of each freshwater supply sources against each of the above criteria are presented in Appendix J. Since 2012, PG&E has also completed field implementation of the alternative freshwater sources evaluation (which involved the installation of two new wells in Arizona [HNWR-1A and Site B], the completion of hydraulic testing/video survey of HNWR-1, and the completion of hydraulic testing at Site B), and prepared two technical memoranda summarizing the results (CH2M HILL 2014b) (see Appendix N). For brevity, Exhibit 3.3-1 summarizes the results/conclusions from these evaluations. In summary, all of the freshwater options evaluated have some advantages and some drawbacks.

Based on results from field implementation of the alternative freshwater sources evaluation, the HNWR-1 well can supply enough water of sufficient quality to supply the groundwater remedy at the nominal flowrate of 450 gpm but not at the maximum flow of 900 gpm. HNWR-1A and Site B wells can supply the maximum flow of 900 gpm.

EXHIBIT 3.3-1
SUMMARY OF DETAILED EVALUATION OF THREE FRESHWATER SOURCES
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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. Although pumping fresh water from Park Moabi would have negligible effects on the rate of Cr(VI) remediation, there are two potential problems: 1) pumping more than about 60 gpm from a well or wells at Park Moabi poses a risk of upconing of high TDS water from depth and degrading water quality in the existing wells, and 2) if high TDS water were pumped from Park Moabi and injected into the freshwater wells, it could be drawn back to the park over the course of the remedial action and degrade the water quality in the existing wells (see Appendix J for further details).
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-1A, HNWR-1, and Site B wells) is more favorable than the California option (Moabi Regional Park wells). As part of the field implementation of the alternative freshwater source evaluation, PG&E conducted a step rate extraction test at HNWR-1 in October 2013, as well as a 72-hour constant-rate extraction test at HNWR-1 in February 2014, to confirm the well's capacity to meet the need of the remedy. Similar testing was also done at Site B well. Test results indicated that HNWR-1 can supply enough water of sufficient quality for the groundwater remedy at the nominal flowrate of 450 gpm but not the maximum flow of 900 gpm. Site B well can supply enough water at the maximum flow (CH2M HILL 2014b). In addition, a video survey of the HNWR-1 well was conducted in October 2013 to verify well construction details and condition. Based on the interpretation of the survey results, while the construction of the HNWR-1 well is sufficient for its original intent (irrigation well), it is not sufficient for long-term daily operation as a reliable component of the groundwater remedy. The well construction severely limits the options available for future well rehabilitation and the effectiveness of rehabilitation overall. The construction details of the surface seal, which protects the well from infiltration of fluid at the surface, are not completely known (CH2M HILL 2014b). Therefore, PG&E has installed a new well (HNWR-1A) in the vicinity of the existing HNWR-1 well to provide the primary source of fresh water for the remedy. Data collected to date show that HNWR-1A will supply enough water of sufficient quality (quality comparable to HNWR-1) for the groundwater remedy at the maximum flow of 900 gpm (CH2M HILL 2014r). From a quantity perspective, both existing HNWR-1 and/or Site B wells can serve as backup water source. To provide maximum flexibility and reliability in remedy freshwater supply, provisions to plumb and operate both wells if needed in the future are provided in the 90% design. Between the two wells, HNWR-1 is preferred because it requires a smaller footprint to be brought online than Site B due to the former's close proximity to HNWR-1A and the planned 12-inch water pipe. Site B will require installation of additional conveyance piping from the well to the HNWR-1 location, additional electrical power to the well, and all aboveground infrastructure necessary at the well site. Regarding the proposed tie-in of the Topock-2/-3 wells to supplement the primary freshwater source at the 60% design stage, to ensure first priority for remedy use and after further evaluation of the additional controls, instrumentation, and tank upgrades that would need to be installed in the existing TCS freshwater storage

EXHIBIT 3.3-1
SUMMARY OF DETAILED EVALUATION OF THREE FRESHWATER SOURCES
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Evaluation Criteria	Analysis Factors and Considerations	Evaluation Results/Conclusions
		tanks in order to harmonize various demands for fresh water, PG&E now proposes to separate the freshwater supply storage for the remedy and the Compressor Station. Because of this separation of freshwater storage, the tie-in of Topock-2 and -3 wells has been eliminated in the 90% design. Topock-2/-3 wells will continue to supply water for Compressor Station use via the existing 6-inch pipeline. Constant rate extraction tests conducted for a duration of 72 hours at both HNWR-1 and Site B wells suggest that neither will substantially adversely affect the production rates of existing nearby wells.
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. Based on testing conducted to date, the existing wells in Arizona (HNWR-1, HNWR-1A, and Site B) contain naturally occurring arsenic levels above the federal/state MCL of 10 µg/L. Site B well also contains Cr(VI) concentrations above the cleanup goal of 32 µg/L. Therefore, any future use of Site B water for the remedy will require blending with other water (HNWR-1, HNWR-1A) prior to injection. On November 20, 2013, the SWRCB issued a decision letter that provides the SWRCB's rationale and conditions for allowing injection of naturally occurring arsenic above MCL without pre-treatment. However, in compliance with DTSC's direction, PG&E has included as a contingency in the 90% design a freshwater pre-injection treatment system to reduce arsenic to below the federal/state MCL of 10 µg/L. In its direction, DTSC further noted that removal of fluoride was not warranted due to the elevated baseline values already above the MCL where water will be injected. 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. It is difficult to remove organic carbon using conventional water treatment methods. 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/Pre-Final (90%) 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 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. 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 (e.g., oxidizing agents such as calcium hypochlorite, acids such as sulfuric acid). 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-1A and Site B wells will require power and connection to the existing power poles owned by Mojave Electric Cooperative in Arizona. Site B well will also require an extension of the water pipeline from the HNWR-1 location and installation of aboveground infrastructure at the well site. As previously mentioned, a pre-injection treatment system for reducing arsenic to concentrations below the federal/state MCL of 10 μg/L is included in this 90% design.

The primary drawback to the use of the existing wells in Arizona (HNWR-1, HNWR-1A, and Site B) is the elevated concentration of arsenic in the wells. In addition to the slightly elevated levels of arsenic, fluoride is present in these wells at slightly elevated levels. Further, Site B well contains Cr(VI) concentration above the site cleanup of 32μg/L. On November 20, 2013, the SWRCB issued a decision letter that provides the SWRCB's rationale and conditions for allowing injection of naturally occurring arsenic above the MCL without pre-treatment. However, in compliance with DTSC's direction, a freshwater pre-injection treatment system (FWPTS) to reduce arsenic to below the federal/state MCL of 10 μg/L has been included in the 90% design as a contingency. In its direction in the 60% design comment RTC #21 DTSC-2 (see Appendix I), DTSC further noted that removal of fluoride was not warranted due to the elevated baseline values already above the MCL where water will be injected.

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 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, PG&E proposes the use of the HNWR-1A well as the primary freshwater source for the groundwater remedy in the 90% design, with the HNWR-1 well as a secondary source and Site B well as a contingent source. To provide maximum flexibility and reliability in remedy freshwater supply, provisions to plumb and operate both HNWR-1 and Site B wells if needed in the future are provided in the 90% design. In addition, in compliance with DTSC's direction in its comment on the 60% design, a FWPTS to remove arsenic is included in the design as a contingency only.

3.3.2.1 Uncertainties and Assumptions

The performance and health of the primary freshwater supply well (HNWR-1A) 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 O&M Manual, 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 FWPTS (see Exhibit 3.3-2).

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^3/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 (110 feet)
r = radius (defines the boundary of the delineated source water protection area in feet around the well)

For the HNWR-1A well, with a screened interval spanning 110 feet and pumping at the current design (modeled) flow rate of 450 gpm, this equation resolves to a radius of 2,039 feet. This radius extends to within 1,200 feet of the Kinder Morgan Mojave Topock Compressor Station in Arizona[4] (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 Kinder Morgan Mojave Topock Compressor Station. Also within this radius is an area that consists of rusty cans and other metal debris scattered on the land surface. [5]

---

[4] Per DTSC's request in 60% RTC #156 DTSC-56, an internet search regarding the former underground storage tanks (USTs) at the Topock Marina was conducted. There were four USTs at the Marina; the first one was permanently removed October 1990, two were permanently removed in January 1993, and the fourth was permanently removed in November 2010. There was a release reported in October 1990; that case was closed in March 1998.

[5] As detailed in 60% RTC #158 DTSC-57 (see Appendix I of the 90% BOD Report), a question was raised in a public meeting about a rumored former "Topock Dump" located within this radius that reportedly contained trash from local residents. PG&E was not aware of any such former dump. A member of the FMIT who has lived in the area for many years indicated that the area of debris and can scatter was the only "dump" that he knew of in the area and speculated that it might have been trash left from a railroad work camp. DTSC visited the cited area in Arizona and it did not appear to be a significant threat to groundwater resources. PG&E agrees that this debris does not appear to represent a threat to groundwater.

EXHIBIT 3.3-2
CONTINGENCY MATRIX FOR POTENTIAL PROBLEMS WITH FRESHWATER SUPPLY (HNWR-1A) INJECTION
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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
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 • Bring HNWR-1 online	Bring Site B well online.
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	• Isolate the upper well screen interval from the lower screen interval (e.g., using an in-well packer). • Increase riverbank extraction (note that this option could only be used to offset a marginal reduction in freshwater supply). • Aerate freshwater prior to injection (note that this option requires small piping changes and addition of fittings).	• Bring Site B well online • Implement contingent arsenic treatment system per State Water Resources Control Board letter (SWRCB 2013)[1]
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	• Bring Site B well online

Note:

[1] The referenced letter provides the SWRCB's findings and conditions for allowing injection of fresh water containing naturally occurring arsenic above the maximum contaminant level (MCL) without pre-treatment. The letter requires that if the leading edge of the arsenic plume, i.e., arsenic concentrations at the concentration in the injected fresh water, extend more than 150 feet away from injection locations, PG&E must immediately reassess its modeling calculations and quickly identify interim actions it can take to limit the migration of the arsenic plume. The letter further directs the cessation of the injection of untreated fresh water if the arsenic concentration caused by injection of fresh water is detected above the water quality objective (10 parts per billion [10 µg/L]) at 225 feet from the injection locations.

EXHIBIT 3.3-3
RADIUS OF FIVE-YEAR GROUNDWATER TRAVEL TIME TO HNWR-1A WELL
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Water produced by wells in the HNWR-1 location is expected to be a mix of water recharged from the Colorado River and groundwater flowing down from the Sacramento Valley to the east (CH2M HILL 2012d). Note that groundwater travel time from the river to a well located at the distance of HNWR-1 location is likely many months to a few years. Depending on the transport properties, some contaminants move much slower than the water. All contaminants are subject to dispersion and dilution between the river and a well. So if a contaminant is found in the river, there is ample time to stop pumping or institute additional monitoring before it shows up in a well near the river, and the concentration of the contaminant in the well is likely to be considerably less than in the river.

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-1A and the area with rusty cans and other metal debris, so in the unlikely event that groundwater contaminants are migrating from this area, they would be expected to be detected first at Topock-2 and -3. In response to DTSC's request (60% RTCs #160 DTSC-59 and #709 DTSC-222; see Appendix I), Topock-2 and -3 data collected for supply purposes will be provided to the agencies during remedy operation (see Volume 2 of the O&M Manual, Section 5.4, Domestic/Private Wells Sampling Program).

As mentioned previously, a component of the water produced from HNWR-1 location should 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-1A. 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-1A is not considered warranted.

At DTSC's request and per resolution of 60% RTC #161 DTSC-60, the MW-55 well cluster will be sampled periodically as data at this location could have some value in detecting contaminants originating from any sources in the developed area around the Topock Marina (see Volume 2 of the O&M Manual, Table 5.2-5).

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).

The freshwater supply system consists of the following:

- Extraction well or well(s) in Arizona (HNWR-1A well is the primary freshwater supply well with HNWR-1 as the secondary supply well, and Site B as the contingent supply well if needed)
- Freshwater piping network
- Freshwater storage
- 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/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item	Design Parameters (gpm)		
	Minimum	**Nominal**	**Maximum (Design)**
Freshwater supply injection flow rate[b]			
FW-01	50	100	200
FW-02	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 [c]	150	450	900
Freshwater supply extraction flow rate[d]			
Primary supply well in Arizona – HNWR-1A	150	450	900

Freshwater Supply Operational Parameters

Item	Design Parameter
Projected life of the system	30 years
Uptime	80%
Pipeline capacity, gpm	900[d]
Freshwater storage capacity	10,000 gallons
Supply pump operating mode	The production well pump will turn on when the storage tanks drop to a pre-set level. The well will continue pumping until the tanks reached a pre-set level that will correspond to a full tank, just slightly below the emergency tank overflow level.
Supply pump	The pump will operate on an as needed basis to maintain the designated minimum water level to supply 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 will be provided for the Refuge to use. A detailed sampling and monitoring program associated with the HNWR-1A well is presented in Volume 2, Sampling and Monitoring Plan of the Operation and Maintenance Manual.
Power for the supply pump	Power will be supplied by Mohave Electric Cooperative.

EXHIBIT 3.3-4
FRESHWATER SUPPLY DESIGN BASIS
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item	Design Parameter
Water Pipe	The material of construction for belowground water pipes is plastic (HDPE), and for aboveground water pipes is steel with American Water Works Association [AWWA] C205 cement mortar lining or plastic (HDPE or CPVC). Steel pipe will have an exterior coating to prevent external corrosion. Based upon this design approach, no cathodic protection is required.

Notes:

gpm = gallons per minute

[a] The pre-final nominal scenario assumes IRL-1 and IRL-2 will receive River Bank Extraction Well water (carbon-amended if Cr(VI) 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 (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. IRL-1 and IRL-2 will be installed as dual-screen wells with the shallow screen (upper one-third of the saturated interval) separated from the deep screen (lower two-thirds of the saturated interval) with a pneumatic packer. The pre-final nominal scenario assumes injection of River Bank Extraction Well water into the deep screen only at IRL-1 and IRL-2. IRL-3 and IRL-4 will be installed with both a shallow screen (upper two-thirds of the saturated interval) and deep screen (lower one-third of the saturated interval). IRL-3 and IRL-4 will be designed to accommodate a pneumatic packer for potential future isolation of the shallow and deep screened intervals; however, under the pre-final nominal scenario, only freshwater will be injected into IRL-3 and IRL-4 and the shallow and deep screens in these wells will not be isolated.

[b] See Table 3.3-1 for design flows related to Freshwater Injection Wells ("FW" wells) and Table 3.2-2 for design flows related to Inner Recirculation Loop wells ("IRL" wells).

[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] This value represents freshwater flows into the Freshwater and IRL Injection Wells. Any shortage in flow will be made up by the secondary groundwater supply well HNWR-1 if needed. As a contingency, provisions (i.e., additional piping, power supply, and aboveground water infrastructure) are included in the 90% design to allow for Site B to be brought online to supplement any shortage in flow if needed.

3.3.3.1 Freshwater Supply Piping Network

Figure 3.3-1 presents a schematic of the alignment of the freshwater piping network. The total length of freshwater pipe is approximately 46,000 feet, with about 1 percent aboveground and 99 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 updated 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-1A 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 Gas Transmission, as the entity responsible for the pipe bridge within the PG&E organization, is leading the discussion with Kinder Morgan regarding modifications to the Arched Bridge.

After crossing the Colorado River into California, the water pipeline will follow PG&E's natural gas pipeline ROW to the remedy freshwater storage tank. Midway along the PG&E's natural gas pipeline ROW, the freshwater pipeline will branch to the north to connect to the piping corridor located near NTH and the Compressor Station entrance road. In the event that pre-treatment of fresh water is required, all fresh water will be piped to the Compressor Station for treatment, and the treated fresh water will be conveyed along the entrance road prior to joining the freshwater pipeline along NTH.

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. A branch of the freshwater piping will cut across 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 from the remedy freshwater storage tank that aerially traverses Bat Cave Wash on a pipe support (see Figure 3.3-1). Once it crosses the wash, the pipe will go underground until it reaches the injection well.

Alternative to Northern Aerial Crossing of Bat Cave Wash

As discussed with Agencies, stakeholders, and Tribes during the June 19, 2014 TWG site walk and at the July 17, 2014 TWG meeting, PG&E is evaluating alternatives to the northern pipe bridge in the uplands because it is located in the Tribes' proposed exclusion area in the Tribal Cultural Values Assessment (CVA) April 25, 2014 Amendment. A summary of the alternatives and the evaluation conducted to date is as follows:

- **Alternative 1** – Relocate the pipe bridge south of the culverts (see photo in Exhibit 3.3-5 below). This option was eliminated due to safety concerns regarding construction and O&M near the overhead electrical line.
- **Alternative 2** – Cross Bat Cave Wash underground upstream of the culverts. This option was eliminated to avoid the sensitive ecological resources in the wash, consistent with the past design modification to relocate pipes/conduits out of Bat Cave Wash.
- **Alternative 3** – Install pipes/conduits in the IM-3 access road. This alternative is being further evaluated, and may include replacement of the existing culverts as well as raising the road bed to allow for piping/conduits to be installed above the culverts. PG&E will continue to provide updates to the CWG/TWG as this alternative is further evaluated and developed prior to the Final (100%) design submittal.

EXHIBIT3.3-5
PHOTOGRAPH OF THE IM-3 ACCESS ROAD/CULVERTS (MAY 2014)
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

3.3.3.2 Freshwater Supply Storage

Storage of fresh water is required to meet the flow demands to injection wells during 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. In addition, freshwater storage is required to meet the fire flow storage requirement for the remedy facilities located on the Compressor Station, Transwestern Bench, and MW-20 Bench (see last paragraph of this section).

Consistent with the mitigation directives to use existing facilities where possible, PG&E proposed the shared use of the existing Compressor Station freshwater supply tanks for the remedy in the 60% design. 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. As discussed in RTC #168 DTSC-63, to ensure first priority for remedy use and after further evaluation of the additional controls, instrumentation, and tank upgrades that would need to be installed in the existing tanks in order to harmonize various demand for freshwater, PG&E now proposes to separate the freshwater supply storage for the remedy and the Compressor Station in the 90% design. A separate and smaller tank (10,000 gallons) will be installed inside the Compressor Station for remedy use only and will be supplied by well HNWR-1A from Arizona. Note that Topock-2/-3 wells will continue to supply water for Compressor Station use via the existing 6-inch pipeline. The remedy freshwater storage tank will be a coated carbon steel tank equipped with piping, valves, fittings, level switches and transmitters, an overflow pipe, and a tank vent.

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). Therefore, fire protection water for the remedy facilities located on the Compressor Station, Transwestern Bench, and MW-20 Bench will be supplied from the existing TCS freshwater tanks (combined volume of 420,000 gallons).

3.3.3.3 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 and provide hydraulic control to prevent migration of the chromium plume beyond identified plume boundaries. 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 (see Exhibit 3.3-4 for details).

Injection wells were located based on groundwater modeling results and field reviews were conducted to locate suitable sites for drilling. Injection wells will be constructed using up to 12-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, 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 significantly 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. Any additional wells needed to achieve this capacity would be installed in the same area as the primary well. Well drilling at any one area would only continue until this target of three times the design capacity was reached. There is also a possibility that the design flow rates for individual well locations could be adjusted to allow for somewhat more injection in the higher permeability locations and somewhat less injection in the lower permeability locations. In sum, there may be more than one well installed at the FW or IRL well locations initially to ensure sufficient capacity.

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. PG&E's consideration of installation of additional wells will be conducted consistent with the PA, CHPMP, CIMP, and the cultural resource mitigation measures in the EIR, including but not limited to the requirements that new facilities be placed in areas already disturbed by previous grading and other mechanized activities to the extent practicable (PA, § III(B)(2)(c), EIR Mitigation Measure CUL-1a-9); that existing monitoring wells and related facilities shall be used to the maximum extent practicable (PA, § III(B)(2)(a)); and that PG&E shall, to the extent practicable, restore the areas affected by the Topock Remediation Project (PA, §§ III(B)(3)(c),V, EIR Mitigation Measure CUL-1a-8(e)).

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.

3.3.3.4 Contingent Freshwater Pre-Injection Treatment System (FWPTS)

As noted previously, in compliance with DTSC's directive in its review comment on the 60% design (RTC #145 DTSC-50), a FWPTS to reduce arsenic to concentrations less than the federal/state MCL of 10 μg/L prior to injection is included in this 90% BOD, as a contingency. The planned primary source of the Arizona groundwater will be water from HNWR-1A, and the secondary source will be water from the existing well HNWR-1. A contingent well, Site B, can also supplement the freshwater supply if needed. The contingent FWPTS would be located at the TCS, next to the planned remedy-produced water conditioning plant (see Figure ES-5). All components of the contingent FWPTS are located on previously disturbed areas within the PG&E-owned parcel. Because of its location, the contingent FWPTS has been 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 was based on bench scale studies and experience in designing and operating arsenic groundwater treatment systems on non-Topock projects. A detailed description of the basis of design for the contingent FWPTS and results from the bench scale test are presented in the Addendum to the FWPTS Design Basis Memo included as Appendix M of this 90% BOD. The design basis memo was submitted to agencies, stakeholders, and Tribes for review and comment on December 15, 2013 as part of the 60% comment resolution process. On January 30, 2014, DTSC provided concurrence with the overall concept and technology proposed for the contingency system for arsenic treatment, as well as comments on the memo. Responses to DTSC's comments were prepared and included in a Response to Comments table attached to the memo in Appendix M.

Technology Selection/Bench Scale Testing

For the conceptual design basis, PG&E identified and evaluated proven treatment technologies for arsenic that are USEPA Best Available Technologies (USEPA 2001) and have been successfully used by municipalities and industry. Unproven technologies or technologies that have not been used in full-scale applications were not considered. 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 Addendum to the FWPTS Design Basis Memo (Appendix M).

As a result of this evaluation and screening process, the AA technology with disposable and regenerable (AA) adsorptive media, coagulation filtration, and iron-based adsorbent granular ferric hydroxide (GFH) were selected for bench-scale testing. As discussed at the January 16, 2013 CWG and January 17, 2013 TWG meetings, the bench scale test was conducted using HNWR-1 water at an offsite laboratory, CH2M HILL's Applied Science Laboratory. The purpose of this bench scale test was 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 showed that GFH was effective at removing arsenic to less than the treatment goal for arsenic (i.e., the federal/state MCL of 10 µg/L). The GFH media performed better than the disposable AA and offering longer running periods between media change-outs. Coagulation and filtration, although effective, creates a solid waste stream 5 times greater than GFH that must be transported and disposed of off-site and is more difficult to operate. Based on these reasons, GFH was selected for the FWPTS design.

Process Description

Exhibit 3.3-6 presents a process schematic using GFH. As shown, groundwater will be pumped and conveyed from HNWR-1A to the remedy freshwater storage tank. Water will be pumped from this tank and will be injected with hypochlorite for arsenic oxidation and with acid to reduce pH to 6.5; both hypochlorite and lower pH improve arsenic removal in the media vessels. After chemical injection, water will be passed through cartridge filters to remove solids that would otherwise clog the media, reducing performance and run time. With the solids removed, the water will be divided into two or three streams (nominal or maximum flow) and each will be processed through a single treatment media vessel (configured in parallel) in a downward flow direction. Automatic valves will divert the flow to the proper vessels and will control the flow rate into each in service vessel. During nominal flow, the third and treatment media vessel will be in standby mode. During maximum flow, three treatment media vessels will be operating.

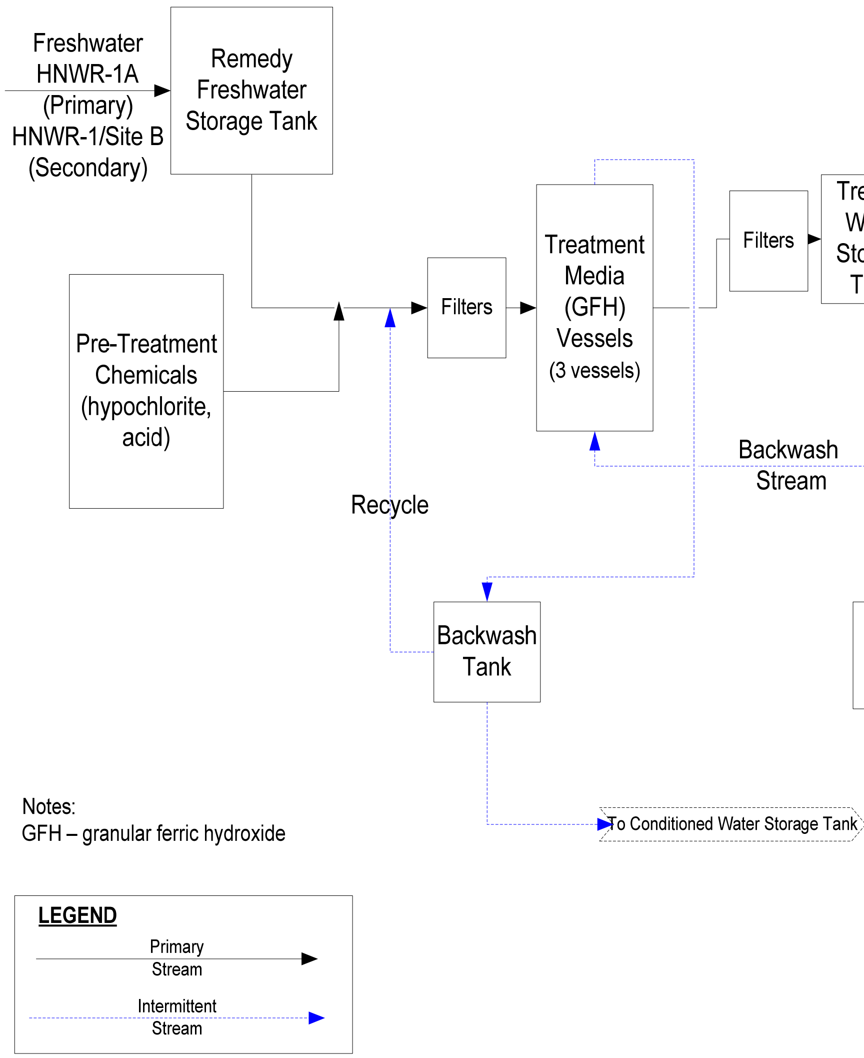


EXHIBIT 3.3-6
CONTINGENT FRESHWATER PRE-INJECTION TREATMENT PROCESS SCHEMATIC
Groundwater Remedy Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

PG&E evaluated dechlorination alternatives to remove residual chlorine from the treated freshwater. The reason for this step is to prevent the dechlorination chemicals in treated freshwater from adversely affecting microorganisms in the remediation zones. Dechlorination is often accomplished by addition of commonly used chemicals such as ascorbic acid, calcium thiosulfate, and hydrogen peroxide. The evaluation factors included cost-effectiveness and safety issues related with handling and storage, and the results showed calcium thiosulfate was the best option. The equipment needed for dechlorination includes chemical storage tanks or totes, metering pumps, and an inline static mixer. Due to climate conditions at Topock, the equipment would be housed in an air-conditioned storage building.

Media Backwash and Replacement

The amount of wastewater generated is a function of backwash frequency of the GFH media. Backwashing prevents over-compaction of the media bed, enabling good flow conditions. The selected arsenic removal process is highly efficient, enabling a high recycling rate of the backwash water; therefore the volume of wastewater needing to be managed will be minimal. The majority (approx. 95 percent) of the backwash water generated will be recycled in the FWPTS, leaving only about 5 percent of the backwash stream needing to be managed (this stream is not expected to have elevated arsenic concentrations). The management options for the remaining backwash water include reuse in the cooling towers, discharge to the evaporation ponds, and/or trucking to off-site permitted disposal facilities.

At some point during treatment operations, the media will lose its adsorptive capacity and will need to be replaced. Spent media will be removed from each vessel and sent to a landfill. Prior experience operating GFH treatment processes shows that the spent media is not hazardous (Ela and Saez 2006). The actual replacement frequency will be determined during full-scale operation. Based on the bench testing, this would be no more frequently than every 8 months, but is expected to be less frequent. For the purposes of the conceptual design, it is assumed that the media will require annual replacement. The estimated quantity of solid waste (including spent cartridge) to be managed is 17-33 tons per year.

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 waste 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.

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.

EXHIBIT 3.4-1
SUMMARY OF REMEDY-PRODUCED WATER VOLUME BY SOURCE AND TYPE
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Source/Type[a]	Wells [b]	Events/ Year	Annual Volume, MG/year [c]	Comments
Backwash				
Injection Wells	32	30-51 [d]	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] If the contingent FWPTS were to be implemented, backwash water generated from the treatment system would be an additional source of remedy-produced water. The majority (approx. 95%) of the backwash water generated will be recycled in the FWPTS, leaving only about five percent of the backwash stream needing to be managed (this stream is not expected to have elevated arsenic concentrations). The volume of this backwash stream is anticipated to be minimal.

[b] 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 River Bank Extraction Wells, 5 East Ravine Extraction Wells, 2 TW Bench Extraction Wells, and 1 Freshwater supply well.

[c] MG = million gallons

[d] 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.

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 ES-4A. With the exception of pipelines connecting to IRL-4, all utility corridors are located in existing roadways/ROWs or previously disturbed areas. Most pipelines will be installed in pre-cast concrete trenches or direct buried belowground consistent with the utility corridor. The exceptions are utilities located on pipe bridges. See Appendix C (Design Criteria), Section C.5.1, Piping, for the type of pipelines included in the design.

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 drawing I-02-03 of Appendix D for Freshwater Injection Wells, I-03-01 for the East Ravine Extraction Wells, I-03-02 for the Transwestern Bench Extraction Wells, I-03-03 for the Topock Compressor Station Injection Wells, I-04-01 to -06 for the NTH IRZ Extraction and Injection Wells, I-05-01 for the River Bank Extraction Wells, and I-05-02 for the Inner Recirculation Loop Injection Wells. The benefit of this approach is to reduce vehicle traffic and speed up rehabilitation activities. If pumped through the pipelines over long distance, solids could cause obstructions to form in the pipe or accumulate at low points. For this reason, it is better to remove solids closer to the point of generation. See Section 3.4.2.1 for additional details on management of remedy-produced water.

Rehabilitation wastewater from existing wells 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-1A 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 Injection Wells associated with the remedial action. 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 carbon-amended 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 (see the Conditioning Requirements column in Exhibit 3.4-2). 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).

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 3.4-2 and 3.4-3 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.

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.

EXHIBIT 3.4-2
REUSE/DISPOSAL OPTIONS AND ASSOCIATED DEGREE OF CONDITIONING REQUIRED
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Reuse/Disposal Option	Conditioning Requirements	Other Constraints
1. Trucking off-site	Prior to trucking offsite, field neutralization and/or field filtered with a transportable treatment unit may occur. 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. In the event wastewater needs to be trucked offsite during remedy operations, truck loading stations are included in the 90% design to facilitate the operation. The stations are located at the Compressor Station, the Transwestern Bench, and the MW-20 Bench. In addition, the existing truck loading station at the evaporation ponds will be improved to facilitate offsite trucking of wastewater if needed[a].
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. In such case, prior to disposal at the TCS ponds, field neutralization and/or field filtered with a transportable treatment unit may occur. Produced water must be compatible with the existing piping to the ponds; see design criteria in Appendix C Section C.5.1. The disposal of remedy-produced water in the TCS evaporation ponds must meet the substantive requirements of the ponds' waste discharge requirements (WDRs).	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. Provisions to enhance evaporation, thereby increasing the ponds' capacity, are included in the 90% design[a]. 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. In response to RTC #204 DOI-87, once the remedy is operational, evaluation of concentrations of constituents discharged to the ponds from other remedy wastewater streams and appropriate measures to protect migratory birds, if needed, will be conducted, in cooperation with the agencies.
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.

EXHIBIT 3.4-2
REUSE/DISPOSAL OPTIONS AND ASSOCIATED DEGREE OF CONDITIONING REQUIRED
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Reuse/Disposal Option	Conditioning Requirements	Other Constraints
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 (when the IRZ operating cycle is on) and distributed among the wells so that hydraulic control is maintained. Produced water injected back in to the wells would not represent consumptive use.

Notes:
Two reuse/disposal options for remedy-produced water that were previously being considered are not being further evaluated in the remedy design. These options include the Infiltration Gallery in Bat Cave Wash and the Moabi Regional Park sewage ponds. If PG&E proposes to evaluate these options further in the future, PG&E will discuss the options with agencies and Tribes at that time.

[a] Water accumulated in the ponds will evaporate over time. In the event the ponds are full (i.e., water level in the ponds reaches the maximum level allowed by the RWQCB), water can also be trucked off-site via the truck loading station at the ponds. The preferred method of water disposal is evaporation; therefore, a new drip system and agitators will be installed to enhance evaporation at the ponds. The drip system will utilize a sump pump mounted on a pontoon platform in the middle of the ponds, which will pump through perforated HDPE pipe along the upper perimeter of the pond walls. The agitator and pumps will be powered by 120/240 VAC generated by a generator operating on natural gas or by direct connection to the compressor station power system.

- If the generator is installed, it will be in a small building inside the pond fence line that also includes a control panel and a bank of batteries. Natural gas for the generator will be piped from the PG&E transmission line 300B, approximately 500 feet away. A new regulator rack will be installed to reduce the gas line pressure from line pressure down to the operating level of the generator.
- If the power is supplied directly from the compressor station power system, the new electrical conductors will be installed along the right-of-way that currently contains the discharge pipeline that carries water from the compressor station to the ponds. A small control building or panel would be installed to house the pond controls and communications equipment.

PG&E is evaluating both options and will include the selected option in the Final (100%) design. Improvements to the ponds will also include the installation of actuator valves at the discharge points into the ponds, security cameras, and a radio transmitter so that station operations personnel can adequately monitor the system (this radio transmitter may not be necessary if the power is supplied from the compressor station power system). In addition, the existing pond fence may be upgraded to provide enhance security.

In addition, a new concrete containment area will be installed at the existing truck loading station to enhance the ability to pump pond water to tanker trucks for trucking water off-site, if needed. Figure 3.4-1 presents a layout of the improvements at TCS ponds using a generator.

EXHIBIT 3.4-3
REUSE/DISPOSAL MANAGEMENT PLAN FOR WATER PRODUCED DURING FINAL GROUNDWATER REMEDY
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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	Process through B-side of Remedy-produced Water Conditioning Plant, then to: 1. IRZ injection wells 2. Compressor station cooling towers
Backwash of IRZ injection wells, TCS injection wells, IRL Injection Wells receiving water from river bank extraction wells, and IRZ CIP[a]	2.35[b]	Process through A-side of Remedy-produced Water Conditioning Plant, then to IRZ injection wells
Well rehabilitation (all wells) - first flush	0.77[b,c]	1. TCS ponds[d] 2. Trucked offsite[d] 3. Field neutralization and/or field filtered with a transportable treatment unit, and then convey water to Remedy-produced Water Conditioning Plant (A-side) for processing and re-inject into IRZ injection wells.
Well rehabilitation (all wells) – second flush	1.8 [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. Process through B-side of Remedy-produced Water Conditioning Plant, then to: 1. IRZ injection wells 2. Compressor station cooling towers
Other water – some purge and decontamination water	0.1	1. Process through A-side of Remedy-produced Water Conditioning Plant, then to 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: Process through A-side of Remedy-produced Water Conditioning Plant, then to IRZ injection wells For construction of the initial wells (prior to having the IRZ wells and the Remedy-produced Water Conditioning Plant in place), the management options will also include re-injection into the aquifer where the well is drilled and processing at the IM-3 treatment plant (after characterization).

Note:
MG = million gallons

If the contingent Freshwater Pre-injection Treatment System (FWPTS) were to be implemented, backwash water generated from the treatment system would be a potential additional source of remedy-produced water. The majority (approx. 95%) of the backwash water generated will be recycled in the FWPTS leaving only about 5% of the backwash stream needing to be managed (this stream is not expected to have elevated arsenic concentrations). The management options for backwash water include reuse in the cooling towers, discharge to the evaporation ponds, and/or trucking to off-site permitted disposal facilities.

[a] Prior to transferring the spent solution from the Clean-in-Place (CIP) System to the remedy-produced water conditioning plant, the solution will be allowed to settle and precipitate solids prior to pumping to the conditioning plant. Spent solutions from CIP System could also be shipped off-site for disposal.

[b] Assumes half of the flow to the IRL Injection Wells is fresh water with the remainder amended with carbon.

[c] 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.

[d] Note that prior to the disposal at the TCS ponds or trucking offsite, field neutralization and/or field filtered with a transportable treatment unit may occur.

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 first flush to second flush rehab water is proposed to be defined through easily measured onsite water quality tests such as pH, turbidity, and conductivity. In general, during well rehab events, turbid and/or discolored water (first flush) will be removed from the well until the water becomes clear and the well is relatively clean. All first flush water will be contained in temporary, portable tanks, tested, and managed in accordance with the schematic shown in Figure 3.4-3. 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.[6] 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 in-situ remediation and 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.

[6] In response to comments on the 60% design (RTCs #341 and #757), a contingency plan to remove scaling ions from remedy-produced water was developed. The contingent system, referred to as the dissolved metals removal system (DMRS), would be located entirely in the planned Remedy-produced Water Conditioning Building inside the TCS. No additional footprint is required for installation of this contingency system. The DMRS would be designed to be fully integrated into the currently planned conditioning process for remedy-produced water, thereby allowing for easy installation if required in the future. See O&M Manual Volume 3, Appendix A, for more details.

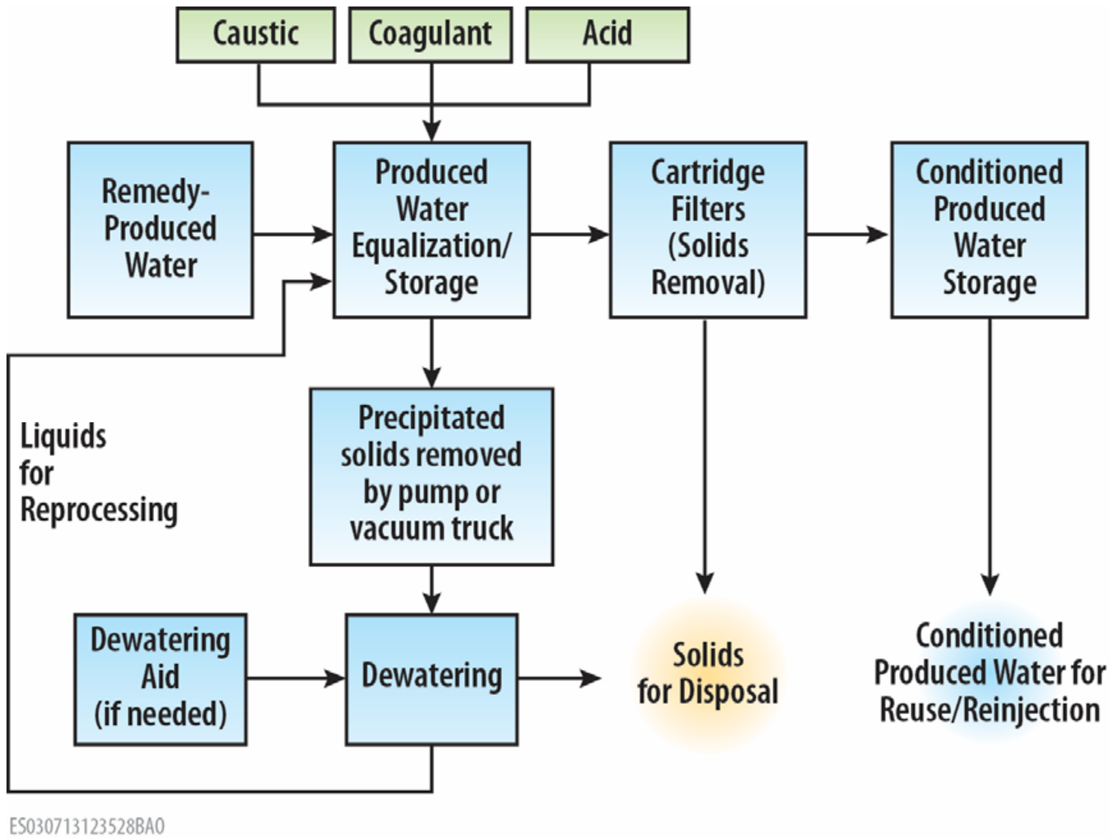


EXHIBIT 3.4-4
REMEDY-PRODUCED WATER CONDITIONING PROCESS SCHEMATIC
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

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 a concrete foundation 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 20 to 35 pounds per square inch (47 to 72 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. Pneumatically-actuated control valves will be supplied with the system to automatically divert or allow an operator to divert flow to stand-by filters when differential pressure exceeds operator adjustable set point. The packaged system will be installed on skid fabricated of structural steel shapes. The steel will be factory coated with epoxy. The filter housings will be

fabricated of stainless steel or plastic to resist corrosion from 2,000 to 3,000 mg/L chloride in produced water. The system will include an electrical control panel on skid to supply 120- VAC power for instruments and other low voltage equipment.

EXHIBIT 3.4-5
REMEDY-PRODUCED WATER CONDITIONING SYSTEM DESIGN CRITERIA
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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 below 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.
  - Two 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.
- Three truck loading stations will be used for unconditioned produced water – Compressor Station, MW-20 Bench, and Transwestern Bench. For details, see engineering drawings in Appendix D.
- 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 decontamination pad).
- A coagulant will be used to improve settling of suspended solids in produced water. A flocculant dewatering aid will also be used, if needed, 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 (Remedy SCADA), security, as well as access roads and pathways, operator's facilities, equipment and materials storage, equipment maintenance and testing areas, office space, bathrooms, and two onsite laboratories (one at the Remedy-produced Water Conditioning Plant and one at the long-term remedy support area for maintenance and equipment storage at Moabi Regional Park). Also needed for proper operations of the remedy are soil storage areas (located at Moabi Regional Park) and waste management areas (see Section 6, Waste Management Plan, of the O&M Plan [Volume 1 of the O&M Manual]).

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 90% design stage, it is estimated that the groundwater remedy could require up to 3.2 million kilowatt-hours (KWh) of electricity annually (see Appendix D, drawing E-00-33 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. Two new natural gas engine-driven generators with associated switchgear and auxiliary systems will be installed in the existing Auxiliary Building, which houses the existing generators and generator switchgear. This location was selected due to its close proximity to the existing generators and the remedy system. A new power supply conduit will run underground from the electrical switchgear inside the Auxiliary Building to a connection point outside the nearby Remedy-produced Water Conditioning Building (see Figure 3.5-1). The existing switchgear in the existing Auxiliary Building will be replaced/enhanced with new switchgear to enable full integration with the existing equipment and increase power reliability for the remediation facilities. To free up the space for the new generators to be installed inside the Auxiliary Building, the existing air compressors will be consolidated with the existing air dryer in a new Air Compressor Building, located just to the east of their current location. This new air compressor location is preferred by the compressor station staff for ease of operation and maintenance of both the power and the compressed air systems.

Secondary power supply can be power generated from small photovoltaic solar panels at the Operations Building at the TW Bench, the Remedy-produced Water Conditioning Building at the TCS, and at select remote well locations. In addition, a portable, rental backup generator of similar make and model of the existing generator (Isuzu Model 6WG1X) will be mobilized onsite as needed during project implementation to provide power. A connection panel is included in the 90% design (see Appendix D, Drawing E-00-51, Detail 4) and space has been reserved for the portable rental generator (see Figure 3.5-1).

For the freshwater supply well (HNWR-1A) in Arizona, the power supply source will be power directly provided by Mohave Electric Cooperative.

The power system will be transmitted along the pipeline corridors to serve all remedy facilities located in California - including wells, aboveground buildings, etc. Power will be supplied from the TCS at 480 VAC and will be stepped up to 12K VAC with a 1,000-kilovolt-ampere (kVA) transformer. 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. The transformers at the load centers will range in size from 225 kVA to 300 kVA, and will be mounted aboveground on shallow concrete foundations. At each well or other load, a motor control panel 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 conduit in underground concrete trenches. While the National Electrical Safety Code (NESC) requires burial depths of 30 inches for medium voltage, the 90% design applies a minimum depth of 36 inches for buried medium voltage power. If required to avoid conflicts with other utilities, power conduits may have to go deeper; typical vertical separations from pipes could be 6-12 inches (see engineering design drawings in Appendix D for details on depths). Lightning protection systems and equipment will be provided for all equipment and structures. All electrical systems and equipment will be grounded.

3.5.2 Remedy Supervisory Control and Data Acquisition (SCADA) System

A SCADA system will be installed for controlling and monitoring the remedy. The Remedy SCADA equipment will be located inside the Operations Building at the Transwestern Bench. Exhibit 3.5-1 provides a schematic of the Remedy SCADA system. As shown in Exhibit 3.5-1, the main components of the Remedy SCADA system include the following:

- Operator Interface Terminal or Human/Machine Interface devices that present process data to a human operator, and through which the human operator monitors and controls the process. From the OITs (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.

- 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. The control scheme for the PLC has been developed and is included in the technical specifications for the PLC (see Appendix E, Section Number 40 96 00).
- Communication infrastructure connecting the supervisory system to the remote terminal units.
- Various process and analytical instrumentation (e.g., flow, pH, and conductivity measurement)

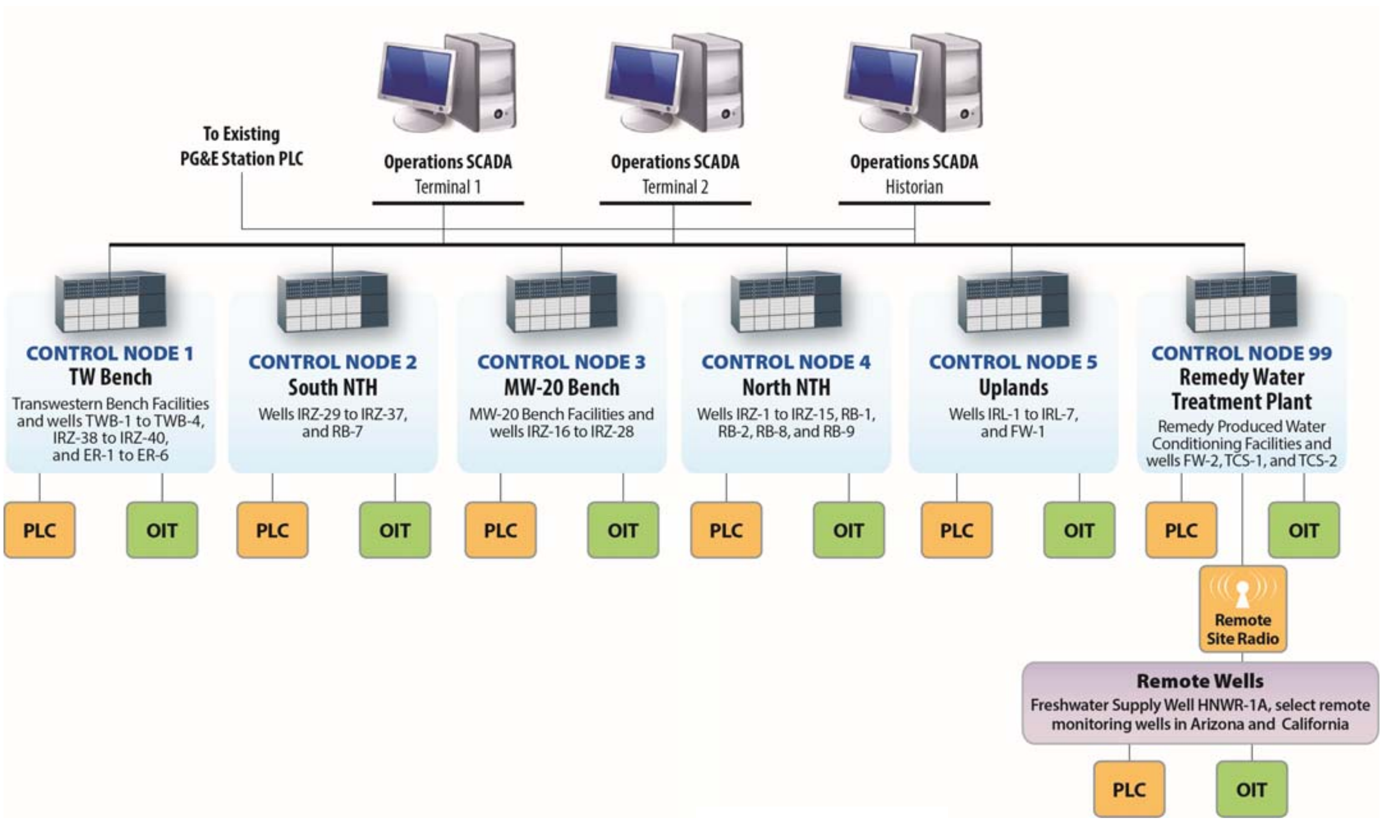


EXHIBIT 3.5-1
SCHEMATIC OF THE REMEDY SCADA SYSTEM
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

The Remedy SCADA system will communicate with numerous digital controllers organized into six nodes (see below). 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 OITs. 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 wells will be transmitted back to the main control station using wires, fiber optic communications, radio transmission (e.g., information from freshwater supply well(s) in Arizona; select monitoring wells in the floodplain/along the NTH IRZ, near the TCS, and in the East Ravine; and the equipment at the TCS ponds will be transmitted via radio to the Station

PLC and from the Station PLC network to the Remedy SCADA), 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 Operations Building.

The control nodes will have a PLC and an OIT for operators to monitor and control system equipment. The six nodes are as follows:

- Node 1 (TW Bench) – Transwestern Bench Facilities and wells TWB-1, TWB-2, IRZ-38 to IRZ-40, and ER-1 to ER-6 (and future provisional TW-3 and TW-4).
- Node 2 (South NTH) – Wells IRZ-29 to IRZ-37, RB-3 through RB-5 (and future provisional RB-6 and RB-7).
- Node 3 (MW-20 Bench) – MW-20 Bench Facilities and wells IRZ-16 to IRZ-28.
- Node 4 (North NTH) – Wells IRZ-1 to IRZ-15, RB-1, RB-2 (and future provisional RB-8 and RB-9).
- Node 5 (Upland) – Wells IRL-1 to IRL-5 and FW-1 (and future provisional IRL-6 and IRL-7).
- Node 99 (Remedy Water Treatment Plant) – Remedy Produced Water Conditioning Facilities and wells FW-2, TCS-1, and TCS-2.

The remedy will have security equipment such as cameras, intrusion alarms, and card readers (see Section 3.5.4 for additional details). The Remedy SCADA will monitor the security equipment via an interface at the Operations Building. This information will be communicated to PG&E's utility data network to be monitored by PG&E's security center.

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, an air compressor, 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.

Major equipment associated with the freshwater supply well (HNWR-1A) 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 four main areas, namely the Compressor Station, the Transwestern Meter Station Bench (also called the TW Bench), the MW-20 Bench, and the northwest area of Moabi Regional Park. 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. The northwest area of Moabi Regional Park is located on federal lands, and on previously disturbed areas near the existing graded road (National Trails Highway).

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 decontamination 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.

The northwest area of Moabi Regional Park is currently used as an off-highway vehicle (OHV) staging area and for storage of mobile homes/related equipment and recreational vehicles.

Exhibit 3.5-2 provides a summary of currently planned remedy buildings/structures for major equipment and key supporting functions. Figures 3.4-1 and 3.5-1 through 3.5-8 present layouts and photo simulations of remedy buildings/structures at the TCS evaporation ponds, the Compressor Station, the TW Bench, and MW-20 Bench. 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 will be located at the Compressor Station in proximity to 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 (see Item 4 below) and Moabi Regional Park (see Item 6 below).

EXHIBIT 3.5-2
REMEDY BUILDINGS AND STRUCTURES
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Compressor Station	TW Bench	MW-20 Bench
• Remedy-produced Water Conditioning Plant and associated tanks/chemical storage • Truck loading/unloading station • Equipment decontamination pad • Remedy freshwater storage tank • New metal building to house the relocated air compressors	• Carbon Amendment Building and Carbon Storage Tank for TCS Loop • Operations Building • Truck loading/unloading station • A fence around the TW Bench • Existing equipment decontamination pad (reuse) • Security equipment (cameras, intrusion alarms, card readers, etc.)	• Carbon Amendment Building and Carbon Storage Tank for NTH IRZ and IRL • Truck loading/unloading station • Existing storage tanks (reuse 3 frac tanks) • Security equipment (cameras, intrusion alarms, card readers, etc.)
HNWR-1A Well	**Moabi Regional Park**	**TCS Evaporation Ponds**
• A fence around the well similar to Topock-2/-3 and HNWR-1 • Security camera pole with lights • Aboveground piping and electrical/ control equipment associated with the well, as well as a sand separator. • Sunshade to protect electrical equipment. • Gravel driveway and yard	• Training facilities, conference room, laboratory, maintenance, and soil storage area during long-term O&M	• Enclosure for generator • Pond observation cameras • Concrete containment for water truck loading station

3. The new power generators will be housed in the Auxiliary Building, which also houses the existing generators and switch gear equipment. The Auxiliary Building is in close proximity to the connection point for the remedy system. In order to free up space for the new generators, the existing air compressors will be relocated into a new metal building to the east of their current location, and consolidated with the air dryer. This new air compressor location is preferred by the compressor station staff for ease of operation and maintenance of both the power and the compressed air systems.

4. An Operations Building will be located at the centrally located TW Bench to house certain supporting functions for essential functions for long-term O&M (PLCs, uninterruptible power supply, communications, SCADA, OITs, etc.). As part of space planning, space is reserved in the Operations Building for a small drinking water system (approximately 2,000 gallons per day capacity) to provide drinking water for operators/crews and visitors and potable water for eyewash and safety shower if needed in the future. The primary source for drinking/potable water will be the Compressor Station; sink-mounted point-of use reverse osmosis systems may also be used to supply drinking/potable water. If needed in the future, it is envisioned that the small drinking water system will use RO to remove arsenic and fluoride and will likely comprise a booster pump, a package wall-mounted RO system, calcite filters for neutralization, and a 400 gallon pressure tank. 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 (see Figure 3.5-9A).

5. A fence will be installed at the current HNWR-1A well location in Arizona to protect the well and associated electrical/control equipment. Sunshades will also be provided to protect the equipment.
6. As discussed in RTCs #26 DTSC-4 and #446 FMIT-135, to reduce the infrastructure at the TW Bench, PG&E proposed moving some functions originally intended to occur at the TW Bench – construction headquarters, training, conference room, laboratories, maintenance, and storage – to a location at Park Moabi. Discussion with BLM is ongoing regarding the potential use of the northwest area of Park Moabi to support remedy construction and longer term O&M functions.

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 has been 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. The Site Security Plan is included in the appendix of the Construction/Remedial Action Work Plan (CH2M HILL 2014m).

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 has been 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 prepared, addresses 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. The Access Plan is included in the appendix of the Construction/Remedial Action Work Plan. 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 has prepared a protocol to provide outreach to Moabi Regional Park staff regarding communication to visitors about the restrictions for off-road vehicle use and to establish an informational kiosk. The protocol is included in the Construction/Remedial Action Work Plan (CH2M HILL 2014m). 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 has prepared a protocol to establish signage warning that the area is off limits to off-road vehicle usage is including the protocol in the Construction/ Remedial Action Work Plan. PG&E's efforts will 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. Figures 3.5-9A and 3.5-9B shows existing and new access roads and pathways to service remedy facilities. As shown in this figure, four 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 (#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 (#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.
- A new road in the floodplain to construct and service the IRZ and River Bank Extraction Wells, including future provisional wells and associated piping. At this 90% design stage, this gravel road will "ring" around the floodplain and replace multiple shorter access routes previously planned in the 60% design; therefore, the net change in linear footage of access road is minimal.
- A new access road north of the TW Bench to accommodate for shared use of the bench and to allow for access to/from Transwestern's equipment during the construction, operation, and maintenance of remedy facilities at the bench.

In addition, significant erosion was observed on the existing road just to the west of freshwater well FW-2, monitoring wells MW-S/HH/II, and associated piping (see Exhibit 3.5-3). These remedy infrastructures will need to be protected. This existing road will be improved and drainage will be engineered to divert flow/debris away from the remedy features.

EXHIBIT 3.5-3
SEVERE EROSION OBSERVED ON ROAD, WEST OF FRESHWATER INJECTION WELL FW-2
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

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 (see Figure 3.6-1). 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 35 new well locations), and data quality objectives are discussed in the Sampling and Monitoring Plan, Volume 2 of the O&M Manual.

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. Application of the data collection and evaluation process for the purpose of monitoring well design is presented in Section 3 of the Construction/Remedial Action Work Plan (CH2M HILL 2014m).

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
- Constructability 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.

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.

Constructability 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 constructability. 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 constructability 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. Monitoring well designs are included in drawings C-16-01 through 03 of Appendix D, Plans (Engineering Drawings).

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. Ease of use and maintenance of pressure transducers for collection of water level data is not negatively affected by this well design.

- **Constructability 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.
- **Well Decommissioning** – Conventional wells may generally be decommissioned in-place in accordance with the Standard Operating Procedure for Well and Borehole Decommissioning.

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 well, but requires the use of an inflatable packer or equivalent, which could introduce materials that are less stable in the subsurface environment at the Topock site. Ease of use and maintenance of pressure transducers for collection of water level data is not negatively affected by this well design, though the design of the packer used must allow access to the lower screened interval.
- **Constructability 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. For example, historical use of inflatable packers in East Ravine wells required frequent checks and maintenance as a result of failures early in their operation. The failure mode observed in these packer failures were inherent in the design of inflatable packers. Packers used in monitoring wells must remain inflated and function for long period of time (i.e., years) to maintain monitoring zone isolation. This is a different operating condition than that of the remediation wells. Packers used in remediation wells served to isolate screened intervals and facilitate the distribution of varying quantities of carbon-amended water to each screened interval individually, but long-term isolation is not a requirement. Therefore, packers are ideal for use in remediation wells because there are opportunities to remove and maintain them, as necessary. 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.
- **Well Decommissioning** – Dual-screen wells may generally be decommissioned in-place in accordance with the Standard Operating Procedure for Well and Borehole Decommissioning.

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 constructability 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. Ease of use and maintenance of pressure transducers for collection of water level data is not negatively affected by this well design.
- **Constructability and Longevity** – As more well casings are nested within one borehole the constructability 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.
- **Well Decommissioning** – Nested wells may generally be decommissioned in-place in accordance with the Standard Operating Procedure for Well and Borehole Decommissioning.

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. The ability to use pressure transducers may be significantly reduced depending on the well design factors, including designs where pressure transducers are not able to be installed, maintained, or operated. Based on experience with FLUTe liners in the East Ravine, it is recommended that testing be conducted prior to

deployment of any multi-level system that contains elastomeric materials to insure the stability of those materials in a geochemically reduced environment.

- **Constructability and Longevity** – Multi-level systems can typically be installed in a 10-inch diameter borehole, or smaller. Although these systems are relatively complex, constructability 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.
- **Well Decommissioning** – The decommissioning procedures for multi-level wells will vary by individual design. While some designs may generally be decommissioned in-place in accordance with the Standard Operating Procedure for Well and Borehole Decommissioning, other more complex designs may require decommissioning by removal of the well materials.

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. 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. In addition, these well types can generally be decommissioned in place, which is the preferred decommissioning method as it represents the field procedures that are least intrusive and create the least amount of disturbance. 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 constructability 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 two 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 monitoring well location MW-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.

In response to agency comment on the monitoring well network proposed in the 60% BOD Report, future provisional locations for angled (i.e., slant) well construction on the California bank of the Colorado River have been added. In addition, angled wells might be required at select monitoring well locations in the upland (associated with the arsenic monitoring network). As discussed with the agencies during the development of this 90% BOD Report, elevated detections of hexavalent chromium in monitoring wells MW-X and MW-Y, which will be constructed on the Arizona side of the river, would trigger a discussion as to whether the slant well(s) should be constructed. If constructed, the optimal design of the slant well(s) could be any of the four listed above in Section 3.6.2 depending on the functional requirements of the well(s). In addition to borehole quantity constraints, once the well utility requirements are established, the constructability of each design will have to be carefully considered prior to finalizing.

TABLE 3.2-1
Pre-Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

	Pre-Final Injection/Extraction Rate per Model Layer (gpm)			Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates	
Well Location ID[a]	Nominal	Minimum	Maximum						X	Y
IRZ-1 (Extraction)[b]									7615297.081	2104063.768
Layer 1	20	20	80	120	65	Dual Screen Well	1	0		
Layer 2					93					
Layer 3	20	20	80	180	124					
Layer 4					79					
IRZ-2									*7615314.733*	*2104010.323*
Layer 1	*0*	*0*	*6*	*50*	*71*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*70*	*93*					
Layer 3	*0*	*0*	*6*	*100*	*119*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*50*	*72*					
IRZ-3									*7615415.553*	*2103957.160*
Layer 1	*0*	*0*	*6*	*70*	*86*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*80*	*96*					
Layer 3	*0*	*0*	*6*	*90*	*109*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*63*					
IRZ-4									*7615392.091*	*2103849.460*
Layer 1	*0*	*0*	*6*	*70*	*90*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*70*	*93*					
Layer 3	*0*	*0*	*6*	*80*	*100*	*Dual Screen Well*	*0*	*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	0		
Layer 2					93					
Layer 3	40	20	80	140	99					
Layer 4					56					
IRZ-6									*7615440.751*	*2103744.711*
Layer 1	*0*	*0*	*6*	*70*	*91*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*70*	*90*					
Layer 3	*0*	*0*	*6*	*70*	*94*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*54*					
IRZ-7									*7615514.912*	*2103691.892*
Layer 1	*0*	*0*	*6*	*70*	*92*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*60*	*87*					
Layer 3	*0*	*0*	*6*	*70*	*93*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*40*	*52*					

TABLE 3.2-1
Pre-Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Minimum	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Pre-Final Well Coordinates Y
IRZ-8									7615501.889	2103615.023
Layer 1	0	0	6	60	84	Dual Screen Well	0	1		
Layer 2	0	0	6	60	81					
Layer 3	0	0	6	60	84	Dual Screen Well	0	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	0		
Layer 2					75					
Layer 3	40	20	80	120	80					
Layer 4					50					
IRZ-10									7615569.264	2103470.371
Layer 1	0	0	6	40	69	Dual Screen Well	0	1		
Layer 2	0	0	6	40	65					
Layer 3	0	0	6	40	68	Dual Screen Well	0	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	0		
Layer 2	10	0	20	40	62					
Layer 3	10	0	20	40	66	Dual Screen Well	1	0		
Layer 4	10	0	20	40	51					
IRZ-12									7615660.246	2103350.817
Layer 1	0	0	6	40	60	Dual Screen Well	0	1		
Layer 2	0	0	6	40	57					
Layer 3	0	0	6	40	59	Dual Screen Well	0	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	0		
Layer 2	9	0	20	40	52					
Layer 3	9	0	20	40	59	Dual Screen Well	1	0		
Layer 4	9	0	20	40	53					
IRZ-14									7615736.699	2103202.539
Layer 1	0	0	6	40	55	Dual Screen Well	0	1		
Layer 2	0	0	6	40	53					
Layer 3	0	0	6	40	50	Dual Screen Well	0	1		
Layer 4	0	0	6	30	44					

TABLE 3.2-1
Pre-Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm)			Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
IRZ-15									7615766.310	2103145.565
Layer 1	7	0	15	40	49	Dual Screen Well	1	0		
Layer 2	7	0	15	40	48					
Layer 3	7	0	15	40	48	Dual Screen Well	1	0		
Layer 4	7	0	15	30	43					
IRZ-16									7615794.469	2103038.226
Layer 1	6	0	15	40	51	Dual Screen Well	1	0		
Layer 2	6	0	15	40	49					
Layer 3	6	0	15	30	42	Dual Screen Well	1	0		
Layer 4	6	0	15	20	36					
IRZ-17									7615861.49	2102994.285
Layer 1	7	0	15	40	51	Dual Screen Well	1	0		
Layer 2	7	0	15	40	49					
Layer 3	7	0	15	30	39	Dual Screen Well	1	0		
Layer 4	7	0	15	20	33					
IRZ-18									*7615834.113*	*2102912.441*
Layer 1	*0*	*0*	*6*	*40*	*51*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*40*	*49*					
Layer 3	*0*	*0*	*6*	*20*	*30*	*Dual Screen Well*	*0*	*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	0		
Layer 2	7	0	13	30	41					
Layer 3	7	0	13	20	28	Dual Screen Well	1	0		
Layer 4	7	0	13	15	24					
IRZ-20									7615807.564	2102769.249
Layer 1	4	0	13	35	47	Dual Screen Well	1	0		
Layer 2	4	0	13	30	42					
Layer 3	4	0	13	15	24	Dual Screen Well	1	0		
Layer 4	4	0	13	10	20					
IRZ-21									7615815.994	2102691.507
Layer 1	5	0	10	40	48	Dual Screen Well	1	0		
Layer 2	5	0	10	20	29					
Layer 3	5	0	10	10	18	Dual Screen Well	1	0		
Layer 4	5	0	10	15	26					

TABLE 3.2-1
Pre-Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Y
IRZ-22									*7615819.972*	*2102619.334*
Layer 1	*0*	*0*	*6*	*35*	*44*	*Dual Screen Well*	*0*	*1*		
Layer 2	*0*	*0*	*6*	*15*	*27*					
Layer 3	*0*	*0*	*6*	*10*	*19*	*Dual Screen Well*	*0*	*1*		
Layer 4	*0*	*0*	*6*	*15*	*27*					
IRZ-23 (Extraction)[b]									7615824.866	2102534.901
Layer 1					33					
Layer 2					28	Single Screen Well (Layers 2, 3, & 4)[d]				
Layer 3	100	40	160	70	24		1	0		
Layer 4					24					
IRZ-24									*7615822.168*	*2102468.274*
Layer 1	*0*	*0*	*13*	*40*	*31*	*Dual Screen Well*	*0*	*1*		
Layer 2					*28*					
Layer 3	*0*	*0*	*13*	*40*	*26*					
Layer 4					*25*					
IRZ-25									7615826.121	2102415.641
Layer 1	8	0	18	40	29	Dual Screen Well	1	0		
Layer 2					27					
Layer 3	8	0	18	40	26					
Layer 4					24					
IRZ-26									*7615818.538*	*2102313.742*
Layer 1	*0*	*0*	*13*	*40*	*28*	*Dual Screen Well*	*0*	*1*		
Layer 2					*26*					
Layer 3	*0*	*0*	*13*	*40*	*24*					
Layer 4					*24*					
IRZ-27									7615801.341	2102238.870
Layer 1	8	0	18	40	27	Dual Screen Well	1	0		
Layer 2					25					
Layer 3	8	0	18	40	23					
Layer 4					24					
IRZ-28									*7615797.904*	*2102180.167*
Layer 1	*0*	*0*	*13*	*40*	*26*	*Dual Screen Well*	*0*	*1*		
Layer 2					*24*					
Layer 3	*0*	*0*	*13*	*40*	*23*					
Layer 4					*22*					

TABLE 3.2-1
Pre-Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Y
IRZ-29									7615792.463	2102082.530
Layer 1	7	0	15	40	25	Dual Screen Well	1	0		
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*	*0*	*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	0		
Layer 2					16					
Layer 3	6	0	13	25	16					
Layer 4					16					
IRZ-32									*7615812.857*	*2101863.292*
Layer 1	*0*	*0*	*13*	*30*	*21*	*Dual Screen Well*	*0*	*1*		
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	0		
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)*	*0*	*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	0		
Layer 2					10					
Layer 3					10					
Layer 4					10					

TABLE 3.2-1
Pre-Final Remediation Well Design Parameter Summary: National Trails Highway IRZ Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Y
IRZ-36									*7615948.819*	*2101605.697*
Layer 1	*0*	*0*	*25*	*25*	*7.4*	*Single Screen Well (All Layers)*	*0*	*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	0		
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)*	*0*	*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	0	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)*	*0*	*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:

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of the pre-final (90%) design submittal and are continuing to be evaluated. 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
Pre-Final Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm)			Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final 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	0		
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	0		
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	0		
Layer 4					50					
RB-4									7616337.509	2102908.528
Layer 1				70[g]	50					
Layer 2					55					
Layer 3	50	25	170	100	37	Single Screen Well (Layers 3 & 4)[g]	1	0		
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	0		
Layer 4					16					
RB-6									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					
RB-7									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					

TABLE 3.2-2
Pre-Final Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

	Pre-Final Injection/Extraction Rate per Model Layer (gpm)								Pre-Final Well Coordinates	
Well Location ID[a]	Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	X	Y
RB-8									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					
RB-9									*TBD*	*TBD*
Layer 1				*TBD*[g]	*TBD*					
Layer 2					*TBD*					
Layer 3	*0*	*25*	*170*	*TBD*	*TBD*	*Single Screen Well (Layers 3 & 4)*[g]	*0*	*1*		
Layer 4					*TBD*					
Inner Recirculation Loop Injection Wells[b]										
IRL-1									7614392.08	2103402.91
Layer 1	0			80	62					
Layer 2		35	200		71		1	0		
Layer 3	75			170	74	Dual Screen Well				
Layer 4					64					
IRL-2									7614133.272	2103058.411
Layer 1	0			74	62					
Layer 2		35	200		63	Dual Screen Well	1	0		
Layer 3	75			160	65					
Layer 4					64					
IRL-3									7613976.088	2102799.301
Layer 1					55					
Layer 2				140	55					
Layer 3	100	35	200		59	Dual Screen Well	1	0		
Layer 4				71	61					
IRL-4									7613953.827	2102380.665
Layer 1					46					
Layer 2				115	46	Dual Screen Well	1	0		
Layer 3	200	35	200		49					
Layer 4				56	51					
IRL-5									*TBD*	*TBD*
Layer 1					*TBD*					
Layer 2	*0*	*35*	*200*	*TBD*	*TBD*	*TBD*	*0*	*1*		
Layer 3					*TBD*					
Layer 4					*TBD*					

TABLE 3.2-2

Pre-Final Remediation Well Design Parameter Summary: Inner Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Y
IRL-6[f]									*TBD*	*TBD*
Layer 1	*0*	*35*	*200*	*TBD*	*TBD*	*TBD*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
IRL-7[f]									*TBD*	*TBD*
Layer 1	*0*	*35*	*200*	*TBD*	*TBD*	*TBD*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
Extraction Total:	**150**	**0[c]**	**500[c]**	---	---		**5**	**4**	---	---
Injection Total:	**450[d]**	**150[d,e]**	**900[d,e]**	---	---		**4**	**3**	---	---

Notes:

Gray Italics denote future provisional wells.

gpm = gallons per minute

[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of the pre-final (90%) design submittal and are continuing to be evaluated.

[b] The pre-final nominal scenario assumes IRL-1 and IRL-2 will receive River Bank Extraction Well water (carbon-amended 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 or/and River Bank Extraction Well water during the lifetime of the remedy. IRL-1 and IRL-2 will be installed as dual-screen wells with the shallow screen (upper one-third of the saturated interval) separated from the deep screen (lower two-thirds of the saturated interval) with a pneumatic packer. The pre-final nominal scenario assumes injection of River Bank Extraction Well water into the deep screen only at IRL-1 and IRL-2. IRL-3 and IRL-4 will be installed with both a shallow screen (upper two-thirds of the saturated interval) and deep screen (lower one-third of the saturated interval). IRL-3 and IRL-4 will be designed to accommodate a pneumatic packer for potential future isolation of the shallow and deep screened intervals; however, under the pre-final nominal scenario, only fresh water will be injected into IRL-3 and IRL-4 and the shallow and deep screens in these wells will not be isolated.

[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 0 gpm and 500 gpm, respectively.

[d] Injection flow rate includes 300 gpm of fresh water for the nominal flow, up to 150 gpm of fresh water for the minimum 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 or IRL-7 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
Pre-Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Y
Transwestern Bench Extraction Wells										
TWB-1									7615903.03	2100962.45
Layer 1					11					
Layer 2					11					
Layer 3					11					
Layer 4	13	1	15	20	11	Single Screen Well (Layers 3 & 4)[e]	1	0		
TWB-2									7615993.88	2100972.00
Layer 1					8.3					
Layer 2					8.7					
Layer 3					8.7					
Layer 4	9	1	15	15	8.7	Single Screen Well (Layers 3 & 4)[e]	1	0		
TWB-3									*7615776.618*	*2101143.378*
Layer 1					*12*					
Layer 2					*13*					
Layer 3					*13*					
Layer 4	*0*	*1*	*15*	*25*	*13*	*Single Screen Well (Layers 3 & 4)e*	*0*	*1*		
TWB-4									*7616088.146*	*2100858.533*
Layer 1					*5.5*					
Layer 2					*5.9*					
Layer 3					*5.9*					
Layer 4	*0*	*1*	*15*	*20*	*5.9*	*Single Screen Well (Layers 3 & 4)[e]*	*0*	*1*		

TABLE 3.2-3

Pre-Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

	Pre-Final Injection/Extraction Rate per Model Layer (gpm)								Pre-Final Well Coordinates	
Well Location ID[a]	Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	X	Y
East Ravine Extraction Wells[b]										
ER-1									7616510.976	2101089.290
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-2									7616666.277	2100998.762
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
		2 Total	4 Total							
ER-3									7616855.469	2100897.942
Layer 1	0.5			90	30	Single Screen Well or Open Bore	1	0		
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	0		
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*	*0*	*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	0		
Layer 2					20					
Layer 3					20					
Layer 4					20					
ER-7									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					

TABLE 3.2-3
Pre-Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm) Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates X	Y
ER-8									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
ER-9									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
ER-10									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
ER-11									*TBD*	*TBD*
Layer 1	*0*	*0.5*	*1*	*TBD*	*TBD*	*Single Screen Well or Open Bore*	*0*	*1*		
Layer 2					*TBD*					
Layer 3					*TBD*					
Layer 4					*TBD*					
TCS Injection Wells										
TCS-1									7615167.690	2101171.376
Layer 1	6.75	2	20	50	37	Dual Screen Well	1	0		
Layer 2					21					
Layer 3	6.75	2	20	40	21					
Layer 4					25					
TCS-2									7615149.128	2100899.663
Layer 1	6.75	2	20	40	27	Dual Screen Well	1	0		
Layer 2					26					
Layer 3	6.75	2	20	40	27					
Layer 4					17					
Extraction Total:	**27**	**10[c]**	**75[c]**	---	---	---	**7**	**8**	---	---
Injection Total:	**27**	**10[c]**	**75[c,d]**	---	---	---	**2**	**0**	---	---

Notes:
Gray Italics denote future provisional wells.
gpm = gallons per minute
[a] Number of wells, total screen intervals, and screen depth placement at each well location ID are for purposes of the pre-final (90%) design submittal and are continuing to be evaluated. 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 discrete 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.

TABLE 3.2-3

Pre-Final Remediation Well Design Parameter Summary: TCS Recirculation Loop Wells

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design

PG&E Topock Compressor Station, Needles, California

	Pre-Final Injection/Extraction Rate per Model Layer (gpm)								Pre-Final Well Coordinates	
Well Location ID[a]	Nominal	Minimum	Maximum	Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	X	Y

[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 freshwater.

[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
Pre-Final Remediation Well Design Parameter Summary: Freshwater Injection Wells
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Well Location ID[a]	Pre-Final Injection/Extraction Rate per Model Layer (gpm)[b]			Pre-Final Well Screen Length (feet)	Model Layer Saturated Thickness (feet)	Pre-Final Well Depiction	Pre-Final Well Count	Pre-Final Future Provisional Well Count	Pre-Final Well Coordinates	
	Nominal	Minimum	Maximum						X	Y
FW-1									7613297.30	2102955.36
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 depth placement at each well location ID are for purposes of pre-final (90%) design submittal and are continuing to be evaluated. One well screen interval may include more than one model layer. A maximum of two discrete screen intervals will be included per individual well.

[b] Well testing will be conducted to assess specific injectivity per Section 4 of the O&M Plan (Appendix L, O&M Manual, Volume 1).

TABLE 3.6-1
Preliminary Construction of Proposed Groundwater Monitoring Wells
Groundwater Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

Monitoring Well Category / Location ID	Estimated Depth to Groundwater (ft bgs)	Estimated Saturated Thickness Above Bedrock (ft)	Estimated Depth to Bedrock (ft bgs)	Estimated Number of Intervals to be Monitored[1]	Estimated Length of Interval(s) to be Monitored (ft)[1]	Estimated Depths to be Monitored (ft bgs)[1]	
Arsenic Monitoring Well							
MW-AA	41	282	323	2	50	70 to 120	220 to 270
MW-BB	73	261	334	2	50	90 to 140	220 to 270
MW-CC	65	260	325	2	50	90 to 140	220 to 270
MW-DD	105	230	335	2	50	120 to 170	220 to 270
MW-EE [2]	105	228	333	2	50	120 to 170	220 to 270
MW-FF	105	201	306	2	50	120 to 170	220 to 270
MW-GG	111	199	310	2	50	120 to 170	220 to 270
MW-HH	86	90	176	1	50	100 to 150	
MW-II	83	93	176	1	50	100 to 150	

Notes:

[1] The screened intervals as shown are preliminary, and are based on assumptions in the current site conceptual model (primarily the total projected thickness of the unconsolidated aquifer) as well as the specific purpose of the proposed monitoring location. The number, length, and depths of the monitoring intervals for each location will be finalized concurrently with fieldwork. These decisions will be based on additional information collected during construction of the remedy well network.

[2] Pending future provisional monitoring well location

Abbreviations

ft = feet

ft bgs = feet below ground surface

IRL = Inner Recirculation Loop

NTH IRZ - National Trails Highway In-Situ Reactive Zone

TBD = To Be Determined

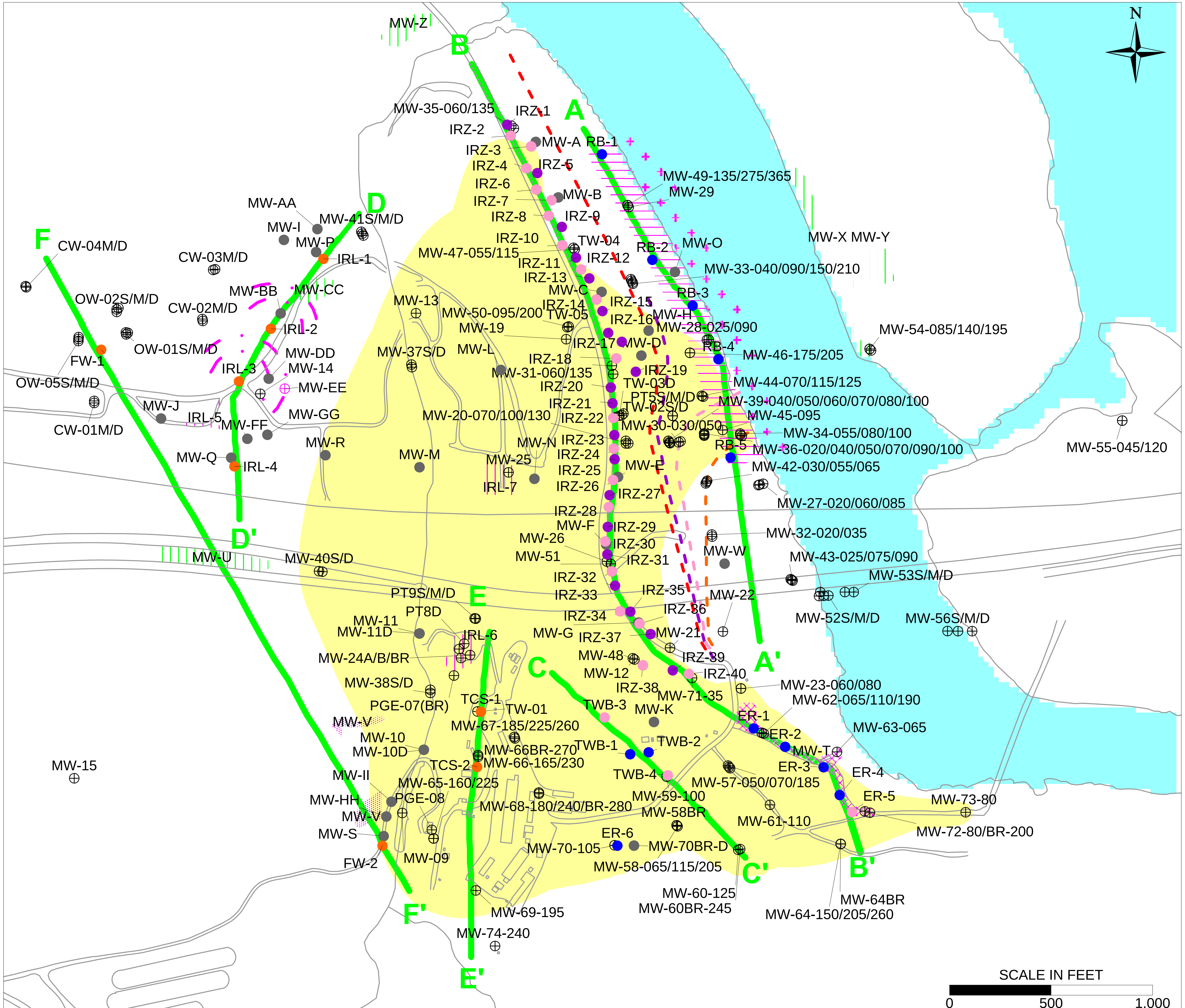
TCS = Topock Compressor Station

TABLE 3.6-2
Monitoring Well Design Matrix
Groundwater Remedy Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

Type of Monitoring[1]	Monitoring Objectives	Well ID	Estimated Saturated Thickness Above Bedrock	Estimated Number of Monitoring Intervals	Potential 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, R, and W	< 100 feet	1 to 2	10 to 20	Conventional, Nested	Multilevel
			100 to 280 feet	2 to 4	20 to 50	Nested	Conventional, Multilevel
Extraction Well Monitoring	Monitor water levels and average water quality near extraction wells at the northern end of the IRZ line, river bank (both the CA and AZ sides), and Transwestern Bench	A, B, H, K, O, T, W, X, Y, 70BR-D, and potential slant wells	< 100 feet	1 to 2	20 to 50	Conventional, Nested	Multilevel
			100 to 350 feet	2 to 4	20 to 50	Nested	Conventional, Multilevel
Plume Monitoring	Monitor average changes in chromium plume as the remediation progresses	L, N, U, V, Z, 10D, and 11D	90 to 390 feet	1 to 4	20 to 50	Conventional, Nested	Multilevel
Freshwater Injection Well Monitoring	Monitor water levels	J, Q, and S	150 to 220 feet	2 to 4	20 to 50	Nested	Conventional, Multilevel
Arsenic Monitoring	Monitor potential migration of arsenic from freshwater injection wells	AA, BB, CC, DD, EE, FF, GG, HH, II	90 to 280 feet	1 to 2	20 to 50	Conventional, Nested	Multilevel
COPC Monitoring	Monitor potential COPC migration	I, J, U, V, W	30 to 280 feet	1 to 4	20 to 50	Conventional, Nested	Multilevel

Notes:

[1] Basis for type of monitoring can be found in the O&M Manual Volume 2 Tables 2.1-1 (Monitoring Program Wells and Surface Water Sampling Points) and 2.6-1 (Monitoring Program Wells and Surface Water Sampling Points for COPC Monitoring)



LEGEND

- AREA FOR PROPOSED MONITORING WELL
- AREA FOR FUTURE PROVISIONAL IRL INJECTION WELL
- AREA FOR FUTURE PROVISIONAL EAST RAVINE EXTRACTION WELLS
- AREA FOR FUTURE PROVISIONAL RIVERBANK EXTRACTION WELLS
- AREA FOR PROVISIONAL MONITORING WELL
- AREA FOR POTENTIAL SLANT WELL SCREENS
- ARC FOR IRL-2 AND IRL-3 ARSENIC MONITORING WELLS
- CUMULATIVE HEXAVALENT CHROMIUM PLUME FOOTPRINT >32 ppb (12/31/2013)
- CROSS-SECTION LOCATIONS
- EXISTING MONITORING WELL LOCATIONS
- PROPOSED MONITORING WELL LOCATIONS
- PENDING/FUTURE PROVISIONAL MONITORING WELL LOCATIONS

PROPOSED REMEDIATION WELLS

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

APPROXIMATE EXTENT OF REDUCING RIND

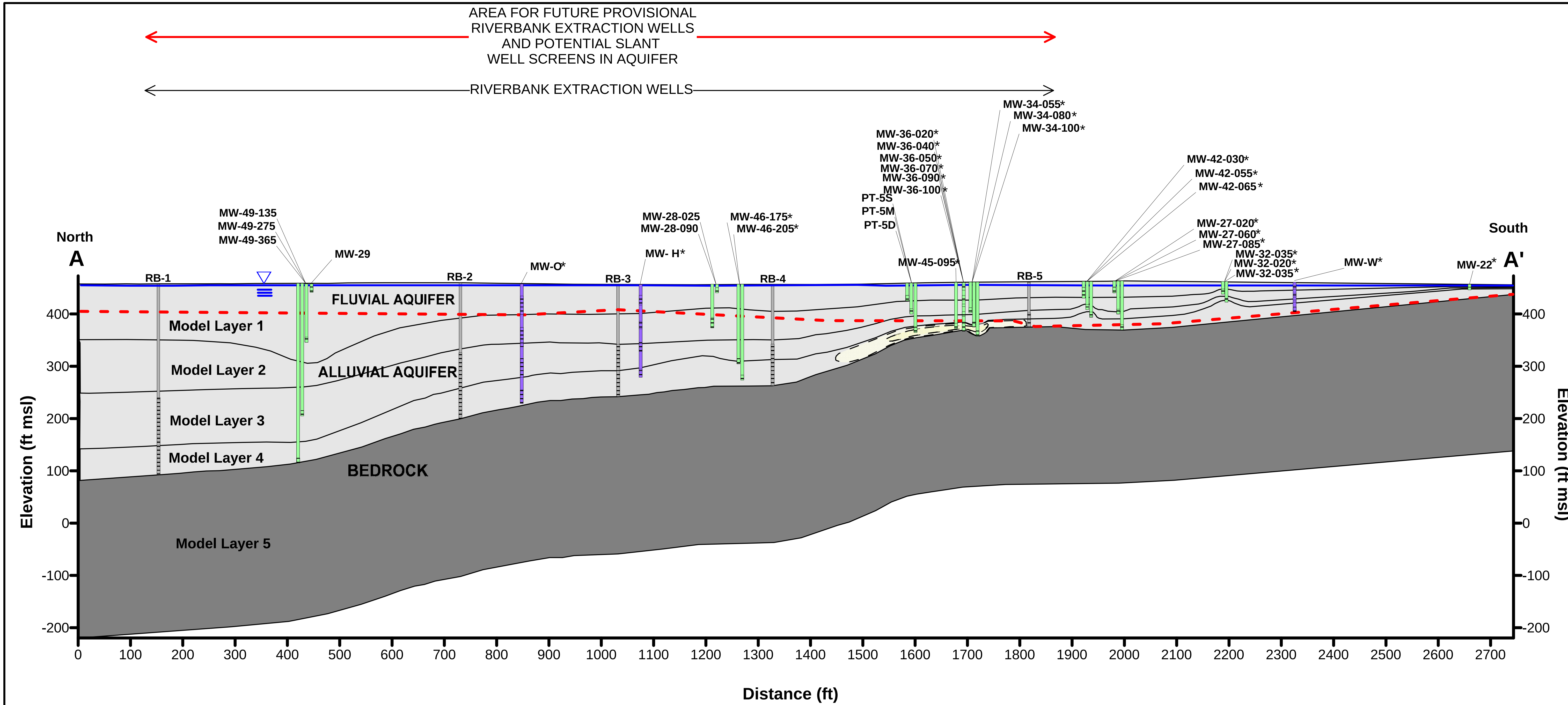
- MODEL LAYER 1
- MODEL LAYER 2
- MODEL LAYER 3
- MODEL LAYER 4

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

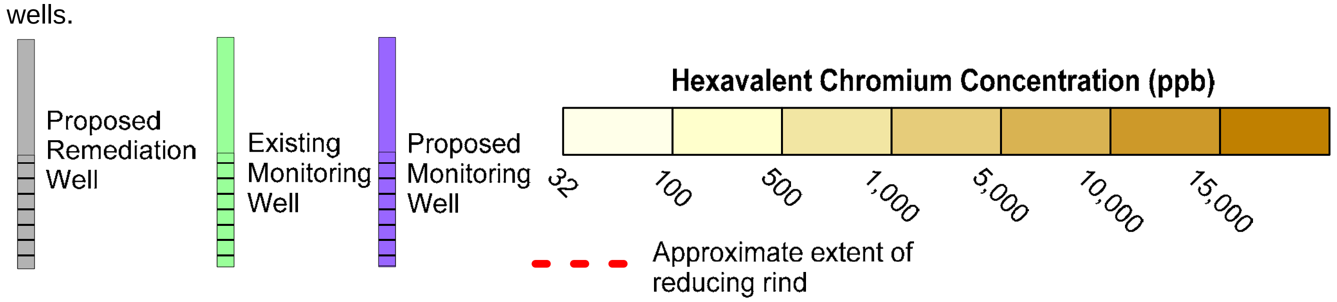
CONCEPTUAL FINAL GROUNDWATER REMEDY CROSS-SECTION LOCATIONS

ARCADIS

FIGURE 3.1-1



*Well is projected onto cross-section. Actual well screen elevations are honored in all wells. Model layer boudaries are adjusted to correlate to the projected wells.



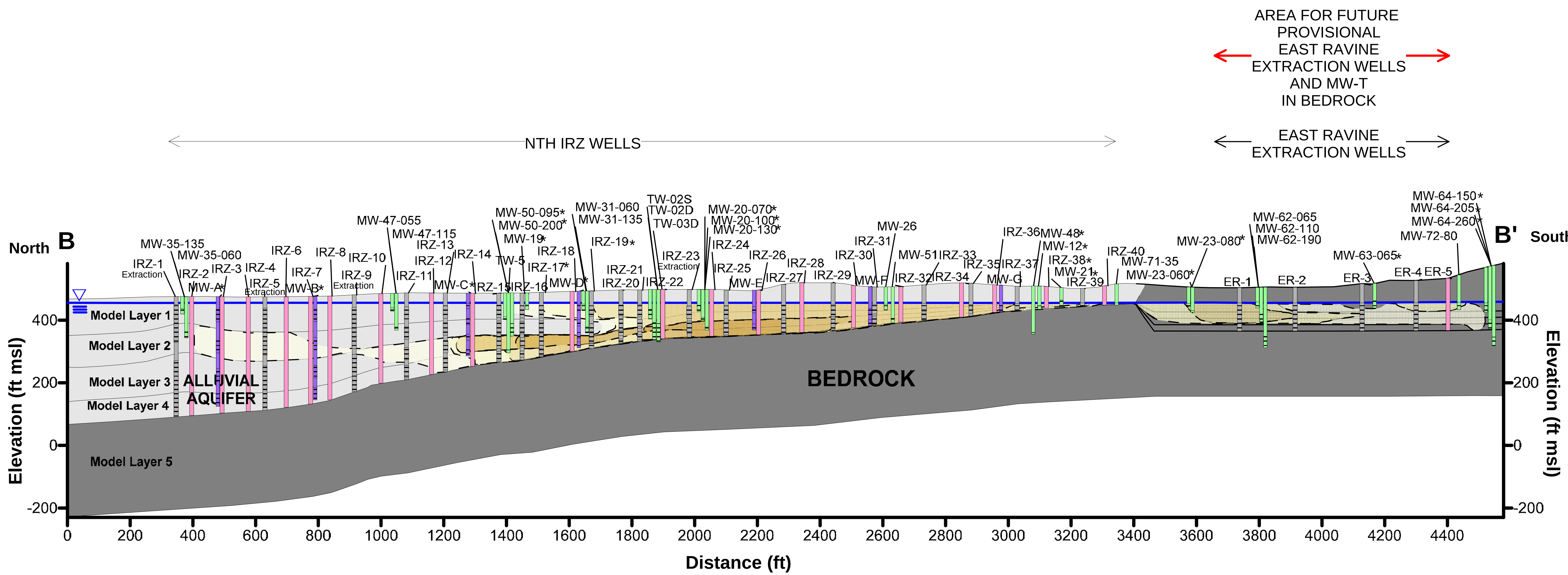
Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of pre-final (90%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. River Bank Extraction Wells (RB-1 to RB-5) 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
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

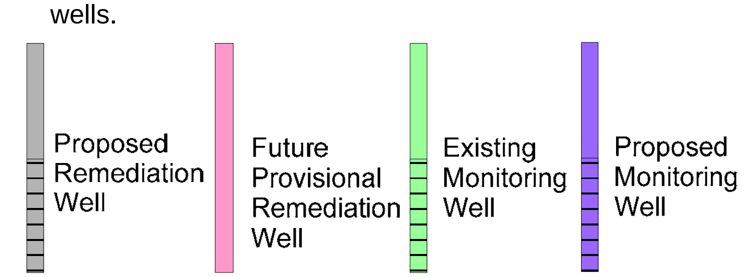
CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION A-A'

ARCADIS

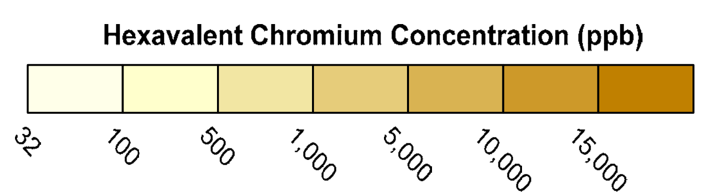
FIGURE
3.1-2



*Well is projected onto cross-section. Actual well screen elevations are honored in all wells. Model layer boudaries are adjusted to correlate to the projected wells.



Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of pre-final (90%) 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 remediation 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 (ER-1 to ER-4) are not expected to produce significant water and automated pump cycling could be required.

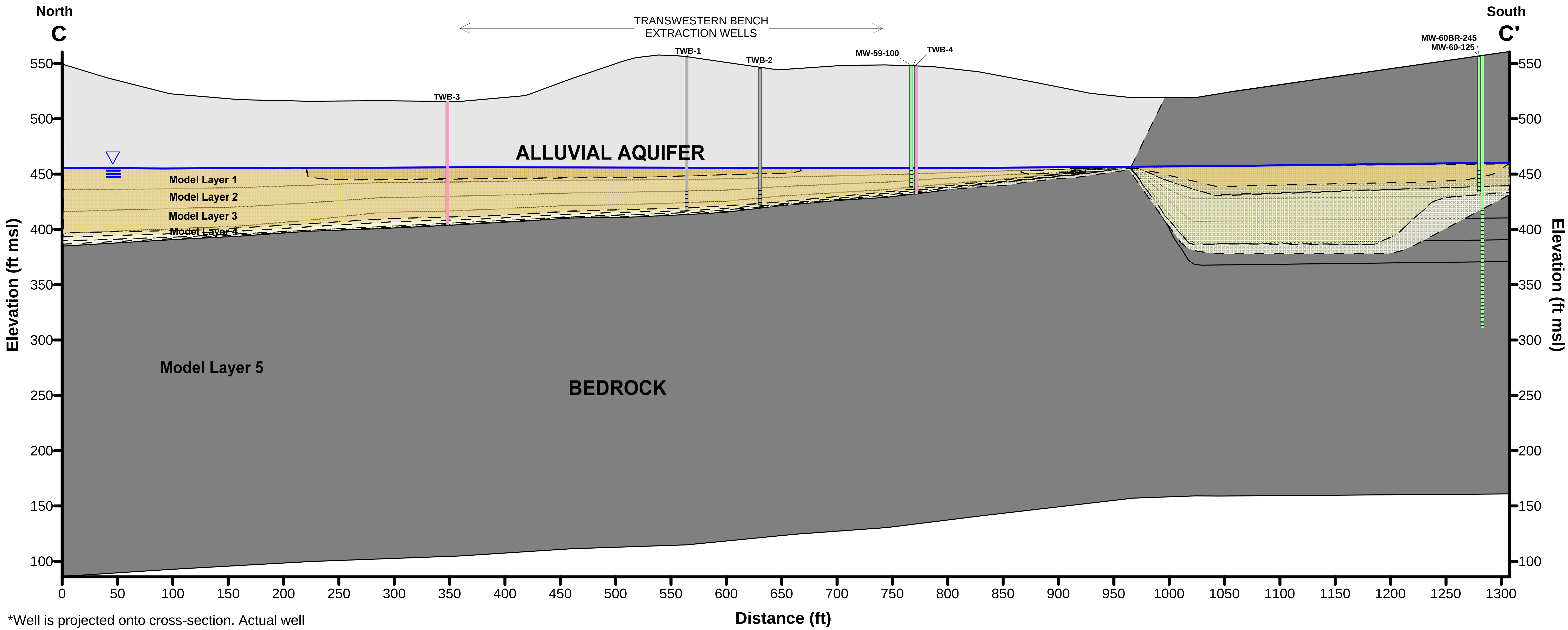


GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION B-B'

ARCADIS

FIGURE
3.1-3



*Well is projected onto cross-section. Actual well screen elevations are honored in all wells. Model layer boudaries are adjusted to correlate to the projected wells.

Proposed Remediation Well

Future Provisional Remediation Well

Existing Monitoring Well

Hexavalent Chromium Concentration (ppb)

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

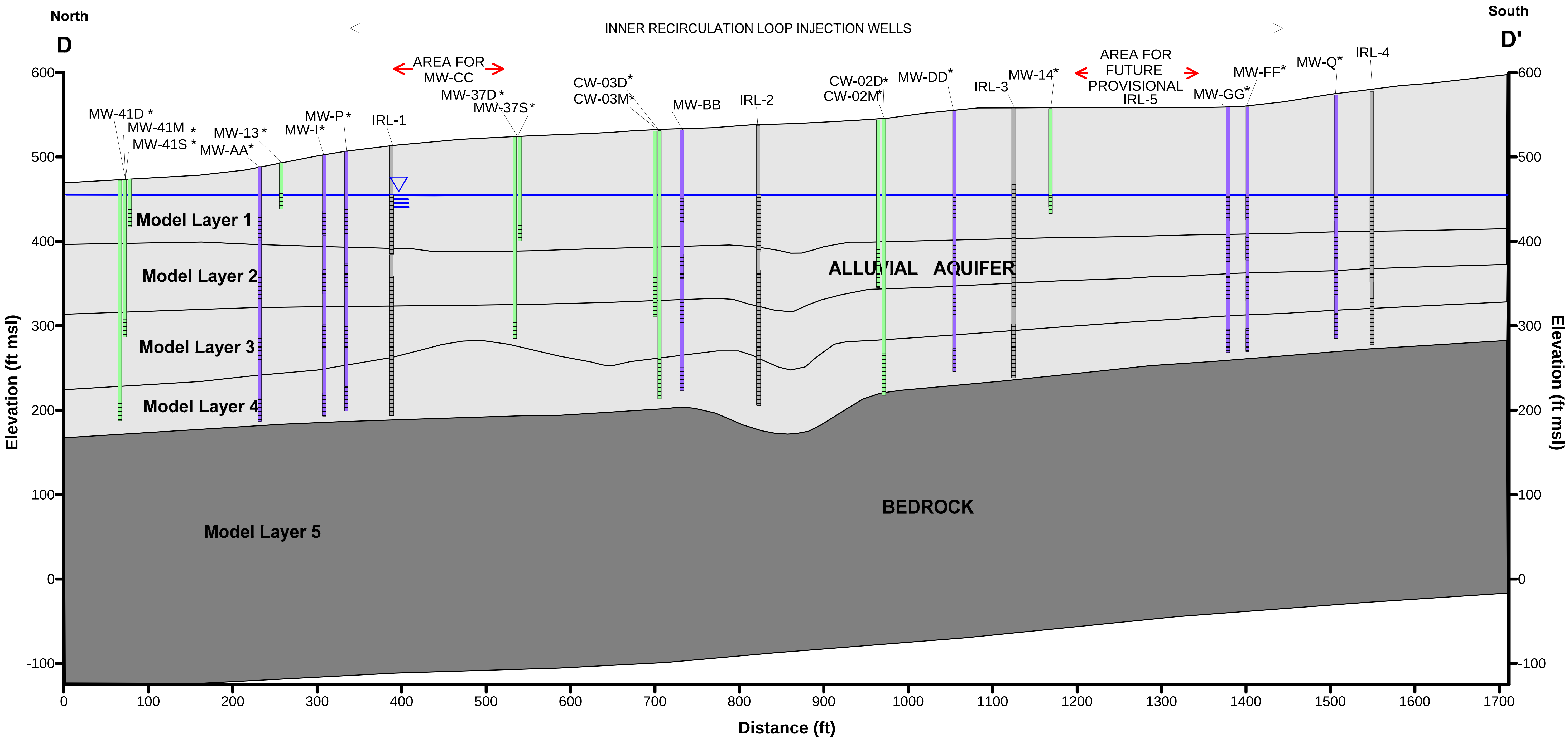
Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of pre-final (90%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. One well location ID may 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 remediation well. Dual screen wells will consist of one well with two discrete 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
PRE-FINAL (90%) 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 pre-final (90%) 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 remediation well. Dual screen wells will consist of one well with two discrete screen intervals separated by a packer (as appropriate).

*Well is projected onto cross-section. Actual well screen elevations are honored in all wells. Model layer boudaries are adjusted to correlate to the projected wells.

Proposed Remediation Well

Future Provisional Remediation Well

Existing Monitoring Well

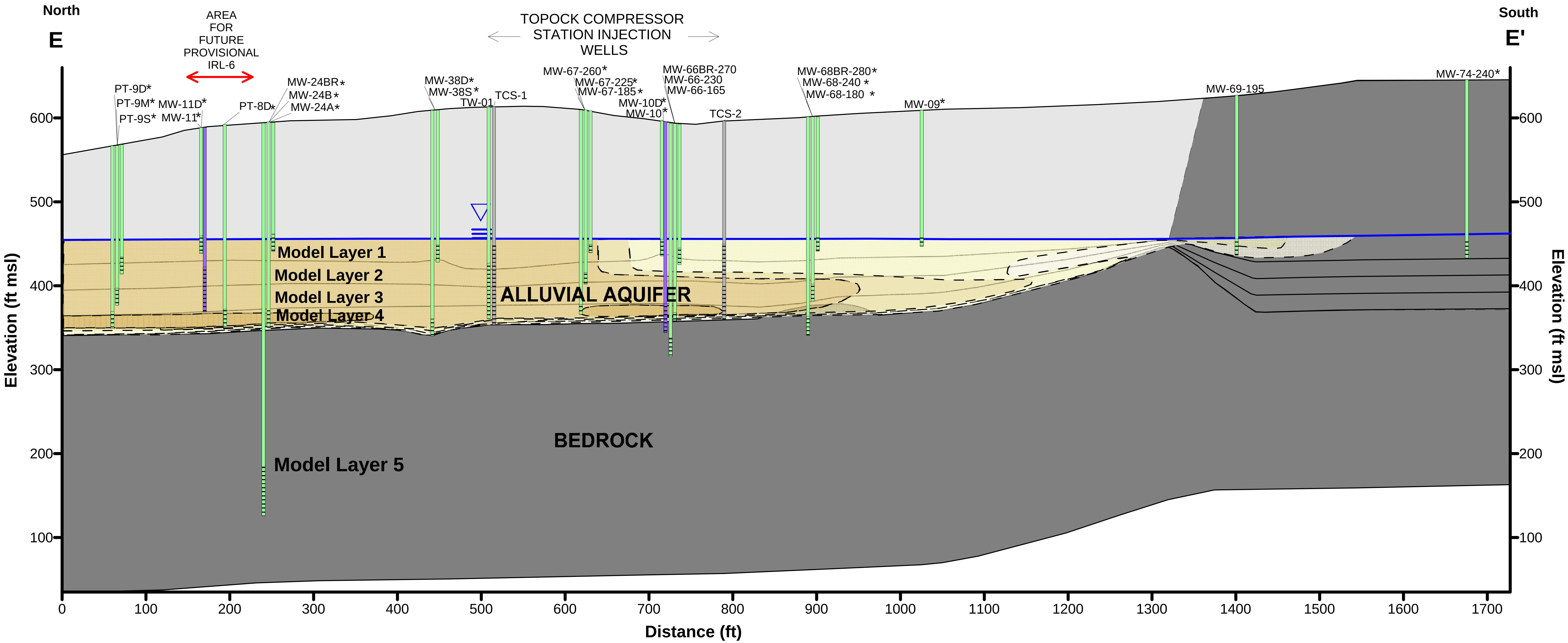
Proposed Monitoring Well

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION D-D'

ARCADIS

FIGURE
3.1-5



*Well is projected onto cross-section. Actual well screen elevations are honored in all wells. Model layer boudaries are adjusted to correlate to the projected wells.

Proposed Remediation Well

Future Provisional Remediation Well

Existing Monitoring Well

Proposed Monitoring Well

Hexavalent Chromium Concentration (ppb)

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

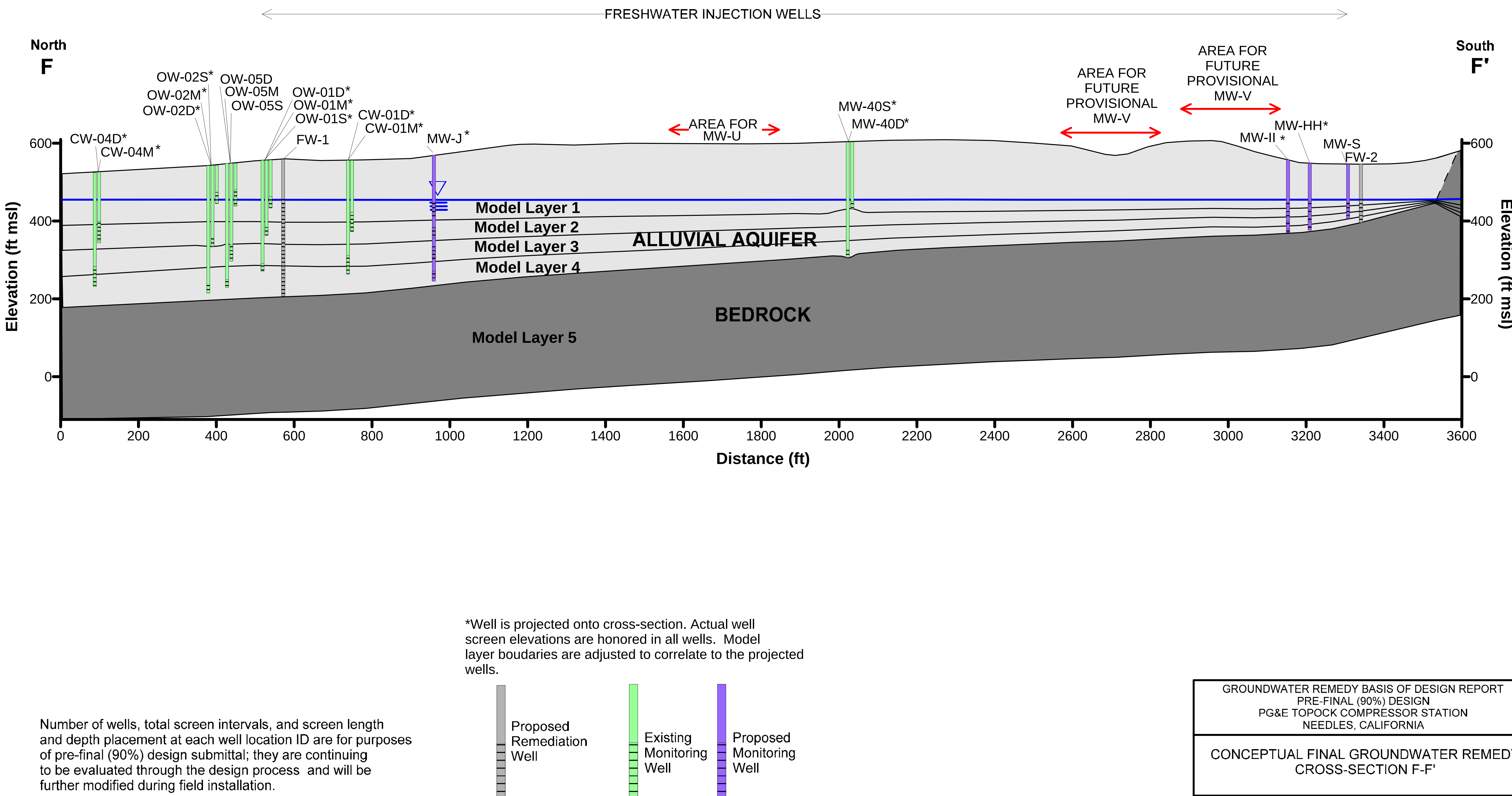
Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of pre-final (90%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation. One well location ID may 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 remediation well. Dual screen wells will consist of one well with two discrete screen intervals separated by a packer.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY
CROSS-SECTION E-E'

ARCADIS

FIGURE
3.1-6



*Well is projected onto cross-section. Actual well screen elevations are honored in all wells. Model layer boudaries are adjusted to correlate to the projected wells.

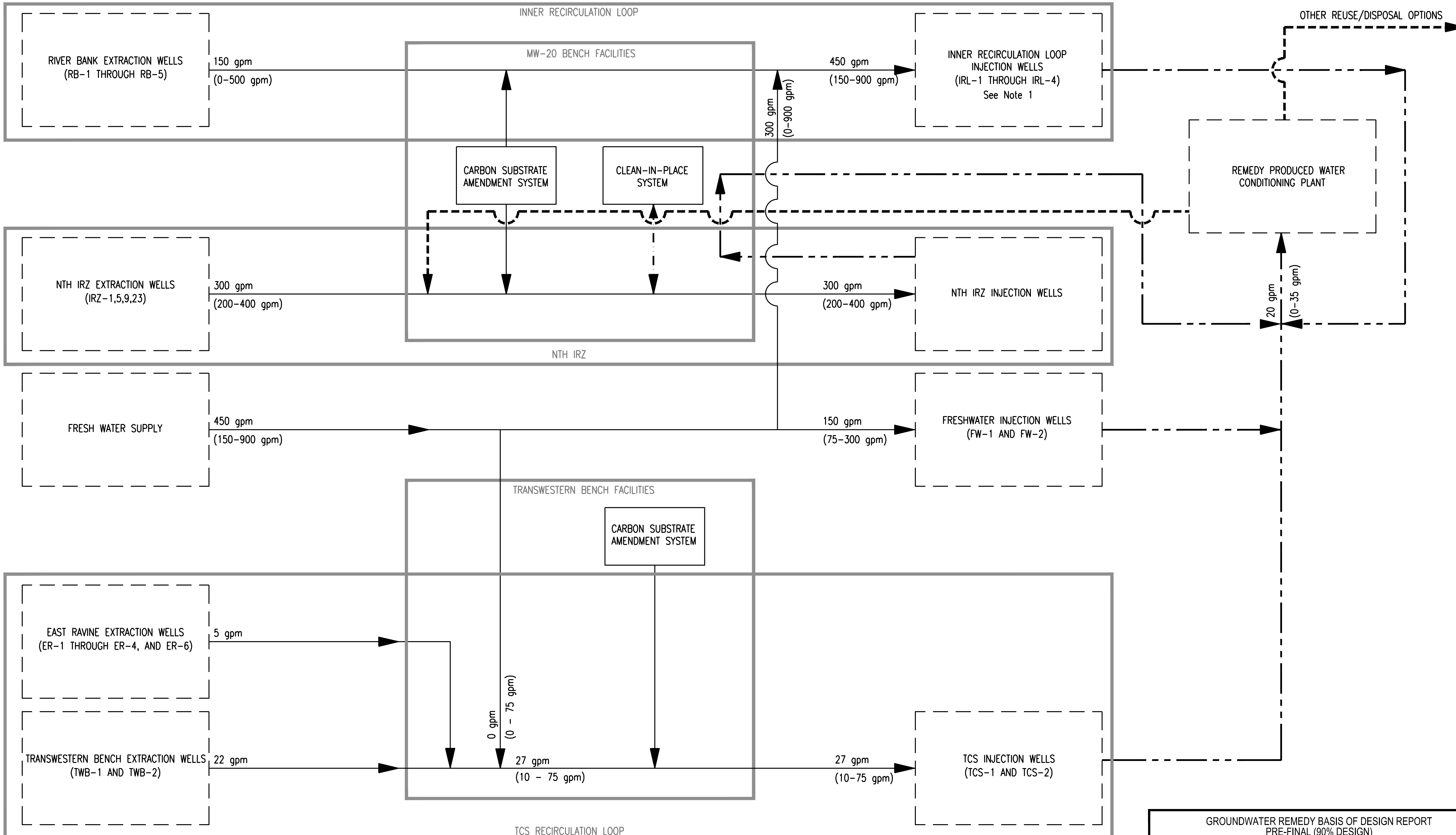
Number of wells, total screen intervals, and screen length and depth placement at each well location ID are for purposes of pre-final (90%) design submittal; they are continuing to be evaluated through the design process and will be further modified during field installation.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) 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
CLEAN-IN-PLACE LINE
REMEDY PRODUCED WATER LINE (BACKWASH)
TREATED WATER LINE

150 gpm	NOMINAL FLOW RATE
(0-500)	REASONABLE MINUMUM - MAXIMUM FLOW RATE
gpm	GALLONS PER MINUTE
NTH	NATIONAL TRAILS HIGHWAY
IRZ	IN-SITU REACTIVE ZONE
TCS	TOPOCK COMPRESSOR STATION

NOTE:

1. The pre-final (90% design) nominal scenario assumes IRL-1 and IRL-2 will receive River Bank Extraction Well water (carbon-amended if hexavalent chromium concentrations in the River Bank Extraction Wells exceed the clean-up goal) to the lower two-thirds of the saturated interval; and IRL-3 and IRL-4 will receive freshwater.

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90% DESIGN)
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CONCEPTUAL FINAL GROUNDWATER REMEDY PRE-FINAL (90%) SYSTEM FLOW DIAGRAM

ARCADIS

FIGURE
3.2-1

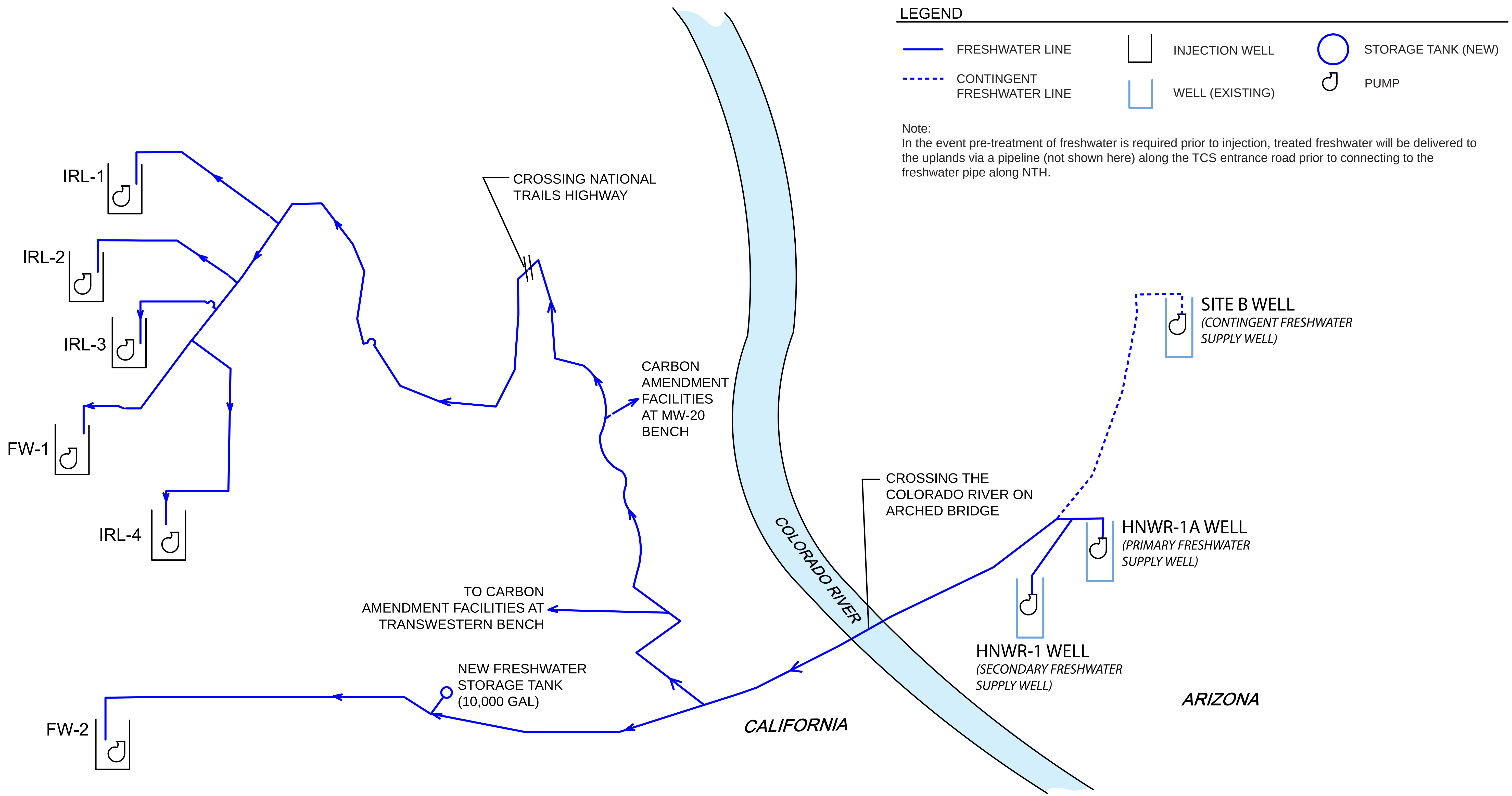


FIGURE 3.3-1
REMEDY FRESHWATER PIPELINE SCHEMATIC
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.

ES102411163118BAO_Fig_3-3-1_FreshwaterPipelineSchematic_v2.ai_082214_lho

LEGEND

- - - - Underground Gas Supply Pipe

■ Proposed Remedy Structure

Notes:

1. All remedy structure locations are approximate.
2. An alternate method of supplying power to the pumps and agitators is by direct connection to the compressor station power system. With this alternative, the new electrical conductors will be installed along the right-of-way that currently contains the discharge pipeline that carries water from the compressor station to the ponds. A small control building or panel would be installed to house the pond controls and communications equipment. PG&E is evaluating this option and will include the selected power supply method in the final (100%) design.

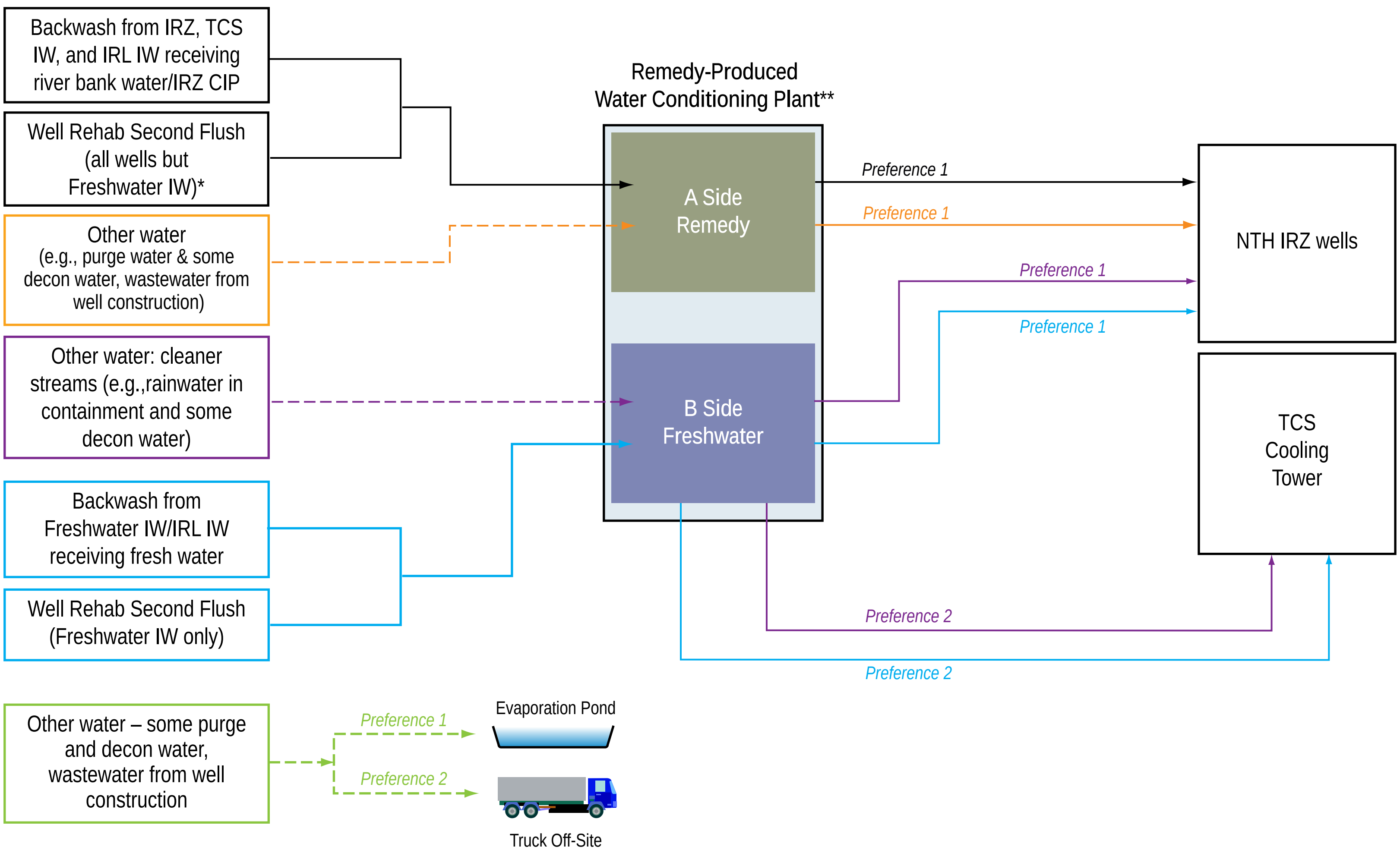
N

0 75 150 300 Feet

FIGURE 3.4-1
LAYOUT OF EVAPORATION ENHANCEMENT EQUIPMENT AT THE TCS EVAPORATION PONDS
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MAPFILES\2014\CMS\DESIGN90\FIG341_POND_PHOTO.MXD ECLARK1 8/20/2014 11:55:22 AM



LEGEND

Piping

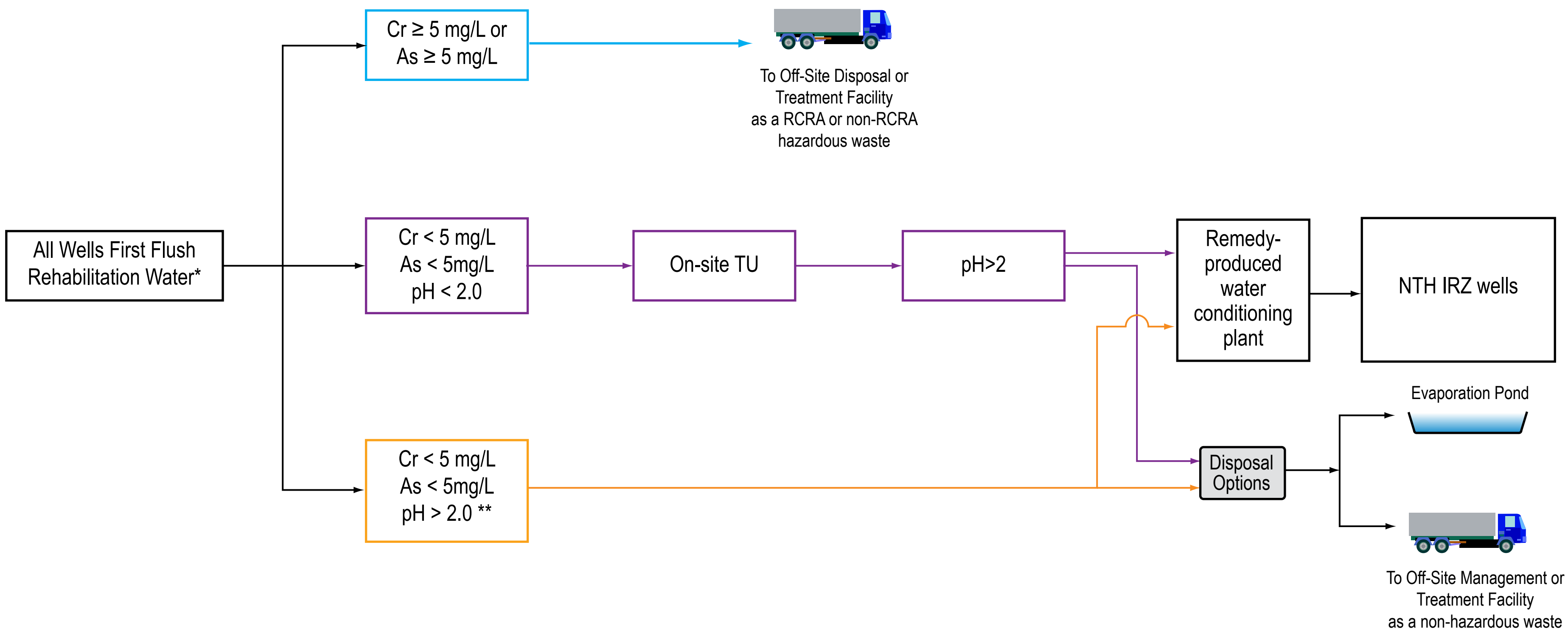
Conveyed by truck

* 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.

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 3.4-2
REMEDY-PRODUCED WATER SCHEMATIC – BACKWASH AND SECOND FLUSH REHABILITATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



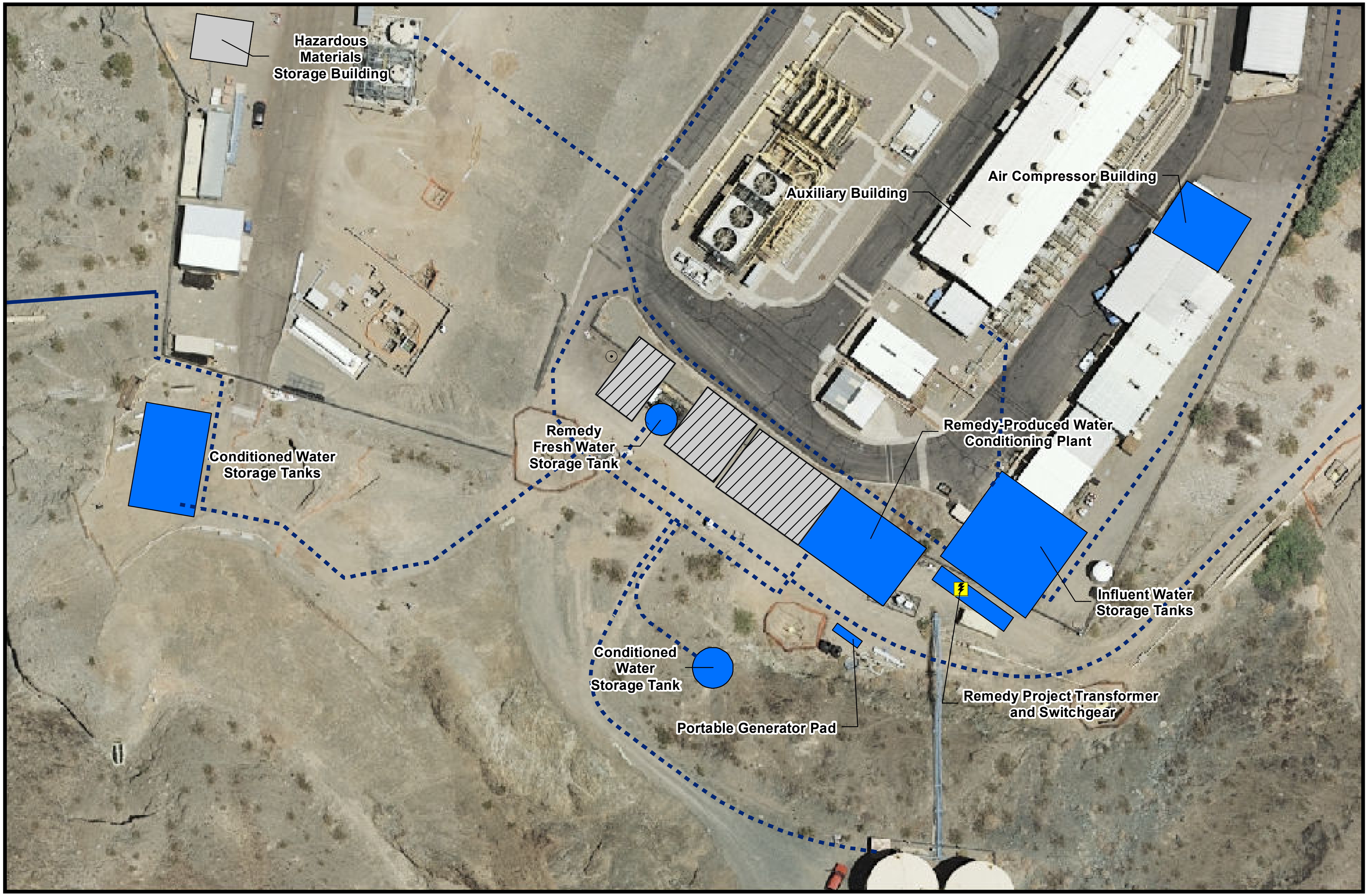
LEGEND

Piping

Conveyed by truck

TU Treatment Unit permitted for (pH adjustment) hazardous waste treatment per California Code of Regulations Title 22. TU may be equipped with filters to remove solids.
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
RCRA Resource Conservation and Recovery Act

FIGURE 3.4-3
REMEDY-PRODUCED WATER SCHEMATIC – FIRST FLUSH REHABILITATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

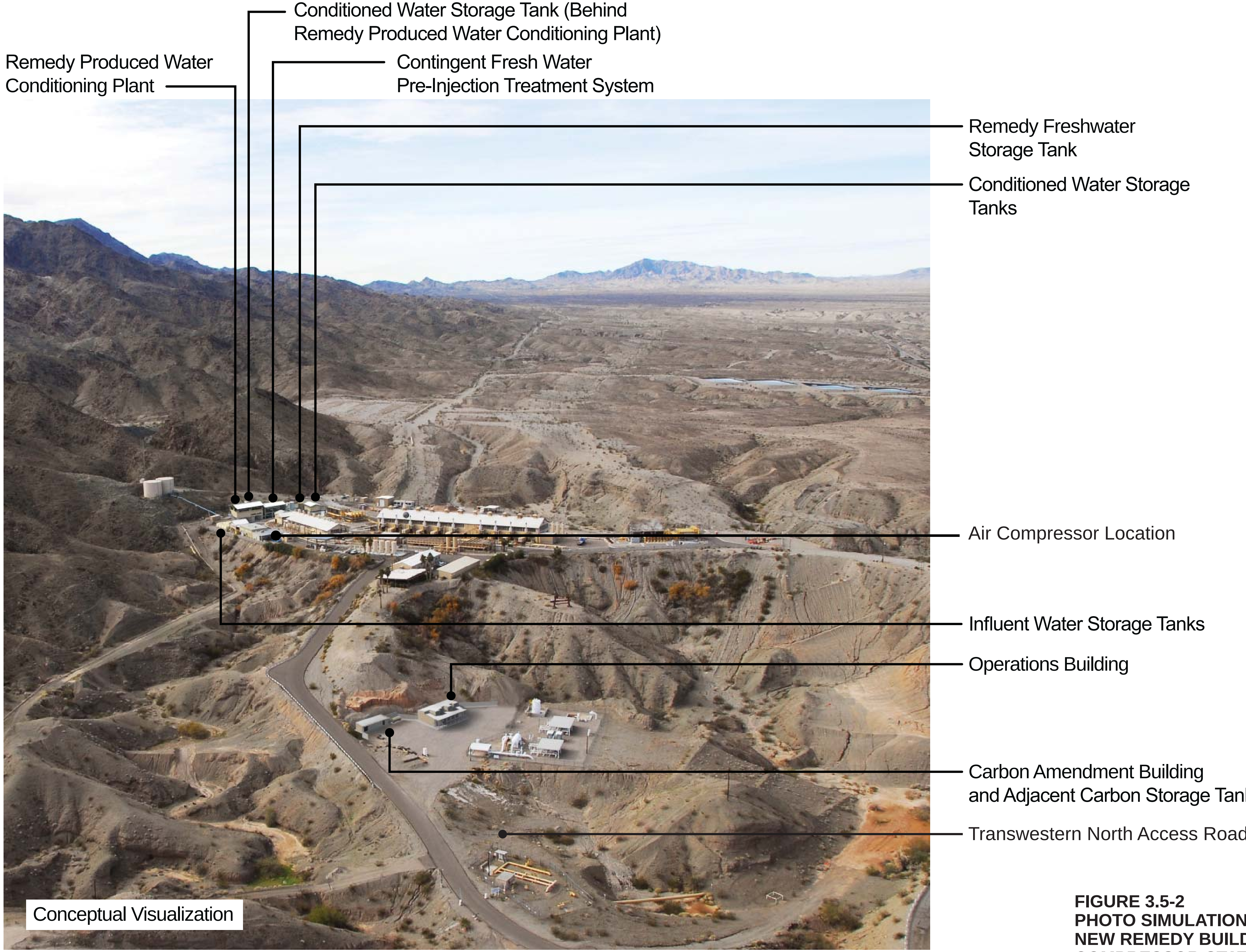


LEGEND

- Electrical Transformer
- Aboveground Pipe
- Underground Pipe/Conduit
- Proposed Remedy Structure
- Contingent Freshwater Pre-injection Treatment System

Notes:
1. All remedy structure locations are approximate.
2. An equipment decontamination pad will be installed in the footprint of the Contingent Freshwater Pre-injection Treatment Building (first grey area right immediately adjacent to the Remedy-Produced Water Conditioning Plant).

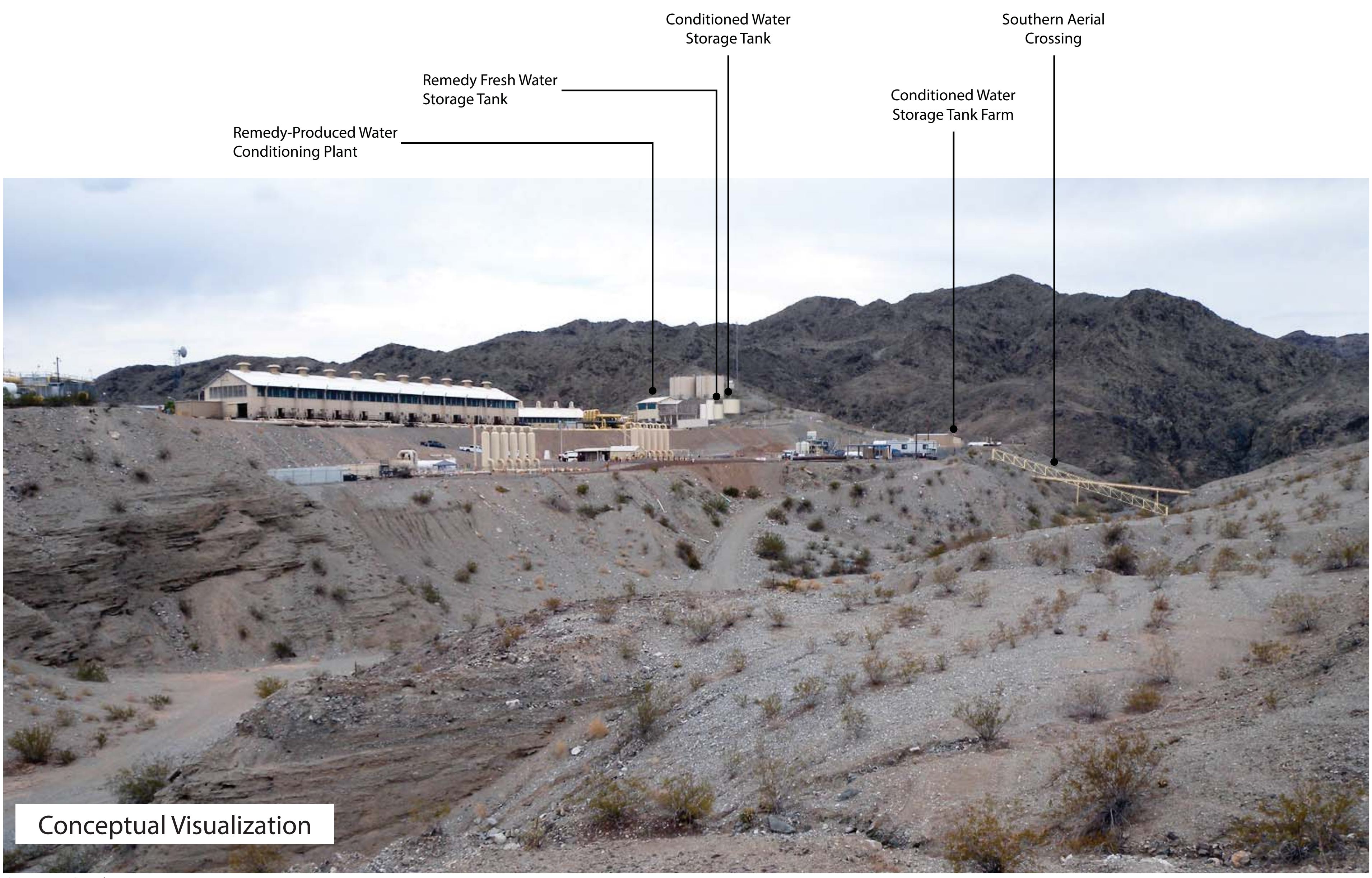
FIGURE 3.5-1
LAYOUT OF NEW REMEDY BUILDINGS AND STRUCTURES INSIDE THE COMPRESSOR STATION
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA



Source: IDC Architects 2014.

FIGURE 3.5-2
PHOTO SIMULATION OF NEW REMEDY BUILDINGS/STRUCTURES IN COMPRESSOR STATION AND TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Source: AECOM, January 2011.



Source: IDC Architects 2014

FIGURE 3.5-3
PHOTO SIMULATIONS OF EIR KEY VIEW 2 VS. 90% DESIGN
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.

LEGEND

- Future Provisional Extraction Well
- Proposed Electrical Transformer Location
- Access Routes
- Underground Pipe/Conduit
- Proposed Remedy Structure

Note:
All wells and remedy structure locations are approximate.

FIGURE 3.5-4
LAYOUT OF NEW REMEDY BUILDINGS AND STRUCTURES AT THE TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Source: IDC Architects 2014.

FIGURE 3.5-5
PHOTO SIMULATION OF NEW REMEDY BUILDINGS AND STRUCTURES AT THE TRANSWESTERN BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

Carbon Amendment Building

Operations Building

Source: IDC Architect 2014.

FIGURE 3.5-6
PHOTO SIMULATION OF NEW OPERATIONS FACILITY – VIEW FROM I-40
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

LEGEND

Existing Wells:
- Extraction Well
- Injection Well
- Monitoring Well

Provisional Wells:
- Injection Well

Planned Wells:
- Extraction, NTH IRZ
- Injection, NTH IRZ
- Remedy Monitoring Well

- Proposed Electrical Transformer Location
- Underground Pipe/Conduit
- Proposed Remedy Structure

Note:
All remedy structure locations are approximate

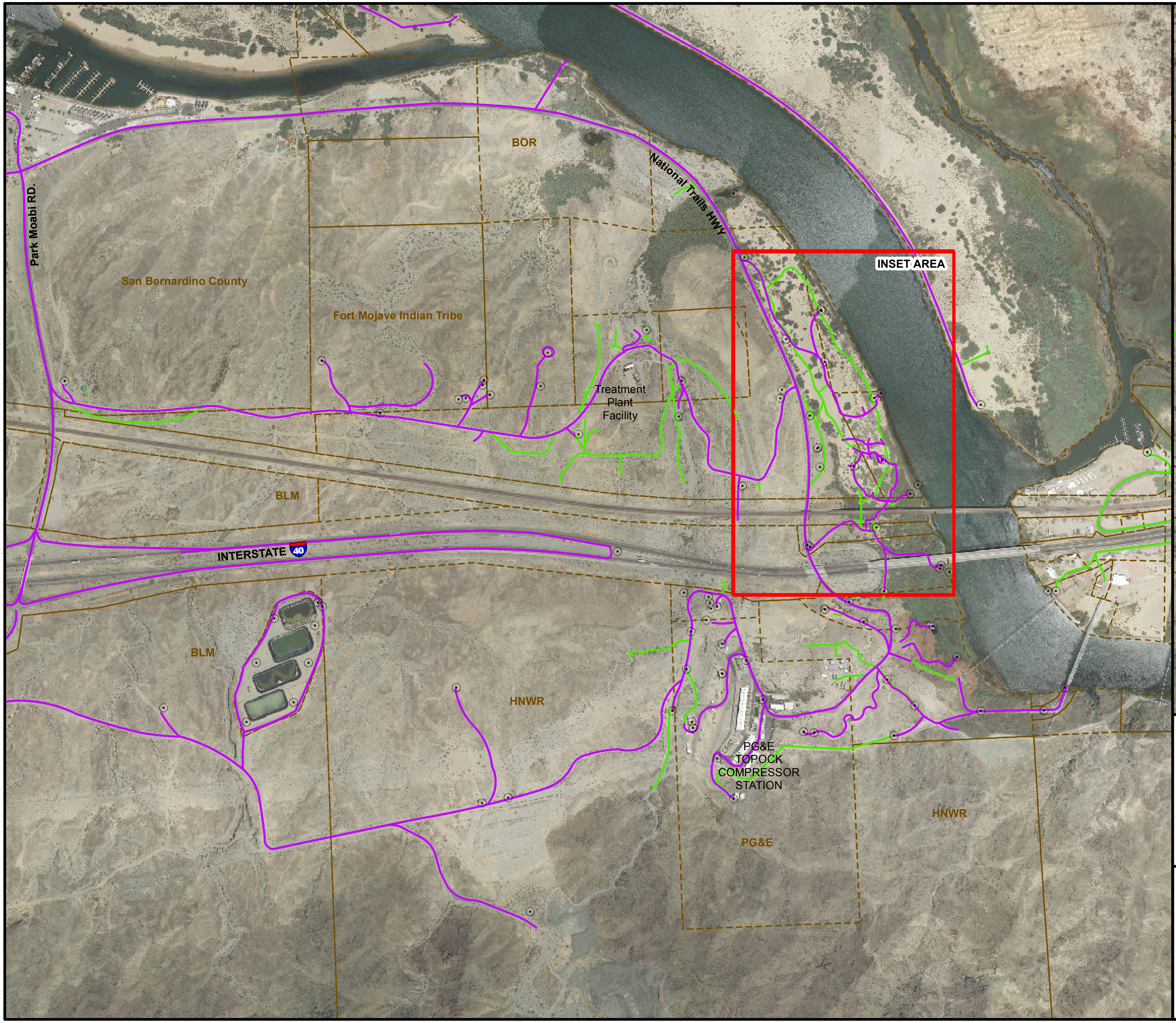
FIGURE 3.5-7
LAYOUT OF NEW REMEDY BUILDING AND STRUCTURES AT THE MW-20 BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN,
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

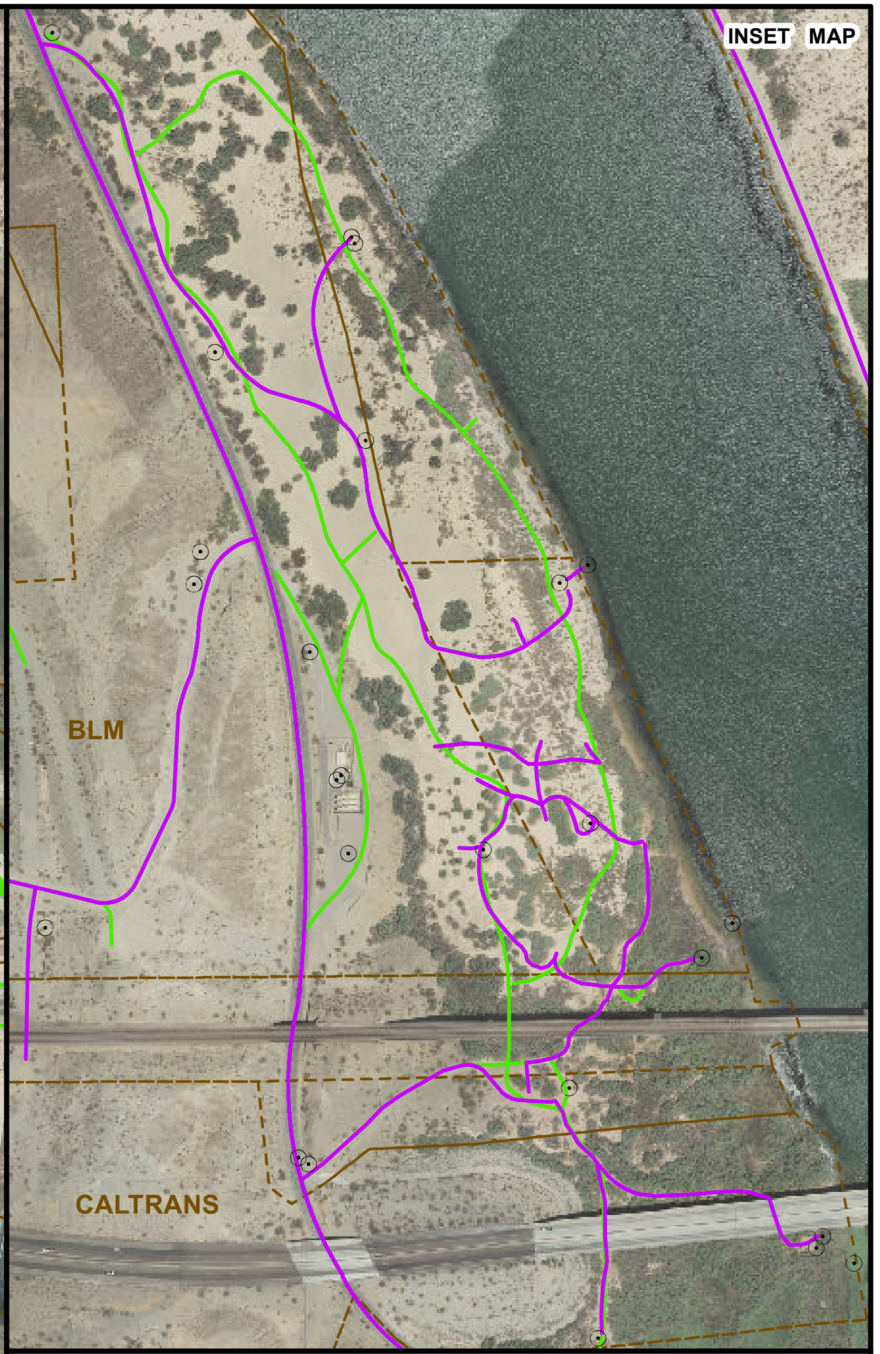
Document Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG357_MW20_Facilities.mxd

Source: IDC Architects, April 2013.

FIGURE 3.5-8
PHOTO SIMULATION OF NEW REMEDY BUILDING AT THE MW-20 BENCH
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL.





LEGEND

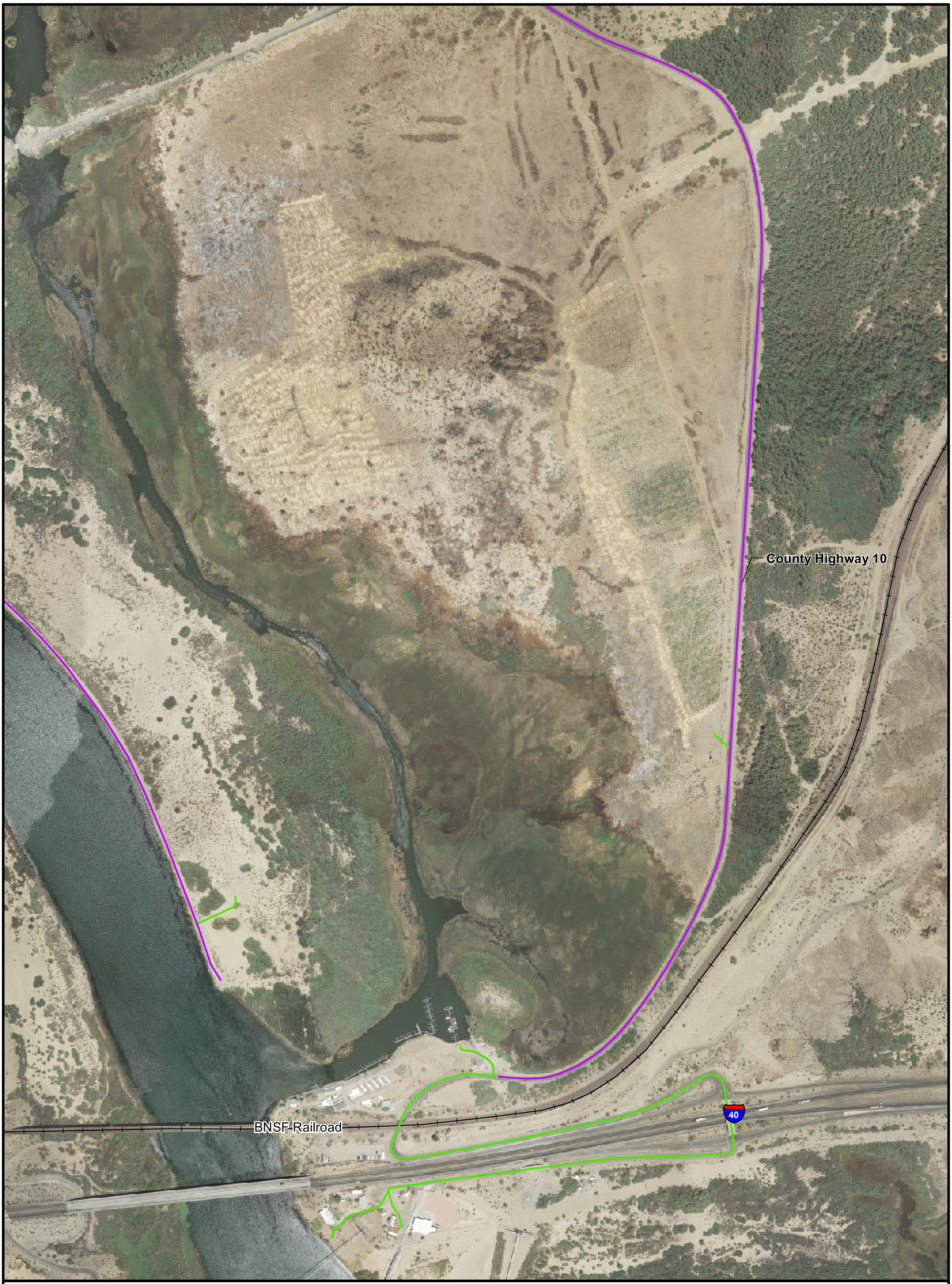
- Existing Well
- Existing Access Route
- New Remedy Access Route

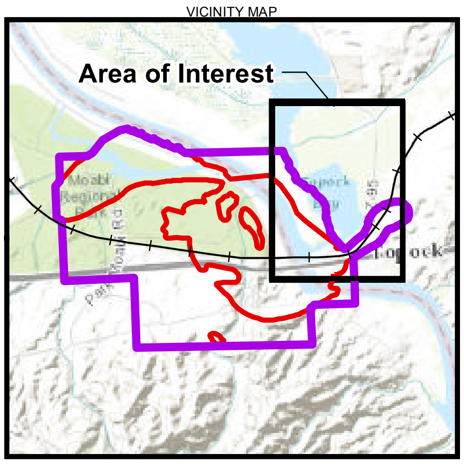
Note:
1. The groundwater remedy will utilize existing and new access routes.
2. Additional routes may be required for future provisional wells.
3. New route locations are approximate

FIGURE 3.5-9A
PROPOSED ACCESS ROUTES FOR REMEDY FEATURES - CALIFORNIA
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG359A_AccessRoutes_CA.mxd Date Saved: 8/22/2014 11:06:35 AM





LEGEND

Existing Access Route

New Remedy Access Route

Note:
1. The groundwater remedy will utilize existing and new access routes.
2. Locations for access routes are approximate.

N

0 200 400 800 Feet

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

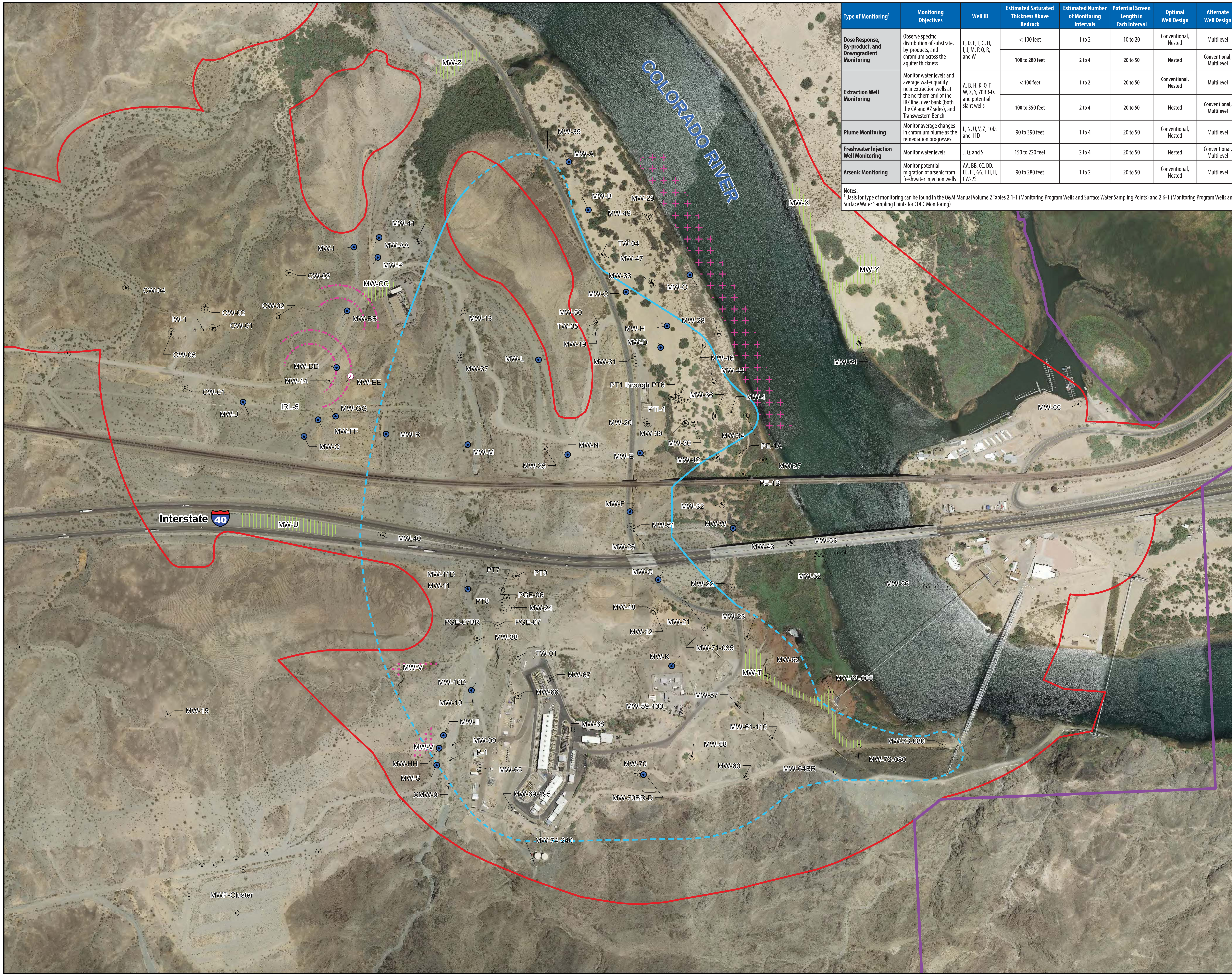
FIGURE 3.5-9B
PROPOSED ACCESS ROUTES FOR REMEDY FEATURES - ARIZONA
GROUNDWATER BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG359B_AccessRoutes_AZ.mxd

Type of Monitoring[1]	Monitoring Objectives	Well ID	Estimated Saturated Thickness Above Bedrock	Estimated Number of Monitoring Intervals	Potential 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, R, and W	< 100 feet	1 to 2	10 to 20	Conventional, Nested	Multilevel
			100 to 280 feet	**2 to 4**	**20 to 50**	**Nested**	**Conventional, Multilevel**
Extraction Well Monitoring	Monitor water levels and average water quality near extraction wells at the northern end of the IRZ line, river bank (both the CA and AZ sides), and Transwestern Bench	A, B, H, K, O, T, W, X, Y, 70BR-D, and potential slant wells	**< 100 feet**	**1 to 2**	**20 to 50**	**Conventional, Nested**	**Multilevel**
			100 to 350 feet	**2 to 4**	**20 to 50**	**Nested**	**Conventional, Multilevel**
Plume Monitoring	Monitor average changes in chromium plume as the remediation progresses	L, N, U, V, Z, 10D, and 11D	90 to 390 feet	1 to 4	20 to 50	Conventional, Nested	Multilevel
Freshwater Injection Well Monitoring	Monitor water levels	J, Q, and S	150 to 220 feet	2 to 4	20 to 50	Nested	Conventional, Multilevel
Arsenic Monitoring	Monitor potential migration of arsenic from freshwater injection wells	AA, BB, CC, DD, EE, FF, GG, HH, II, CW-2S	90 to 280 feet	1 to 2	20 to 50	Conventional, Nested	Multilevel

Notes:
[1] Basis for type of monitoring can be found in the O&M Manual Volume 2 Tables 2.1-1 (Monitoring Program Wells and Surface Water Sampling Points) and 2.6-1 (Monitoring Program Wells and Surface Water Sampling Points for COPC Monitoring)



LEGEND

- Area of Potential Effects (APE)
- EIR Project Area

Existing Wells:

- Monitoring Well

Provisional Wells:

(Items in Pink are Provisional)

- Monitoring Well (MW-EE is a pending/future provisional monitoring well)
- Arc for IRL-2 and IRL-3 Arsenic Monitoring Wells [1]
- Area for Potential Slant Well Screens
- Area for Monitoring Well (MW-V)

Planned Wells:

- Remedy Monitoring Well
- Area for Monitoring Well (Applies to MW-CC, MW-T, MW-U, MW-X, MW-Y, and MW-Z)
- Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013sampling events. Dashed where based on limited data.

Note:
1. Arcs for IRL-2 and IRL-3 arsenic monitoring wells represent a range of potential well locations. Portions of the arcs are not suitable for well installation due to technical and/or cultural resources constraints.
2. All planned and provisional monitoring well locations are approximate.

N

0 210 420 840 Feet

FIGURE 3.6-1
PROPOSED MONITORING WELL NETWORK
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

ES102411163118BAO_Fig_3-6-1_Prop_MW_Network.indd_090414_lho

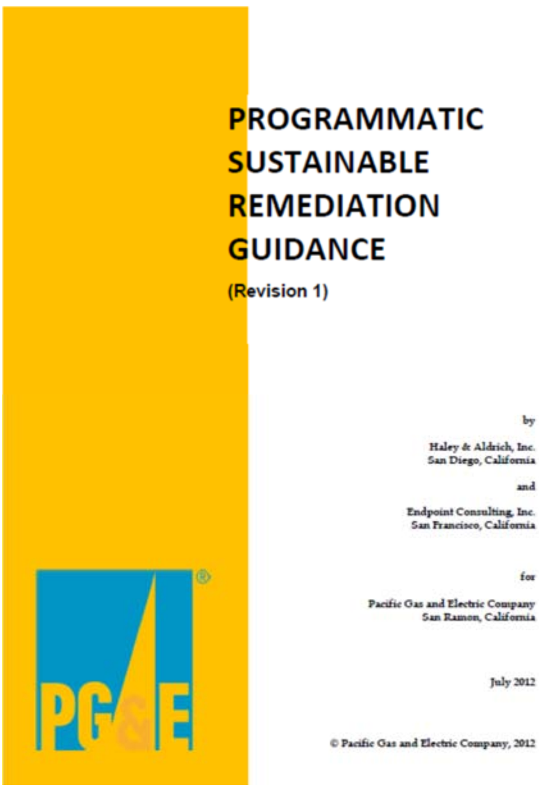
Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG361_91pct_MWonly_LS.mxd

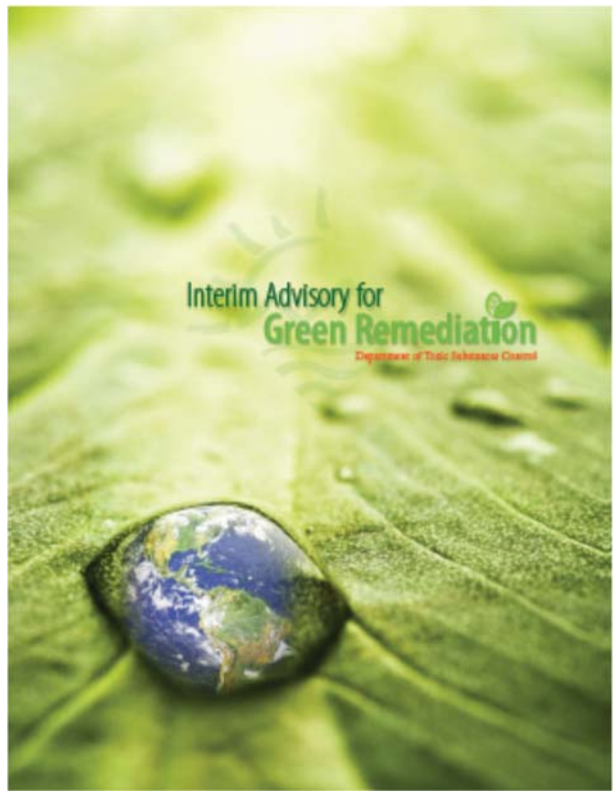
CH2MHILL

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 2011) 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 2012a) (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 90% 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 increased efficiency in long-term O&M. Achieving reduction of the overall project life cycle and increased efficiency in long-term O&M 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 approximately 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 90% 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 2012a), 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
Groundwater Remedy Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

	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 the groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under an 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 increased efficiency in long-term operations and maintenance (O&M). Achieving overall life cycle reductions and increased efficiency in long-term O&M 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**							
	Greenhouse Gas (GHG) Emissions	Air	Atmospheric warming	The following are examples of concepts that have been integrated in the remedial design and/or will be considered in remedy implementation: 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 as well as guiding principles outlined in the *Federal Leadership in High Performance and Sustainable Building Memorandum of Understanding* (USEPA 2006): 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. d) Enhanced indoor environmental quality by employing overhang that shades the Operations Building northern skylights most of the year, allowing for constant natural light and roof-reflected light to flood the building. e) Enhanced indoor environmental quality while optimizing energy performance by employing a mass wall for the Operations Building that delays approximately 4-6 hours of high outdoor heat and therefore reduces the amount of energy required for cooling during business hours. The building walls reject the heat back to the exterior at night time when it is cooler. 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) Integrated 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	
	Liquid Waste Production	Water	Water toxicity/ sediment toxicity/ sediment	The following are examples of concepts that have been integrated in the remedial design: i) Reduce brine production and disposal 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) Evaluated the effectiveness of Aqua Gard technology at IM injection wells to reduce waste stream disposal volume, and incorporated into well design for fresh water injection wells. v) Conducted 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. vi) Conducted a trial of alternative groundwater sampling approaches to further reduce the overall sampling footprint (e.g., reduce purge water generation and management, reduce time spent at each well, minimize potential impacts to sensitive resources) while maintaining or increasing data quality. With DTSC's approval in June 2014, micro-purge sampling technique is being implemented site-wide.	Quantitative	% Reduction in liquid waste production	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
	Solid Waste Recycling or Salvaging (Excluding Soil)	Land	Land use	The following are examples of concepts that have been integrated in the 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 remedy design incorporates the concept of shared use of existing facilities at TCS (e.g., the shared use of the Compressor Station's Hazardous Material Storage Building) to avoid the need for construction of new facilities. iv) The remedy design incorporates all existing monitoring wells, thereby minimizing the number of new wells to be installed. Similarly, the design incorporates most existing access roads and pathways, thereby minimizing the number of new access roads to be built. v) The design also incorporates the approach established in the technical memorandum titled *Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, CA* (PG&E 2012b). The approach is intended to minimize the amount of displaced material	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
Groundwater Remedy Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

	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 the groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under an 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 increased efficiency in long-term operations and maintenance (O&M). Achieving overall life cycle reductions and increased efficiency in long-term O&M 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.							
				that leaves the site and instead provide for eventual return, reuse, or restoration of the material onto the lands from which it was displaced. The approach also minimizes the need for transportation of a portion of the offsite fill material that would have been required.				
ENVIRONMENT	**Resource Depletion/Gain (Recycling)**							
	Energy Use	Subsurface	Consumption	The following are examples of concepts that have been considered/integrated in the remedial design: i) Use energy generated from non-petroleum sources where possible, such as small photovoltaic solar panels at select remote well locations, Remedy-produced Water Conditioning Building, and Operations 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 tank to allow for gravity flow to injection wells, minimize energy use. vii) O&M activities will minimize energy use by optimizing equipment via routine maintenance and minimizing energy consumption during peak energy use periods.	Quantitative	% energy generated by renewable sources	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
	Materials	Land	Consumption and reuse	The following are examples of concepts that are being considered/integrated in the 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	
	Surface Water and Groundwater Extraction	Water, land	Impoundment/ sequester/reuse	The following are examples of concepts that have been integrated into the 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) Pump tests conducted at new water supply wells in Arizona (HNWR-1, HNWR-1A, and Site B wells) suggest that none of these would substantially adversely affect the production rates of existing nearby wells, thereby complying with mitigation measure WATER-1. The following are examples of concepts that have been 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	

TABLE 4.0-1
Green Remediation Evaluation Matrix – Remedy Design and Implementation
Groundwater Remedy Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

	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 the groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under an 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 increased efficiency in long-term operations and maintenance (O&M). Achieving overall life cycle reductions and increased efficiency in long-term O&M 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	**Biological Resources**	General environ-ment	Species disappearances/ diversity reduction	The following are examples of activities that have been integrated into the remedial design: i) Conducted surveys 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 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, a Bird Avoidance and Minimization Plan (BAMP) was developed for special status bird species and those species protected under the federal Migratory Bird Treaty Act, including the Yuma clapper rail (BIO-2a). iv) Developed an Aesthetics and Visual Resources Protection and Revegetation Plan and a Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats consistent with EIR mitigation measures AES-1b/e and AES 2c/f and BIO-1, respectively. 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). vi) PG&E, BLM, USFWS, and DOI coordinated on the Programmatic Biological Assessment (PBA) for the final remedy. On July 7, 2014, the USFWS issued a letter to the BLM and provided concurrence with the findings presented in the new PBA. The findings in the PBA state that the proposed action associated with the remedy was not likely to adversely affect five species listed under the federal Endangered Species Act (ESA) and was not likely to jeopardize one species proposed for listing as threatened under the ESA and one candidate species for listing under the ESA. vii) A habitat restoration plan was prepared for areas on Havasu National Wildlife Refuge (HNWR) lands that will be disturbed by final remedy activities. This restoration plan includes measures to achieve "no-net-loss" of habitat functions and values existing before remedy implementation, and an assessment of the anticipated project impacts and the techniques that will be used to mitigate potential loss of functional values for refuge habitat while the remedy is in operation. viii) A habitat restoration plan for riparian vegetation and other sensitive habitats was prepared and includes measures to protect and preserve certain sensitive habitats including rivers, streams, wetlands, and riparian habitat in the remediation project area. The primary objective during implementation of the final groundwater remedy is to avoid and minimize disturbance of sensitive habitats and, where this is not possible, mitigate for disturbance through salvage or restoration planting.	Semi-quantitative	Sensitive species	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
ENVIRONMENT	**Cultural Resource**	Social	Impact to resources	Examples of activities that have been or 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 Area of Potential Effect (APE). ii) Conducted surveys of archaeological and historic resources to guide the design to protect, avoid, and minimize potential impact to these resources. iii) Elements of the project are designed to avoid direct effects on identified resources. PG&E cultural resources expert participated in field reviews of planned remedial facilities and construction footprints with the design team, and led in-office reviews of locations of planned facilities and construction footprints. 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 adverse effects to cultural and historic resources. iv) In keeping with the Secretary of the Interior's Standards for the Rehabilitation of Historic Buildings, the design of the Remedy-produced Water Conditioning Building, the Contingent Freshwater Pre-injection Treatment Building, and the Operations Building were differentiated from existing historic architecture on the property, but are compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the Topock Compressor Station and its environment. v) 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 - Developed a Cultural Impact Mitigation Program (CIMP) to reduce potential impacts on cultural and historical resources as described in mitigation measure CUL-1a-8. b - Developed a written access plan to preserve Tribal members' access to and use of the 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 independent 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-1a-4. The TRC has been providing advice on the project under direction of the Tribes. d - Funded two cultural resource specialist/project manager positions filled by qualified members 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. The paleontological investigation results were summarized in a report titled Paleontological Resources Management Plan: MMRP CUL-3 (Parus 2014). Information has been incorporated into the Construction/Remedial Action Work Plan as protocols to be implemented during construction.	Quantitative	Cultural resources	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
Groundwater Remedy Basis of Design Report/Pre-final (90%) Design
PG&E Topock Compressor Station, Needles, California

	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 the groundwater remedy, this GREM will be scored during remedy construction and IM decommissioning. Full-scale groundwater remedy operations will be addressed under an 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 increased efficiency in long-term operations and maintenance (O&M). Achieving overall life cycle reductions and increased efficiency in long-term O&M 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.							
				f - Preparing a worker cultural sensitivity education program per mitigation measure CUL-1a-13, with input from Interested Tribes. g - Mapped indigenous plants of traditional cultural significance. Using results of the 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-using existing physical improvements as described in mitigation measure CUL 1a-9. A current version of a map of these areas is included in Appendix A2 of this report. i – The following have been incorporated into the 90% 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 measures AES-1 and AES-2. • All additional phone calls and alarms associated with remediation activities or facilities will 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 will not introduce additional noise to the project area, to the maximum extent feasible (CUL-1a-6). • Lighting 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 (CUL-1b/c-2). The investigation results were summarized in a report titled Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, AZ, and San Bernardino County, CA (BAGS and AE 2014). The information in this report has been used to inform the design (i.e., via reviews by PG&E Remediation Resources Specialist) and incorporated into the Construction/Remedial Action Work Plan as protocols to be following during construction activities. 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). l – A Cultural Resources Treatment Plan was prepared to identify measures to reduce impacts on identified historically significant resources resulting from proposed physical improvements (CUL-1b/c-3). The Plan will be prepared and submitted to DTSC shortly after submission of the 90% design. Due to the confidential nature of information contained in the Plan, its distribution was limited. m – A protocol was developed in coordination with BLM to install signage to indicate areas that are off limits to off-road vehicle usage (CUL-1a-3d). n – A protocol was develop to a) provide outreach to Moabi Regional Park staff regarding communication to visitors about the restrictions for off-road vehicle use, and b) establish an information kiosk (CUL-1a-3c).				
SOCIAL	**Local Economy Boost**							
SOCIAL	**Local Economy Boost**	Social	Employment/ Income/Training	Examples of concepts under implementation for Interim Measure include, but are not limited to, the following: i) Select local providers for construction and construction support. Local providers are defined to be within approximately 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. It is anticipated that the same practices and PG&E's preference will be carried to the construction phase of the groundwater remedy, to the extent feasible.	Quantitative	% of project expenditures providing local economy boost	This evaluation will be performed during remedy construction and decommissioning of IM facilities	
SOCIAL	**Human Health and Safety**							
SOCIAL	**Occupational Health and Safety**	Social	Health and safety	Examples of concepts/activities that have been integrated into the remedial design: i) Developed 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 2011) 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 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 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 2011a) 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. It is PG&E's understanding, after discussions with DTSC and DOI, that with respect to the majority of privately-owned lands, access agreements from existing landowners are appropriate IC mechanisms.

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-1A). 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 as 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 construction and 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 construction and operation of the facilities and the ability for PG&E to construct, 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, unless a Category 1 IC is determined to not be necessary by DTSC and DOI. 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 Railway property (APN 650-151-05 on Figure 5.1-1). As explained in response to a comment from DTSC on the 30% BOD (see Appendix I of the 60% BOD Report, 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 DTSC's comments on the 30% BOD (Appendix I of 60% BOD, RTC #207) and the 60% BOD (Appendix I of this 90% BOD, RTC #247), additional modeling simulations were performed and additional information was obtained from the Topock Marina on Historic Route 66 regarding potential water use and source, respectively:

- An additional simulation of the abovementioned hypothetical domestic extraction wells 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 2,000 gallons per minute for use as fire protection water at their facility. At the time of the 90% design, a 16-inch well has been installed to supply fire protection water; this well is currently in use.

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.

Note that during the evaluation of alternative freshwater sources, the hydraulic data obtained from constant rate extraction tests conducted for a duration of 72 hours at both the HNWR-1 and Site B wells suggest that neither will substantially adversely affect the production rates of existing nearby wells in Arizona (CH2M HILL 2014b). Simulated pumping at HNWR-1A at the nominal design flowrate also suggests that pumping at HNWR-1A also will not substantially adversely affect the production rates of existing nearby wells.

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 starting in 2015).

For planning purposes, Tables 5.1-1A and 5.1-1B provide an updated listing of 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 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 access agreements 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 is planned on non-federal lands, including lands owned by BNSF Railway, Kinder Morgan, the FMIT, and private property owners in the Topock Marina area. In addition, infrastructure is planned on county roadways or their ROWs (San Bernardino County, Mojave County) as well as roadways/ROWs of state transportation agencies (Caltrans, ADOT). Where remedial infrastructure crosses or travels 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 approvals/permits/agreements that PG&E anticipates obtaining for the project:

- Encroachment permits from ADOT and Caltrans for pipeline segment under I-40
- Easement(s) from BNSF for pipeline segments and access roads under BNSF ROW
- Encroachment permits from San Bernardino and Mojave Counties for infrastructure in the county roadways and ROWs
- Any necessary approvals from California and Arizona State Lands for the crossing of the Colorado River on the Arched Bridge
- Consent to common use agreements or other appropriate notification requirements with utility companies for remedial infrastructure on their lands or within their easements and ROWs
- Access agreements with private property owners for remedial structures on their lands, where such agreements do not otherwise exist
- Land Use Covenant for PG&E's Topock Compressor Station parcel

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 siting arsenic monitoring wells during the 90% design, PG&E relocated the freshwater injection well FW-1 in order to utilize two existing monitoring well clusters and thereby avoided drilling additional new monitoring wells on 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 90% 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.

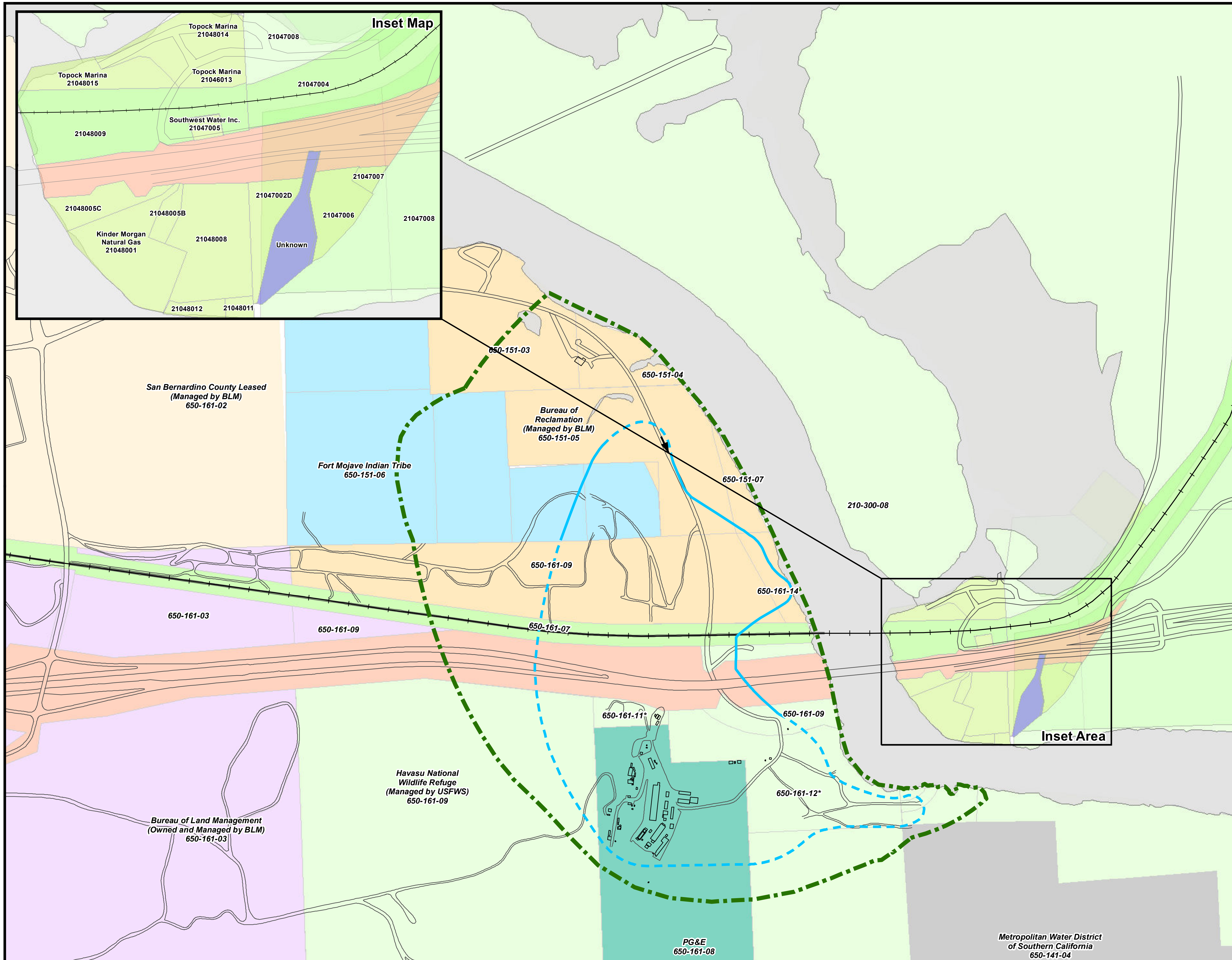
Based on discussions with the RWQCB and the SWRCB, it is anticipated that the substantive requirements of Waste Discharge Requirements (WDRs) and policies of the SWRCB will guide the injection of fresh water for use in the remedy. PG&E plans to coordinate with the RWQCB regarding substantive requirements 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 the contingent freshwater pre-injection treatment system).

TABLE 5.1-1A
Framework for Institutional Control – Federally Owned Land
Groundwater Remedy Basis of Design Report – Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Area	Assessor Parcel No. (APN)	Property Owner	Parties with Other Interests (e.g., existing rights-of-way [ROWs], 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 within the Additional Area where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume	650-151-04	U.,S. Bureau of Reclamation (BOR)	Managed by U.S. Bureau of Land Management (BLM)	Construct and operate and maintain (O&M) pipelines, wells, and/or access roads	X	X
	650-151-05	BOR	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	BOR	Managed by BLM	Construct and O&M pipelines, wells, and/or access roads	X	X
	650-161-14	BOR	Managed by BLM	Construct and O&M pipelines, wells, and/or access roads	X	X
	650-161-09	Havasu National Wildlife Refuge (HNWR)	Managed by U.S. Fish and Wildlife Service (USFWS) Southern California Gas pipeline ROW Southwest Gas pipeline ROW	Construct and O&M pipelines, wells, and/or access roads Soil investigation Utility crossings	X	X
	650-161-09	BOR withdrawn land (managed by USFWS)	Caltrans ROW	Construct and O&M IRZ along NTH, pipelines, wells, and /or access roads Soil investigation	X	X
	650-161-11	HNWR	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	HNWR	Managed by USFWS. PG&E has a possessory interest on this parcel for the operation of a compressor station and associated pipelines. Frontier Telephone ROW Mojave County pipeline ROW PG&E pipeline ROW Southern California Gas pipeline ROW Southwest Gas pipeline ROW Transwestern Gas pipeline ROW	Construct and O&M pipelines, wells, and/or access roads Soil investigation Utility crossings	X	X
	National Trails Highway (portion that runs through the site)	BOR (managed by BLM)	San Bernardino County ROW	Construct and O&M IRZ along NTH, pipelines and wells	X	X
Land outside the Plume and outside of the Additional Area where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume	650-161-02	BOR Withdrawn	Managed by BLM, Leased by San Bernardino County	Construct and maintain a construction headquarters, a soil management/storage area, and associated access roads during remedy construction. After construction, maintain a long-term remedy support area that includes maintenance and equipment storage yard, as well as a soil storage area.		X
	650-161-03	BLM	Managed by BLM	Install and O&M improvements at TCS ponds to enhance evaporation and to allow for trucking of wastewater offsite if needed during remedy operation.		X
	210-300-48	HNWR	Managed by USFWS	Construct and O&M freshwater pipeline		X
	210-470-08	HNWR	Managed by USFWS	Construct and O&M freshwater pipeline, monitoring wells, conduits (e.g., communication), and/or associated access road.		X

TABLE 5.1-1B
Framework for Institutional Control – Non-Federally Owned Land
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Area	Assessor Parcel No. (APN)	Property Owner	Parties with Other Interests (e.g., existing rights-of-way [ROWs], 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 within the Additional Area where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume	650-151-06	Fort Mojave Cultural Preservation	Southwest Gas pipeline ROW	Construct and operate and maintain (O&M) pipelines, wells, and access roads	X	X
	650-161-07	BNSF Railway (CA side)		Construct and O&M pipelines, monitoring wells, and share use of railroad maintenance access road Soil investigation		X
	650-161-08	PG&E	Various utility easements (Southwest Gas, Southern California Gas, Transwestern Gas, Frontier Telephone)	Construct and O&M remedy facilities, pipelines, wells, and access roads Soil investigation Utility crossings	X	X
Land outside the Plume and outside the Additional Area where control of groundwater flow directions and gradients is necessary to contain and remediate the chromium plume	210-48-013 (including portion of county road adjacent to property)	Private property owner (Topock Marina)		Construct and O&M freshwater pipeline		X
	Colorado River	CA State Lands Commission		Crossing Colorado River on the Arched Bridge Construct and O&M potential slant monitoring wells		X
	Colorado River	AZ State Lands Department		Crossing Colorado River on the Arched Bridge Construct and O&M potential slant monitoring wells		X
	210-470-04	TBD		Construct and O&M freshwater pipeline		X
	210-48005B	Private property owner (Bassett)		Construct and O&M freshwater pipeline		X
	210-48005C	Private property owner (Smith)		Construct and O&M freshwater pipeline		X
	210-48001	Kinder Morgan		Construct and O&M freshwater pipeline		X
	210-480-09	BNSF Railway	ADOT (I-40) Transwestern Gas pipeline ROW	Construct and O&M freshwater pipeline Utility crossing		X
	210-300-06	Mohave County (Mohave County Road 10 and Frontage Road adjacent to I-40)		Construct and O&M freshwater pipeline		X
	210-480-09	BNSF Railway (AZ side)		Construct and O&M freshwater pipeline		X
	Various	TBD	Mojave Electric Cooperative ROW Southwest Gas pipeline ROW	Utility crossings (to construct and O&M freshwater pipeline)		X
Bridge crossing the Colorado River	Arched Bridge	Kinder Morgan and PG&E		Install and O&M freshwater pipeline		X



LEGEND

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)

Approximate extent of hexavalent chromium [Cr(VI)] concentrations exceeding 32 micrograms per liter (µg/L) at any depth in groundwater based on fourth quarter 2013 sampling events. Dashed where based on limited data.

Approximate Area for Category 1 Institutional Control
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, unless a Category 1 IC is determined to not be necessary by DTSC and DOI.

Note:
* = 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 5.1-1
AREA FOR CATEGORY 1 INSTITUTIONAL CONTROLS

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION,
NEEDLES, CALIFORNIA

CH2MHILL

Path: \\Zinfandel\proj\PacificGasElectricCo\TopockProgram\GIS\MapFiles\2014\CMS\Design90\FIG511_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 Programmatic Agreement (BLM 2010), Cultural Impact Mitigation Program (PG&E 2014), and Cultural and Historic Properties Management Plan (BLM 2012), at the pre-final (90%) 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 have been documented and reported to DTSC in quarterly compliance reports since Fourth Quarter 2012; these reports are available on the project SharePoint site.

In compliance with mitigation measure CUL-1a-8a, PG&E started work on the CIMP in May 2011, in coordination with Interested Tribes during face-to-face meetings or teleconference calls held once per month. On July 8, 2013, PG&E provided a preliminary draft CIMP (including the IM-3 Decommissioning Plan) to Interested Tribes. Tribes provided comments on the draft CIMP in October 2013. PG&E reviewed and discussed select comments and responses with the Tribes during the March and April 2014 Tribal Monthly Updates. At DTSC's and Tribes' request, the CIMP (PG&E 2014) was submitted on May 1, 2014, in advance of the 90% design (without the IM-3 Decommissioning Plan). PG&E incorporated select Tribes' comments in the May 1, 2014 CIMP, and sent Tribes a letter to explain why certain comments were not incorporated. Table 6.1-2 summarizes actions taken or to be taken in compliance with the CIMP.

6.2 Summary of Compliance with Identified ARARs

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

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

There are 57 ARARs that address several resource areas including biological, air quality, cultural, hazardous materials, and waterways (6 chemical-specific, 38 action-specific, and 13 location-specific). A summary of the actions taken or that will be taken to comply with the identified ARARs is presented in Table 6.2-1. In addition, a summary of actions taken or that will be taken to comply with applicable stipulations in the PA (BLM 2010) 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.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	Mature Plants Survey Report including map of mature plant species Aesthetics and Visual Resources Protection and Revegetation Plan	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 2011b) 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 2012b) was completed on January 17, 2012, and is included in Appendix A4 of the 60% 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 in the 60% BOD Report document 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.	An addendum to the Mature Plants Survey Report (CH2M HILL 2014j) was completed on May 22, 2014, and is included in Appendix A4 of the 90% BOD Report. The addendum contains surveys results and associated maps for the freshwater well sites (HNWR-1 and Site B) in Arizona as well as potential sites identified for soil storage and/or construction staging west of Moabi Regional Park. Figure 2.4-8 in the 90% BOD Report presents the mature plant survey information for Key Views 5 and 11.The Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l) is included in an appendix of the Construction/Remedial Action Work Plan. CH2M HILL biologist Steve Long and E2 biologist Russell Huddleston participated in a field review of planned remedial facilities with the design team on April 7-10, 2014.An additional field review of planned remedial facilities was conducted by CH2M HILL biologist Melissa Fowler and E2 biologist Russell Huddleston on August 6-8, 2014. PG&E biologist Virginia Strohl also led the office reviews of planned facilities and footprints. The purpose of the field reviews along with in office reviews was to ensure the footprints of planned facilities including access routes and construction footprints are designed to avoid disturbance of mature plant specimens and 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 2012b) was completed on January 17, 2012. An addendum to the Mature Plants Survey Report was completed on May 22, 2014. The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan on September 8, 2014.
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.	Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	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.	A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats is included in an appendix of the Construction/Remedial Action Work Plan. The plan was prepared by plant ecologist Russell Huddleston of E2 Consulting under the direction of Linda Cyra-Korsgaard, a CH2M HILL landscape architect licensed in California. The plan will be implemented consistent with mitigation measure CUL-1a-5.	The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats was submitted with the Construction/Remedial Action Work Plan on September 8, 2014.
Aesthetics	AES-1c	c) Plant material shall be consistent with surrounding native vegetation.	Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	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.	This requirement was incorporated into the revegetation plan, and therefore satisfied by implementation of AES-1b/2c.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**	
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 the 60% BOD Report. The detailed specification for colors are included in Appendix E of the 60% BOD Report.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of the 90% BOD Report. The detailed specification for colors are included in Appendix E of the 90% BOD 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.	Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	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.	This requirement will be incorporated into the final revegetation plan, and therefore will be satisfied by implementation of AES-1b/2c.	
Aesthetics	**AES-2**	**Impacts on Views from Colorado River, a Scenic Resources Corridor (Key View 11) - The proposed project shall be designed and implemented to adhere to the design criteria presented below:**					
Aesthetics	AES-2a	a) A minimum setback requirement of 20 feet from the water (ordinary high water mark or OHWM) shall be enforced, except with regard to any required river intake facilities, to prevent substantial vegetation removal along the river bank.	Design submittals	The OHWM along the bank of the Colorado River, from the mouth of Bat Cave Wash to the BNSF railroad bridge, was mapped in March 2011. The OHWM methodology is summarized in a technical memorandum entitled "*Topock Groundwater Remediation Project, Ordinary High Water Mark Mapping Methodology*" (CH2M HILL 2011d) and is included in Appendix A3 of this Basis of Design Report. A 20-feet setback 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 of the 30% BOD Report.	Figure 2.4-6 in the 60% BOD Report illustrates that the locations of the River Bank Extraction Wells and associated piping met the 20-foot setback requirement.	Figure 2.4-6 in the 90% BOD Report illustrates that the locations of the River Bank Extraction Wells and associated access road/piping corridor met the 20-foot setback requirement.	The mapping methodology technical memorandum and a map with the 20-foot setback from the OHWM were submitted on November 18, 2011.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
Aesthetics	AES-2b	b) Existing mature plant specimens shall be protected in place during construction, operation, and decommissioning phases. The identification of plant specimens that are determined to be mature and retained shall occur as part of the design phase and mapped/identified by a qualified plant ecologist or biologist and integrated into the final design and project implementation consistent with CUL1a-5.	Mature Plants Survey Report including map of mature plant species Aesthetics and Visual Resources Protection and Revegetation Plan	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 2011b) 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 2012b) was completed on January 17, 2012, and is included in Appendix A4 of the 60% 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 in the 60% BOD Report 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.	An addendum to the Mature Plants Survey Report (CH2M HILL 2014j) was completed on May 19, 2014 and is included in Appendix A4 of the 90% BOD Report. The addendum contains surveys results and associated maps for the freshwater well sites (HNWR-1 and Site B) in Arizona as well as potential sites identified for soil storage and/or construction staging west of Moabi Regional Park. Figure 2.4-8 in the 90% BOD Report presents the mature plant survey information for Key Views 5 and 11. The Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l) is included as an appendix to the Construction/Remedial Action Work Plan (CH2M HILL 2014m). CH2M HILL biologist Steve Long and E2 biologist Russell Huddleston participated in a field review of planned remedial facilities with the design team on April 7-10, 2014. An additional field review of planned remedial facilities was conducted by CH2M HILL biologist Melissa Fowler and E2 biologist Russell Huddleston on August 6-8, 2014. PG&E biologist Virginia Strohl also led the office reviews of planned facilities and footprints. The purpose of the field review along with in-office reviews was to ensure the footprints of planned facilities, including access routes and construction footprints, are designed to avoid disturbance of mature plant specimens and 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. An addendum to the Mature Plants Survey Report was completed on May 22, 2014. The Aesthetics and Visual Resources Protection and Revegetation Plan was submitted with the Construction/Remedial Action Work Plan on September 8, 2014.
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.	Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	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.	A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) is included in an appendix of the Construction/Remedial Action Work Plan (CH2M HILL 2014m).	The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats was submitted with the Construction/Remedial Action Work Plan on September 8, 2014.
Aesthetics	AES-2d	d) Plant material shall be consistent with surrounding native vegetation.	Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	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.	This requirement was incorporated into the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats included as an appendix to the Construction/Remedial Action Work Plan (CH2M HILL 2014o), and therefore was satisfied by implementation of AES-1b/2c.	The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats was submitted with the Construction/Remedial Action Work Plan on September 8, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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 the 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 the BOD Report for the 60% design. The detailed specifications for colors are included in Appendix E of the 60% BOD Report.	The requirement of this mitigation measure was incorporated into the design criteria as presented in Appendix C of the 90% BOD Report. The detailed specifications for colors are included in Appendix E of the 90% BOD Report.	
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.	Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	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.	This requirement was incorporated into the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats revegetation plan (CH2M HILL 2014o) included as an appendix to the Construction/Remedial Action Work Plan, and therefore was satisfied by implementation of AES-1b/2c.	The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats was submitted with the Construction/Remedial Action Work Plan on September 8, 2014.
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.	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;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (which will be submitted as part of the Cultural Impact Mitigation Program [CIMP; PG&E 2014] and concurrently with the 90% design). The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
Air Quality	AIR-1b	b) Cover loaded haul vehicles while operating on publicly maintained paved surfaces;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	
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;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. 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	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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, and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration which will be submitted as part of the CIMP and concurrently with the 90% design. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	This requirement was incorporated into the BMP Plan of the Construction/Remedial Action Work Plan (Section 4) and the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (presented as an appendix in the CIMP and the Construction/Remedial Action Work Plan). Both plans were submitted as part of the 90% design documents. The Closure Plan for Decommissioning of Remedy Facilities and Restoration will be submitted in the future, prior to decommissioning.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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 CDFW 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, concurrently with the 90% design.	CH2M HILL biologist Steve Long and E2 biologist Russell Huddleston participated in a field review of planned remedial facilities with the design team on April 7-10, 2014. An additional field review of planned remedial facilities was conducted by CH2M HILL biologist Melissa Fowler and E2 biologist Russell Huddleston on August 6-8, 2014. PG&E biologist Virginia Strohl also led the office reviews of planned facilities and footprints. The purpose of the field review along with in- office reviews was to ensure the footprints of planned facilities, including access routes and construction footprints, are designed to avoid disturbance of sensitive habitats to the extent feasible. The Construction/Remedial Action Work Plan was submitted on September 8, 2014 as part of the 90% design document.	
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	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 in the 60% BOD Report 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.	On February 13-17, 2012, a wetland delineation was conducted to determine and map the extent of wetlands and other waters of the U.S. located within the EIR project area. Additional wetland delineation was conducted on July 16-17 and December 12-13, 2012, in study areas identified in the alternative freshwater evaluation. A report titled "*Wetlands and Waters of the United States Final Delineation Report for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California*" (CH2M HILL 2014c) was prepared to summarize results of the above delineation efforts and submitted to DTSC and DOI on April 18, 2014. The report is also included in Appendix A3 of the 90% BOD Report. On July 10, 2013, the USACE confirmed that CERCLA 121(e)(1) permit exemption applies to the Topock remediation project, and therefore, PG&E is not required to comply with the administrative and procedural elements of Section 404 of the Clean Water Act; however, PG&E is obligated to comply with the substantive elements that would normally be required by a permit. The USACE also stated that it therefore will not verify the wetlands and waters delineation. Therefore, PG&E is not seeking verification from the USACE. Rather, PG&E assumes that the jurisdictional waters and wetlands delineated and identified as such in the aforementioned report are all the jurisdictional waters under Section 404 of the	On July 10, 2013, USACE issued a letter (USACE 2013a) that confirmed that a Section 404 permit is not required for the Topock remediation project because the site is exempted under CERCLA 121(e)(1). Additionally, USACE confirmed that it will not verify a jurisdictional delineation for this action because a permit is not required (G. Salas USACE, email communication to V. Nez PG&E, July 12, 2013). The wetland delineation report (CH2M HILL 2014c) was completed on April 18, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		implemented. In any event, a report shall be submitted to DTSC to document compliance with these mandates.				CWA. The locations of jurisdictional waters have been incorporated into the design. At the 90% design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions. There is one well, IRL-4, and one or two associated arsenic monitoring wells that will occur within a jurisdictional waters of the US. There is also a freshwater pipeline that will be installed within an existing unpaved access road within the 100-year floodplain of the Colorado River. However, complete avoidance of other jurisdictional non-wetland waters is not feasible. It has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within waters of the United States. Figure 2.4-5 in the 90% BOD Report shows the unavoidable overlaps between planned remedy infrastructure and the USACE jurisdictional waters. In such cases where complete avoidance is not feasible, certain best management practices (BMPs) will be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands and non-wetland waters of the U.S. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands, the California Department of Fish and Wildlife (CDFW) requires compliance with avoidance and mitigation measures (AMMs) for all work conducted in CDFW jurisdictional washes. The geographic extent of CDFW's jurisdiction is broader than the jurisdictional extent of the USACE under CWA 404 and thus, avoidance and mitigation measures applied to CDFW jurisdictional waters would as a geographic consequence also be applied to CWA 404 waters. While Arizona does not have a similar state program, PG&E will also implement the	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
						same AMMs in Arizona identified by CDFW for California as well to ensure appropriate protection to CWA 404 jurisdictional areas in the project area, including those in Arizona. In addition to the CDFW AMMs, PG&E has identified additional BMPs for implementation during remedy construction, operation and maintenance, as well as decommissioning. The additional BMPs are described in the *Protocol for Compliance with EIR Mitigation and Monitoring Reporting Program BIO-1 and Applicable or Relevant and Appropriate Requirement (ARAR) #32 at the Topock Compressor Station* (see **Exhibit 6.1-1** presented at the end of this table). A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) was also prepared and included in an appendix of the Construction/Remedial Action Work Plan.	
Biological Resources	BIO-1	If during the design process it is shown that complete avoidance of habitats under CDFG 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 CDFG 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 CDFG 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 CDFG 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 CDFG, 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 CDFG, 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 CDFG 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	Havasu National Wildlife Refuge Habitat Restoration Plan, Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats	During the preliminary (30%) design, it has been determined that complete avoidance of habitats under CDFG jurisdiction (e.g., Bat Cave Wash) is not feasible. PG&E will work with the CDFG to determine and complete the Section 1600 permitting process or the substantive equivalent per CERCLA Section 121(e)(1).	Figure 2.4-5 in the 60% BOD Report 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). The 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	During the design, a process similar to the above was also conducted to avoid and minimize impacts to CDFW jurisdictional waters/wetlands. CDFW jurisdictional waters in the project area were delineated and mapped. A technical memorandum titled *Riparian Vegetation and California Department of Fish and Wildlife Jurisdiction for the Topock Compressor Station Groundwater Remediation Project* (CH2M HILL 2014i) was prepared to summarize the delineation results. The memo was submitted to the CDFW on 5/9/14, and to DTSC on 5/21/14, and is also included in Appendix A3 of the 90% BOD Report. The locations of jurisdictional waters have been incorporated into the design. At the 90% design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions. There is one well, IRL-4 and one or two associated arsenic monitoring wells that will occur within a jurisdictional waters of the US. There is also a freshwater pipeline that will be installed within an existing unpaved access road within the 100-year floodplain of the Colorado River. However, complete avoidance of other CDFW jurisdictional non-wetland waters is not feasible for the same reasons described above for the USACE jurisdictional non-wetland waters. Figure 2.4-5A in the 90% BOD Report	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. A technical memorandum summarizing the results of delineating CDFW jurisdictional waters in the project area (CH2M HILL 2014i) was submitted to CDFW on May 9, 2014, and to DTSC on May 21, 2014. The Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) and the Havasu National Wildlife Refuge Habitat Restoration Plan (CH2M HILL 2014n) were submitted with the Construction/Remedial Action Work Plan on September 8, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		habitats under CDFG 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 CDFG regulations and, if applicable. Habitat restoration, rehabilitation, and/or replacement shall be at a location and by methods agreeable to CDFG 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 CDFG, 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.			(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.	shows the unavoidable overlaps between planned remedy infrastructure and the CDFW jurisdictional waters. A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats and a Havasu National Wildlife Refuge Habitat Restoration Plan were prepared and included as appendices of the Construction/Remedial Action Work Plan.	
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	Avoidance and Minimization Plan; Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); Plan for Decommissioning of Remedy Facilities and Restoration	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 2013a). 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.	PG&E submitted the Final Bird Impact Avoidance and Minimization Plan (CH2M HILL 2014d) for disturbance of special-status birds and loss of habitat for the Topock remediation project on April 30, 2014. The plan is also included as an appendix of the Construction/ Remedial Action Work Plan. Results of the 2012 Yuma clapper rail/ California black rail survey were summarized in a report titled *2012 Focused Survey for the Yuma clapper rail and the California black rail at the PG&E Groundwater Remediation Project Site, Needles, California* (CH2M HILL 2013g)". The SWFL surveys were conducted on June 2-6, June 16-20, and June 29-July 3, 2014. Surveys for the western yellow-billed cuckoo were conducted June 16-20, June 29-July 3, and August 4-7,2014.	The Final Bird Impact Avoidance and Minimization Plan (CH2M HILL 2014d) was submitted on April 30, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		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.					

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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 Assessment (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	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration (part of CIMP); 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 in the 60% BOD Report. 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.	On April 1-2 and May 12-13, 2013, USFWS authorized biologist Gabriel Valdes conducted additional protocol surveys for desert tortoise in support of the design including the freshwater supply sites. Gabriel Valdes identified the potential desert tortoise habitat shown in Figure 2.4-10 in the 90% BOD Report. Through coordination with the biologists, 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, BLM, and DOI coordinated on the PBA for the final groundwater remedy. This ESA Section 7 consultation was concluded with receipt of USFWS concurrency letter on July 7, 2014 which preceded the approval of the Construction/Remedial Action Work Plan. Measures outlined in the PBA and associated USFWS determination letter will be implemented before and during construction activities.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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 CDFW, 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 CDFW, 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	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 CDFW, 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 USFWS Havasu National Wildlife Refuge (HNWR) Manager and submitted with the Construction/Remedial Action Work Plan).	<u>Avoidance and Minimization Associated with Decommissioning of IM-3 Facilities and Site Restoration</u> An Avoidance and Minimization Plan associated with the decommissioning of IM-3 facilities will be developed based on surveys conducted prior to decommissioning, and during the breeding season; therefore, this Plans will be also prepared in the future, prior to decommissioning. <u>Avoidance and Minimization Associated with Decommissioning of Remedial Facilities and Site Restoration</u> In compliance with this mitigation measure, an Avoidance and Minimization Plan associated with decommissioning of remedial facilities will be developed based on surveys conducted prior to decommissioning, and during the breeding season; therefore, this Plan will be also prepared in the future, prior to decommissioning. As required by the EIR MMRP, general procedures and protocols for restoring the environment to its preconstruction conditions upon decommissioning of remedial facilities were developed and included as part of the CIMP (CUL-1a-8e). Also in compliance with the CD, a separate Habitat Restoration Plan for the Refuge was prepared and included as an appendix of the Construction/Remedial Action Work Plan.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design	Date Completed
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.		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.	No further action is required. The pre-final (90%) 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 CDFW 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 CDFW 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 CDFW declines to assert jurisdiction because it determines that CERCLA Section 121(e)(1) applies, the project proponent shall consult with CDFW 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.		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.	No further action is required. The pre-final (90%) design does not include a river water intake structure.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**	
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.	Instream Habitat Typing Survey Report	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 2012a). The report was provided to DTSC on May 25, 2012, and is included in Appendix A6 of this BOD report.	No further action is required. The pre-final (90%) design does not include a river water intake structure.	The Instream Habitat Typing Survey Technical Memorandum (CH2M HILL 2012a) was completed on May 25, 2012.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Action (Compliance Status) Intermediate (60%) Design	Action (Compliance Status) Pre-Final (90%) Design	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 CDFW 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 CDFW 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.		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.	No further action is required. The pre-final (90%) 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 CIMP commenced in May 2011, and the CIMP will be submitted with the 90% design (due late 2013).	PG&E started work on the CIMP in May 2011, in coordination with Interested Tribes during face- to- face meetings or teleconference calls held once per month. On July 8, 2013, PG&E provided a preliminary draft CIMP (including the IM-3 Decommissioning Plan) to Interested Tribes. Tribes provided comments on the draft CIMP in October 2013. PG&E reviewed and discussed select comments and responses with the Tribes during the March and April 2014 Tribal Monthly Updates (TMUs). At DTSC's and Tribes' request, the CIMP (PG&E 2014) was submitted on May 1, 2014, in advance of the 90% design (see paragraph below for submittal dates related to the IM-3 Decommissioning Plan). PG&E incorporated select Tribes' comments in the May 1, 2014 CIMP, and sent Tribes a letter to explain why certain comments were not incorporated. IM-3 Decommissioning Plan (Appendix B of CIMP) A preliminary draft IM-3 Decommissioning Plan was submitted to the Fort Mojave Indian Tribe (FMIT) in April 2013. The FMIT provided comments on the preliminary draft Plan in June 2013. PG&E updated the draft Plan and	The Revised Groundwater CMI/RD Work Plan (CH2M HILL 2011a) was completed on November 2, 2011.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
						submitted it to Interested Tribes as an appendix to the CIMP on July 8, 2013. The FMIT and the Hualapai Tribe provided comments on the updated Plan in October 2013. PG&E sent letters to respond to the Tribes' comments on July 8, 2014 and discussed the responses during the July TMU. PG&E incorporated select Tribes' comments and submitted a revised Plan with the 90% design on September 8, 2014.	
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.	PG&E Cultural Resources Expert Glenn Caruso participated in field reviews of planned remedial facilities and construction footprints with the design team on April 7-10, 2014. He also led in-office reviews of locations of planned facilities and construction footprints. 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.	
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 in the 60% BOD Report)	On October 21, 2013, PG&E provided the Tribes a draft of the Access Plan for lands not under federal management for review and comment. Tribal comments were received on November 22, 2013. PG&E has updated and discussed the plan at the July 24, 2014 TMU. The Access Plan is included as an appendix of the Construction/Remedial Action Work Plan. Communication logs with Tribes are submitted to DTSC quarterly as part of the quarterly EIR mitigation measures compliance reports (the last quarterly report was submitted on July 31, 2014; the next quarterly report is due October 31, 2014).	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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).	This mitigation measure will be met through actions taken to comply with CUL-1a-3a through 3d (see below).	
Cultural Resources	CUL-1a-3a	a. Retaining a Qualified Cultural Resource Consultant to implement the Mitigation Monitoring and Reporting Program (MMRP) and conducting yearly inspections (or less frequently upon approval by DTSC) of identified historical resources, including inspections of the Topock Cultural Area, to determine if substantial adverse changes have occurred relative to the condition of the historical resources during the past year or prior to the implementation of the proposed project. PG&E shall offer to retain a Tribal monitor at historic rates of compensation or Tribal representatives designated by the Tribal Council or chairperson, if so requested, to accompany the Qualified Cultural Resources Consultant during the inspections. The Qualified Cultural Resource Consultant shall be a person who is acceptable to DTSC and who is also a qualified archaeologist with a graduate degree in archaeology, anthropology or closely related field, plus at least 3 years of full-time professional experience in general North American archaeological research and fieldwork, with expertise/experience in the Southwest preferred.	Annual cultural resources monitoring report	PG&E has retained qualified cultural resources consultants for implementation of the MMRP, subject to DTSC's approval.	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.	The 2013 annual report titled "*Topock Compressor Station Groundwater Remediation Project: Condition Assessments at Sixty-Nine Archaeological and Historical Sites*" (AE 2014) was submitted to DTSC on March 12, 2014.	DTSC accepted PG&E's nomination and approved AE as the qualified cultural resource consultant for the groundwater remedy project on March 2, 2012. PG&E has offered to retain Tribal monitors at historic rates of compensation.
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).	A site security plan titled *"Groundwater Remedial Action Site Security Plan"* is included in an appendix of the Construction/Remedial Action *Work Plan.* Also, PG&E will summarize any reports of human-caused disturbance to project facilities and the surrounding environment in the EIR mitigation monitoring compliance reports to be prepared quarterly during construction and annually during operations.	A site security plan titled *Groundwater Remedial Action Site Security Plan* is included as an appendix of the Construction/Remedial Action Work Plan, submitted on September 8, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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.	PG&E has prepared a protocol for a) outreach to Moabi Regional Park staff regarding communication to visitors about the restrictions for off-road vehicle use, and b) establishing an information kiosk.	
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.	PG&E has prepared a protocol to establish signage to indicate areas that are off limits to off-road vehicle usage in coordination with BLM.	
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	EIR mitigation measures compliance reports (quarterly during design/ construction, annual during 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.	As directed by this measure, the second annual activity report titled *"Annual Report Technical Review Committee Activities, Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California"* (HDR 2013) was submitted on November 26, 2013. In addition, TRC activities are summarized and included in the quarterly EIR mitigation measures compliance reports (the last quarterly report was submitted on July 31, 2014; the next quarterly report is due October 31, 2014).	The TRC was convened on July 1, 2011. The first annual activity report was submitted on June 29, 2012. The second annual activity report was submitted on November 26, 2013.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		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.					
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.	Mitigation and monitoring plan for culturally sensitive plants	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 2011c) 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 March 12 to 20, 2012. Additional floristic survey was conducted from March 12 through 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.	A Revised Floristic Survey Report (CH2M HILL 2013h) summarizing survey results from 2011 through 2013, including freshwater supply sites, was submitted on December 30, 2013. The report is also included in Appendix A5 of the 90% BOD. A Revised Ethnobotany Survey Report (CH2M HILL 2014e) summarizing survey results from 2011 through 2013 was submitted on January 15, 2014. The report is also included in Appendix A7 of the 90% BOD. The *Supplemental Ethnobotanical Plant Surveys for the Pacific Gas and Electric Company's Topock Compressor Station, San Bernardino, California* report (CH2M HILL 2014f) summarizing the December 2013 Survey results was submitted on February 28, 2014. The supplemental report is also included in Appendix A7 of the 90% BOD. In compliance with this measure, a mitigation and monitoring plan for culturally sensitive plants was prepared and included as Appendix A of the CIMP.	The survey methodology technical memorandum was completed on October 31, 2011, and provided to Interested Tribes on November 8, 2011. The revised Final Floristic Survey Report was completed on December 30, 2013. The revised Final Ethnobotany Survey Report was completed on January 15, 2014. A supplemental report was completed on February 28, 2014. A mitigation and monitoring plan for culturally sensitive plants was prepared and included as Appendix A of the CIMP.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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 the BOD Report for the intermediate (60%) design.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the pre-final (90%) 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 the 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.	The requirement of this mitigation measure has been incorporated into the design criteria as presented in Appendix C of the BOD Report for the pre-final (90%) design.	
Cultural Resources	CUL-1a-8	Prior to commencement of construction, PG&E shall submit as part of the final Remedial Design, a CIMP developed in coordination with Interested Tribes for DTSC's review and approval. The CIMP may be developed in coordination with the federal agencies with land management responsibilities in the project area (e.g., BLM and USFWS) in accordance with the Programmatic Agreement (Appendix PA). The CIMP shall include, at a minimum and to DTSC's satisfaction, the following:	CIMP	Work on the CIMP commenced in May 2011. The CIMP will be submitted as part of final design as directed.	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.	PG&E started work on the CIMP in May 2011, in coordination with Interested Tribes during face- to- face meetings or teleconference calls held once per month. On July 8, 2013, PG&E provided a preliminary draft CIMP (including the IM-3 Decommissioning Plan) to Interested Tribes. Tribes provided comments on the draft CIMP in October 2013. PG&E reviewed and discussed select comments and responses with the Tribes during the March and April 2014 TMUs. At DTSC's and Tribes' request, the CIMP (PG&E 2014) was submitted on May 1, 2014, in advance of the 90% design (see paragraph below for submittal dates related to the IM-3 Decommissioning Plan). PG&E incorporated select Tribes' comments in the May 1, 2014 CIMP, and sent Tribes a letter to explain why certain comments were not incorporated.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
						IM-3 Decommissioning Plan (Appendix B of CIMP) A preliminary draft IM-3 Decommissioning Plan was submitted to the FMIT in April 2013. The FMIT provided comments on the preliminary draft Plan in June 2013. PG&E updated the draft Plan and submitted to Interested Tribes as an appendix to the CIMP on July 8, 2013. The FMIT and the Hualapai Tribe provided comments on the updated Plan in October 2013. PG&E sent letters to respond to the Tribes' comments on July 1 and discussed the responses during the July TMU. PG&E incorporated select Tribes' comments and submitted a revised Plan with the 90% design on September 8, 2014.	
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 the 30% BOD 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 the 60% BOD Report contains a log of Tribal communications since the start of Q1 2013 through March 19, 2013.	Outreach efforts have occurred and are ongoing (e.g., monthly TMUs). Protocols for continued communication were developed and included as part of the CIMP. 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 on July 31, 2014; the next quarterly report is due October 31, 2014.	
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 March 23 2012. 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.	Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final were developed and included as part of the CIMP.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**	
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 March 23 2012. 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.	Protocols for the review of cultural resource-related documents throughout the design, construction, and operational phases were developed and included as part of the CIMP.	
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 March 23 2012. 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.	Protocols for the review of project design documents were developed and included as part of the CIMP.	
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 March 23 2012. 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. A draft CIMP will be provided to interested Tribes for review prior to submittal to DTSC for review and approval.	Protocols for the appropriate methods to be used to restore the environment to its preconstruction condition upon decommissioning of individual groundwater remedy facilities were developed and included as part of the CIMP.	
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	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 March 23 2012. 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.	The plan for the decommissioning and removal of the IM-3 Facility and site restoration was developed and included in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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.	The revised *Management Protocol for Handling and Disposition of Displaced Site Material* was included in Appendix C of the CIMP, Appendix B of the Soil Management Plan (Volume 4 of the Revised O&M Manual), and also as an appendix of the Construction/Remedial Action Work Plan. Detailed procedures to implement the management protocol are included in the Soil Management Plan.	
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 March 23 2012. 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.	Protocols for the appropriate methods, consistent with Mitigation Measure NOISE-3, to reduce auditory impacts, were developed and included as part of the CIMP.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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 March 23 2012. 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.	Protocols for the appropriate methods, consistent with Mitigation Measures AES-1 and AES-2, to reduce visual intrusion were developed and included as part of the CIMP.	
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 March 23 2012. 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.	Protocols for Tribal notification in advance of project-related activities were developed and included as part of the CIMP.	
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 March 23 2012. 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.	Protocols to be followed by project personnel to accommodate key Tribal ceremonies that involve the Topock Cultural Area were developed and included as part of the CIMP.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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 March 23 2012. 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.	Protocols for Tribal monitors to observe ground- disturbing activities were developed and included as part of the CIMP.	
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 March 23 2012. 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.	Provisions required in this mitigation measure were developed and included as part of the CIMP.	
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 March 23 2012. 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.	Protocols for protective measures for archaeological/historical sites during construction were developed and included as part of the CIMP.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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 March 23 2012. 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.	Protocols for the reporting of discoveries of cultural importance were developed and included as part of the CIMP.	
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 March 23 2012. 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.	Protocols for the inspection of remediation facilities and/or staging areas during construction were developed and included as part of the CIMP.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Action (Compliance Status) Intermediate (60%) Design	Action (Compliance Status) Pre-Final (90%) Design	Date Completed
Cultural Resources	CUL-1a-9	During selection of the design and specific locations for physical remediation facilities, PG&E shall, in communication with the Interested Tribes (and subject to their review), and to the maximum extent feasible, as determined by DTSC, give: (1) priority to previously disturbed areas for the placement of new physical improvements; and (2) priority to re-use of existing physical improvements, such as but not limited to wells and pipelines, but not including IM-3 facilities. "Disturbed" areas in this context means those areas outside of documented archaeological site boundaries that have experienced ground disturbance in the last 50 years. PG&E shall produce an aerial map of these disturbed areas to guide project design, and PG&E shall make a good faith effort to provide Tribes with an opportunity to review and comment on the information displayed on the map in determining "disturbed" areas.	Aerial map of disturbed areas	As directed, PG&E prepared an aerial map of disturbed areas to guide project design and made a good faith effort to provide Tribes with an opportunity to review and comment. PG&E provided the disturbed areas map to Interested Tribes for review and comment on May 26, 2011. Written comments on the map were received from the FMIT on July 5, 2011 and the Hualapai Tribe on July 1, 2011. PG&E responded to the Hualapai and the FMIT in July 2011 with an invitation to a site walk for discussion of the comments and 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, including 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.	The aerial map of disturbed areas was updated to include areas with planned facilities associated with freshwater supply in Arizona, and areas west of Moabi Regional Park associated with soil storage. The updated map is included in Appendix A2 of the 90% BOD 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 pre-final (90%) 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 piping corridor is located almost entirely in existing roadways, right- of-ways and previously disturbed areas. • Most of the existing access roads have been incorporated into the 90% design. • The remedy-produced water conditioning plant and the contingent systems (arsenic treatment and dissolved metals removal) are located entirely within the footprint of the Compressor Station. • The operation building and carbon storage/amendment facilities are located on the existing Transwestern Bench and MW-20 Bench. • All of the proposed soil storage and construction staging areas are located on previously disturbed areas. • The main construction headquarters and staging area is located on previously disturbed areas at Moabi Regional Park.	A current version of the aerial map of disturbed areas was submitted on November 18, 2011. An update of the aerial map of disturbed areas is included in Appendix A2 of the 90% BOD Report.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	The design was carried out in a manner that avoids any direct impacts on Loci A, B, and C of the Topock Maze. PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints with the design team on April 7-10, 2014. Glenn Caruso also led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the field review along with in-office reviews is to ensure that project footprints 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 (e.g., noise, aesthetics) to the Maze has been incorporated into the design as follows: <u>Noise/Vibration</u> a) In compliance with EIR mitigation measure NOISE-1a, there is no proposed remediation or new monitoring wells within 45 feet of vibration-sensitive receptors (i.e., homes/ structures) or within 30 feet and 275 feet of vibration-sensitive land uses (i.e., homes) in California and Arizona, respectively. b) During the design, PG&E conducted site visits with Agencies, Tribes, and Stakeholders to view and obtain inputs on locations of planned facilities including new remediation, new monitoring wells, and piping corridors. c) In response to Tribes' comments on the 60% design, PG&E moved all remedy wells and vaults from the west side of NTH to the east side. In addition, PG&E will not use the east side (side that is closer to Maze A) of the TCS evaporation ponds for remedy construction staging. d) As indicated in the 60% RTC #319, the Noise Engineer has reviewed the selection of aboveground transformers and air conditioning units for the enclosures of aboveground communication/control panels for conformance with the project noise design criteria (Appendix C of the 90% BOD Report). e) Mitigation measure NOISE-2 to reduce auditory impacts related to project-generated construction-related noise has been incorporated into the Construction/Remedial Action Work Plan (Section 4) for implementation during construction.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
						f) PG&E has developed protocols to reduce auditory impacts, consistent with EIR mitigation measure NOISE-3, as part of the CIMP, and has included those protocols in the Construction/Remedial Action Work Plan (Section 4) for implementation. <u>Aesthetics</u> a) During the design, PG&E conducted site visits with Agencies, Tribes, and Stakeholders to view and obtain inputs on locations of planned remedial facilities. b) PG&E implemented additional design protocols to reduce visual intrusions, as outlined in Section 2.9.2 of the CIMP. c) PG&E has and will continue to provide opportunities for Agency, Tribal, and Other Stakeholder input on the visual nature of project design through inclusion of visualizations of select remedy components in design documents (CIMP protocol, see Section 2.9.3). d) PG&E has developed protocols to reduce visual intrusion, consistent with mitigation measures AES-1 and AES-2, as part of the CIMP, and has included these protocols in the Construction/Remedial Action Work Plan (Section 4) for implementation.	
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,	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 Chemehuevi Indian Tribe.	There was no change since the 60% design.	As of the time of this writing, PG&E has funded a second project manager position for the Cocopah Indian Tribe. The first funded position was for the Chemehuevi Indian Tribe.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**	
		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.					
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	PG&E will offer interested Native American Tribes the opportunity to provide a traditional healing/cleansing ceremony (or ceremonies) before and after ground disturbing activities occur.	
Cultural Resources	CUL-1a-13	PG&E shall, in communication with Interested Tribes, develop as part of the CMI Workplan, a worker cultural sensitivity education program. The program shall be implemented before commencement of construction and throughout construction and operations as personnel are added. This program may include information provided directly by Tribal entities either in written form or on video, in a manner consistent with Appendix C in the existing BLM Programmatic Agreement. The worker cultural sensitivity education program shall ensure that every person working on the project as an employee or contractor, before participating in design or outdoor activities at the project site, is informed regarding: the cultural significance of the Topock Cultural Area, appropriate behavior to use within the Topock Cultural Area, activities that are to be avoided in the Topock Cultural Area, and consequences in the event of noncompliance.	Worker Cultural Sensitivity Education Program	As described in the CMI Work Plan (Section 4.2.1), the education on cultural/historical resources sensitivity for Topock currently occurs via periodic training and project initiation meetings. Sensitivity training classes are conducted at least annually, and are attended by all workers available to participate. Sensitivity training/education is also provided at project initiation meetings, typically held at the site prior to field work. The training is provided by the Site Operations Manager, the Project Archaeologist, and Interested Tribal members who attend the meetings. In compliance with this measure, a training/education manual will be prepared using existing and new material, as available.	As described in Section 4.2.1 of the CMI/RD Work Plan (CH2M HILL 2011a), 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.	PG&E has prepared, in coordination with agencies and Tribes, educational materials used in Orientation sessions for the Topock project. In addition, PG&E has prepared, in compliance with this measure, a protocol for the development of a cultural sensitivity education program to educate workers (included as an appendix to the Construction/ Remedial Action Work Plan). Implementation of this protocol is underway.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	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 Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints with the design team on April 7-10, 2014. Glenn Caruso also led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the field review along with in-office reviews is to ensure that project footprints 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.	PG&E Cultural Resources Expert Glenn Caruso participated in field review of planned remedial facilities and temporary construction footprints with the design team on April 7-10, 2014. Glenn Caruso also led in-office reviews of planned facilities and temporary construction-related footprints. The purpose of the field review along with in-office reviews is to ensure that project footprints 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-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 Brady and Associates Geological Services (BAGS) and Pat Maloney of Applied Earthworks (AE); Pat Maloney is the qualified cultural resources consultant. 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.	The geoarchaeological investigation report titled *Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, AZ, and San Bernardino County, CA* was completed and submitted to DTSC on February 28, 2014 (BAGS and AE 2014). The information in this report has been used to inform the design (i.e., via reviews by PG&E Cultural Resources Expert) and incorporated into the Construction/Remedial Action Work Plan as protocols to be followed during construction activities (Section 4).	The geoarchaeological investigation report (BAGS and AE 2014) was completed on February 28, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	A Cultural Resources Treatment Plan will be prepared and submitted to DTSC shortly after submission of the 90% design.	
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		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.	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.	PG&E has retained AE, a consulting firm with qualified cultural resources consultants, to observe ground-disturbing activities and provide training as required.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design	Date Completed
		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.					
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.	The requirements of this mitigation measure have been met by implementation of CUL-1b/c-2 and CUL-1b/c-3.	
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 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.	The paleontological investigation results were summarized in a report titled "*Paleontological Resources Management Plan: MMRP CUL-3*" (Parus 2014) and submitted to DTSC on February 28, 2014. The plan is also included in an appendix of the Construction/Remedial Action Work Plan.	The paleontological investigation report (Parus 2014) was completed on February 28, 2014.

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		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.					
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 monitoring 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.	PG&E has retained AE as the qualified cultural resource consultant and prior to construction monitoring, 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. Procedures for implementing this measure are included in an appendix of the Construction/ Remedial Action Work Plan.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This requirement will be met by actions 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This requirement will be met by actions taken under CUL-4.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design	Date Completed
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This requirement will be met by actions 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This requirement will be met by actions taken under CUL-4.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This requirement will be met by actions 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This requirement will be met by actions taken under CUL-4.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	Grading plans including erosion control are included in Appendix D of the 90% BOD. Erosion control measures to be implemented during construction are also included in the Construction/Remedial Action Work Plan.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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 concurrently with the 90% design.	In compliance with mitigation measure HYDRO-1, a BMPs Plan for construction activities was prepared and is included in Section 4.10 of the Construction/Remedial Action Work Plan, as well as an appendix. In addition, an industrial SWPPP was also prepared in compliance with mitigation measure HYDRO-1 and included in Appendix E of the O&M Plan (Volume 1 of the O&M Manual). The SWPPP includes BMPs related to operation and maintenance activities of the remedy.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This measure will be implemented as directed to aid in reducing wind erosion (see BMPs Plan, in Section 4.10 and an appendix of the Construction/Remedial Action Work Plan). Section 6.4 of the O&M Plan (Volume 1 of the O&M Manual) discusses general guidelines for maintenance of access roads and pathways, from visual assessment, local repairs, soil stabilization, and installation/maintenance of erosion controls, to grading.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This mitigation measure will be met through actions to be taken to implement Mitigation Measures GEO-2 and HAZ-2 to prevent contaminated soils from being eroded and contributing contamination into receiving waters.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This measure will be implemented as directed (see BMPs Plan Section 4.10 and in an appendix of the Construction/Remedial Action Work Plan; Section C2.2, Earthwork, in Appendix C (Design Criteria) of the 90% BOD; and Section 7.4, (Access Road and Pathway Maintenance, of the O&M Plan (O&M Manual Volume 1).	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This measure has been and will be continue to be implemented as directed. PG&E will strive to minimize work area footprints to the maximum extent feasible, while maintaining a safe work zone and environment for all staffs, contractors, as well as monitors and observers. As discussed in CUL-1a-9, all of the soil storage and construction staging areas proposed in the 90% design are located on existing and/or previously used staging areas, as well as previously disturbed areas. All trench sections underneath roadways and shoulders are designed to be compacted to 95% and all other areas to at least 90%.	
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 regrading 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	**Resurfacing to Preconstruction Condition** These requirements are included in the restoration guidelines for both the Plan for Decommissioning and Removal of the IM-3 Facility and Site Restoration (see Sections 8.1.2 and 8.1.3 of Appendix B of the CIMP) and measure CUL-1a-8e, Protocols for Restoring the Environment to its Preconstruction Conditions (see Sections 2.5.3 and 2.5.4 of the CIMP). **Habitat Restoration and Revegetation** In compliance with BIO-1, the Havasu National Wildlife Refuge Habitat Restoration Plan and the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (both provided as appendices to the Construction/ Remedial Action Work Plan) include measures to address restoration of native vegetation.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	This measure will be implemented as directed. Storage and handling of hazardous materials are discussed in the HMBP (Appendix F of the O&M Plan).	
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.	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 the BOD Report for the 90% design. Storage and handling of hazardous materials are discussed in the HMBP (Appendix F of the O&M Plan).	
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.	This measure will be implemented as directed. Storage and handling of hazardous materials and spill response procedures will be discussed in the HMBP (Appendix F of O&M Plan).	
Hazardous Materials	**HAZ-1b**	**Spill or Release of Contaminants during Construction and Decommissioning Activities.**					

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
Hazardous Materials	HAZ-1b-a	a) Fueling areas and maintenance areas would be supplied with proper secondary containment and spill response equipment.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	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 are described in the BMPs Plan in an appendix of the Construction/ Remedial Action Work Plan. Appendix C of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration contains a safe fueling and fuel handling policy for activities during implementation of the Work Plan.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	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 are described in the BMPs Plan in an appendix of the Construction/ Remedial Action Work Plan. Appendix G (Construction BMPs Plan) of the Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration contains BMPs for storage and handling of hazardous materials.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	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 are described in the BMPs Plan in Section 4 as well as an appendix of the Construction/Remedial Action Work Plan. Appendix G (Construction BMPs Plan) of the IM3 Decommissioning Plan contains BMPs addressing waste and materials storage and handling areas.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/Remedial Action Work Plan.	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of Remedy Facilities and Restoration	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.	This measure will be implemented as directed, and included in the health and safety plans. 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.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This measure will be implemented as directed, and included in the health and safety plans. Pre-mobilization planning will be used to review the likelihood of encountering contaminated soils, the HMBP, site-specific health and safety plan, and SOPs so that the procedures are followed and the contingencies for handling contaminated soils are in-place.	
Hazardous Materials	HAZ-2c	c. Should evidence of contaminated soil be identified during ground disturbing activities (e.g., noxious odors, discolored soil), work in this area will immediately cease until soil samples can be collected and analyzed for the presence of contaminants by the site supervisor or the site safety officer. Contaminated soil shall be managed and disposed of in accordance with a project-specific health and safety plan and soil management plan. The health and safety plan and soil management plan shall be approved by DTSC before beginning any ground disturbing activities. While the project is exempt from the requirements of the San Bernardino County Division of Environmental Health, the health and safety plan and soil management plan shall be prepared in general accordance with the substantive requirements of this agency.	Health and Safety Plan; Soil Management Plan (Volume 4 of O&M Manual)	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 the 60% 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.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual, which is Appendix L to the 90% BOD. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/Remedial Action Work Plan. A Soil Management Plan (SMP) is included in Volume 4 of the O&M Manual. The SMP includes procedures and protocols for the management and disposal of displaced soil, including potentially contaminated soil, 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.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/Remedial Action Work Plan.	
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.	This mitigation measure will be implemented as directed. A health and safety plan for O&M activities was developed and is included in Volume 5 of the O&M Manual. Similarly, a health and safety plan for construction activities was developed and is included in an appendix of the Construction/Remedial Action Work Plan.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**	
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 (Volume 4 of O&M Manual)	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 (SMP) is included in Volume 4 of the O&M Manual, which is Appendix L to the 60% BOD report. The SMP 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.	This measure will be implemented as directed. An SMP is included in Volume 4 of the O&M Manual, which is Appendix L to the 90% BOD report. The SMP 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 (see Section 4.6 of the SMP).	
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 2009:7) 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	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.	This measure will be implemented as directed. A BMP Plan was prepared and included in an appendix of the Construction/Remedial Action Work Plan. On July 17, 2012, the State Water Resources Control Board amended Order 2009-009-DWQ by adopting Order No. 2012-0006-DWQ NPDES NO. CAS000002. Order 2012-006-DWQ requires effluent monitoring and reporting for pH and turbidity in storm water discharges. The monitoring will be used to evaluate whether numeric action levels (NALs) and numeric effluent limitations (NELs) for Active Treatment Systems included in the Construction General Permit are exceeded. The Permit contains only narrative effluent limitations and does not contain numeric effluent limitations, except for Active Treatment Systems (ATSs).	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
		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 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:					

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		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.					

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design	Date Completed
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 the 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.	This measure will be implemented as directed. The Contingency Plan (Volume 3) of the O&M Manual), which is included in the 90% 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 (or industrial) SWPPP (Appendix E of the O&M Plan) includes a storm water monitoring program in compliance with the new Statewide Industrial Storm Water General Permit, which will become effective on July 1, 2015.	
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.	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.	This measure will be implemented as directed. The industrial SWPPP was developed and included in Appendix E of the O&M Plan. The O&M (or industrial) SWPPP (Appendix E of the O&M Plan) includes a storm water monitoring program in compliance with the new Statewide Industrial Storm Water General Permit which will become effective on July 1, 2015.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
		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.					
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 Table 2.7-1A 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	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.	This measure will be implemented as directed. The industrial SWPPP and BMP Plan include a monitoring and reporting program to assess the effectiveness of BMPs and to modify BMPs and revise the SWPPP, if necessary. On July 17, 2012, The State Water Resources Control Board amended Order 2009-009-DWQ by adopting Order No. 2012-0006-DWQ NPDES NO. CAS000002. Order 2012-006-DWQ requires effluent monitoring and reporting for pH and turbidity in storm water discharges. The monitoring will be used to evaluate whether numeric action levels (NALs) and numeric effluent limitations (NELs) for Active Treatment Systems included in the Construction General Permit are exceeded. The Permit contains only narrative effluent limitations and does not contain numeric effluent limitations, except for Active Treatment Systems (ATSs).	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
		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 Table 2.7-1A). 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.					
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.	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.	This measure will be met through actions to be taken under HYDRO-1.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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;	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	PG&E understands that NOISE-1 analyzes whether construction may result in the exposure of sensitive receptors to groundborne noise and vibration levels that exceed the applicable standards of the San Bernardino County Development Code (83.01.090) and the Mohave County Zoning Ordinance. Potential significant impacts the measure is designed to mitigate are "annoyance and/or architectural/ structural damage." For the purpose of NOISE-1, the EIR defined the Topock Marina Mobile Home Park or single family residences (page 4.9-20) as vibration-sensitive receptors. Based on this definition, none of the proposed remediation or new monitoring wells presented in the 90% 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	PG&E disturbance coordinators (Curt Russell and Chris Smith) have been designated to manage both noise and vibration concerns that may arise during construction. The disturbance coordinators will post their contact information in a conspicuous location near the construction trailer entrance so that it is clearly visible to nearby receivers. The disturbance coordinator will send the construction schedule to nearby vibration-sensitive receptors prior to commencement of that construction work. Should a concern about the actual noise generated by remedy construction arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	Disturbance coordinators were designated on November 18, 2011

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	Date Completed
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This measure will be implemented as directed. Construction equipment will be maintained and fitted with best available noise suppression devices, applicable 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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	This measure will be implemented as directed. Construction equipment will not be left idle for extended periods of time (more than 15 minutes) when not being used.	
Noise	Noise-2c	c) Construction activities shall include the use of berms, stockpiles, dumpsters, and or bins to shield the nearest noise-sensitive receptor adjacent to construction activities to within acceptable non-transportation noise level standards. When construction activities are conducted within the distances outlined above (i.e., 1,850 feet and 5,830 feet from California receptors and 330 feet and 735 feet from Arizona receptors for daytime and nighttime noise, respectively) relative to noise-sensitive uses in the project area, noise measurements shall be conducted by a qualified acoustical consultant at the nearest noise-sensitive land use relative to the construction activities with a sound level meter that meets the standards of the American National Standards Institute (ANSI Section S14 1979, Type 1 of Type 2) to ensure that construction noise associated with the project component complies with applicable daytime and nighttime noise standards. If noise levels are still determined to exceed noise standards, temporary barriers shall be erected as close to the construction activities as feasible, breaking the line of sight between the source and receptor where noise levels exceed applicable standards. All acoustical barriers shall be constructed with material having a minimum surface weight of 2 pounds per square foot or greater and a demonstrated Sound Transmission Class (STC) rating of 25 or greater as defined by the American Society for Testing and Materials' Test Method E90. Placement, orientation, size, and density of acoustical barriers shall be specified by a qualified acoustical consultant.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	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. Figures in Section 4 of the Construction/ Remedial Action Work Plan identify the noise sensitive receptors and potential construction activities that could trigger noise monitoring in accordance with the EIR mitigation measure Noise-2c. Although night-time construction is not planned, activities that could occur within specified distance from the sensitive receptors are identified on both figures for completeness. Noise monitoring locations will be the boundary of the noise receptors facing the project-related construction activities. The	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
						precise monitoring locations will be determined in the field by a qualified acoustical consultant. 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, and is included in the Construction/Remedial Action Work Plan. When construction activities are within the distance outline, the additional requirements specified in this measure will be implemented (additional details are provided in the Construction/Remedial Action Work Plan).	
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.	Construction/Remedial Action Work Plan; Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; 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.	PG&E disturbance coordinators (Curt Russell and Chris Smith) have been designated to manage both noise and vibration concerns that may arise during construction. The disturbance coordinators will post their contact information in a conspicuous location near the construction trailer entrance so that it is clearly visible to nearby receivers. The disturbance coordinator will send the construction schedule to nearby noise-sensitive receptors prior to commencement of that construction work. Should a concern about the actual noise generated by remedy construction arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports.	Disturbance coordinators were designated on 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).	The project has been designed to meet the normally acceptable exterior noise-level standard for places of worship during operation. This mitigation measure also 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.	This measure will be met through actions to be taken under mitigation measures outlined for Impact NOISE- 1 and Impact NOISE-2.	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
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.	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. In addition, the following communication protocols developed as part of the CIMP noise protocol CUL-1a-8h (Section 2.8.4) will also be implemented: All project construction activities will be communicated to nearby noise-sensitive receptors and Interested Tribes. Elements of this communication include: • A detailed project schedule is established and published for all stakeholders. • Monthly notification to agencies and Tribes of scheduled field activities. During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. • After issuing these notifications, notify the nearby noise-sensitive receptors and Tribes of any schedule changes. • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. Per CUL-1a-8k, if ceremonies are requested by any Tribe during construction, then PG&E will follow the protocol to accommodate such requests, which could include monitoring to ensure that construction noise does not exceed the normally acceptable exterior noise level standard in San Bernardino County for places of worship. • The contact information for the disturbance coordinator will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. In addition to the communication methods described above, PG&E will also consider posting construction schedule information at the information kiosk (CUL-1a-3c). PG&E may also decide to use other communication	

TABLE 6.1-1
Summary of Compliance with EIR Mitigation Measures
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Resources	Mitigation Number	Mitigation Measure	Which document(s) will contain or satisfy this measure?[1]	Action (Compliance Status)			Date Completed
				Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design	
						processes, including a Project website (a Project website could list Project activity schedules and other Project related information) that could be accessed by computer or smartphone and/or other simple push applications that apply to mobile devices.	
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.	Alternative Freshwater Sources Evaluation Technical Memorandum	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 *Revised Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL 2013c). Upon receipt of agencies' approval, PG&E will implement the plan. Data collected will be used to evaluate compliance with this measure.	A 72-hour constant-rate extraction test at Havasu National Wildlife Refuge (HNWR)-1 well was conducted in February 11-14, 2014 in accordance with the *Final Implementation Plan for Evaluation of Alternative Freshwater Sources* (CH2M HILL, 2013j). In addition, a 72-hour constant-rate extraction test was conducted at the Site B well from February 7 to 10, 2014. Test results indicated that existing nearby wells will not be substantially affected by pumping at the potential freshwater sites. PG&E presented the information to agencies, Tribes, and stakeholders at the March 19, 2014 TWG meeting, and summarized the results in a technical memorandum (CH2M HILL 2014b) for submittal to DTSC and DOI on April 2, 2014.	

Notes:

[1] The intent of this column is to identify what current or future document(s) are intended to satisfy this measure and be transparent on future forthcoming documentation. This column is not intended to document compliance with the mitigation measure.

EXHIBIT 6.1-1

PROTOCOL FOR COMPLIANCE WITH EIR MMRP MITIGATION MEASURE BIO-1 AND ARAR #32 AT THE TOPOCK COMPRESSOR STATION

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Application of Section 404 of the Clean Water Act to the Project

Pacific Gas & Electric Company (PG&E) has prepared this protocol to identify procedures to be taken to ensure compliance with Section 404 of the Clean Water Act (CWA) and for the Topock Remediation Project (the project) located at the Topock Compressor Station in Needles, California. Section 404 of the CWA is an Applicable or Relevant and Appropriate Requirement (ARAR) for the project. Additionally, the Final Environmental Impact Report (EIR) Mitigation and Monitoring Reporting Program (MMRP; California Department of Toxic Substances Control [DTSC] 2011c) mitigation measure BIO-1 contains applicable mitigation requirements related to CWA Section 404.

The text of MMRP BIO-1 (excerpted) and ARAR #32 are as follows:

> **BIO-1:** "If during the design process it is shown that complete avoidance of habitats under U.S. Army Corps of Engineers (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.
>
> Alternatively, 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 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."
>
> **ARAR #32**: "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." Federal Water Pollution Control Act (Clean Water Act), 33 USC § 1344, 40 CFR 230.10.

Under CWA Section 404, activities that discharge dredged or fill material into waters of the United States typically require a CWA Section 404 permit from the USACE.

PG&E has determined that the Topock Remediation Project would result in a discharge of dredged or fill material into jurisdictional waters and wetlands. However, the project is a CERCLA response action, and therefore the permit exemption at CERCLA Section 121(e)(1) applies to the project's on-site activities.[7] Therefore, PG&E is not required to

[7] *See* 42 U.S.C. 9921(e)(1) ("No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site where such remedial action is selected and carried out in compliance with this section."); DOI Memorandum, dated November 16, 2007.

comply with the procedural permitting requirements under Section 404. Although no CWA Section 404 permit is required for the Project, PG&E must still comply with the substantive requirements of the CWA Section 404.

PG&E received a letter from the USACE Los Angeles District Regulatory Program, dated July 10, 2013 (USACE 2013a), which stated that no permit is required for the Topock Remediation Project because the project is proceeding pursuant to the U.S. Department of the Interior's (DOI) CERCLA authority. Further, the USACE confirmed that no "substantive requirements or applicable conditions" were provided and the USACE would not verify PG&E's wetland delineation because no permit is required for the CERCLA action (USACE 2013b).

Section 404(b)(1) of the CWA requires that alternatives (or proposed actions) be designed to avoid or minimize adverse impacts to aquatic resources and waters of the United States. Compliance with the 404(b)(1) Guidelines can be achieved generally through the use of appropriate and practicable mitigation measures to minimize or compensate for potential adverse impacts of the discharge on the aquatic ecosystem (40 CFR 230.10(d)). Compensatory mitigation is considered after other appropriate and practicable options have been addressed to avoid and minimize adverse impacts to the aquatic environment. "Practicable" is defined in 40 CFR 230.3(q) to mean "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

Further, Section 404(b)(1) requires the least environmentally damaging practicable alternative be selected. During the course of the groundwater remedy design (including the Alternative Freshwater Source Evaluation), efforts were and will continue to be undertaken to avoid and minimize impacts to jurisdictional waters of the United States. However, it has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within waters of the United States. For example, monitoring well Q is sited in a wash because it is designed to monitor the effects of injection from well IRL-4, which was placed in a wash as a result of comment resolution at 30% design. Also, to minimize new infrastructure, the remedy design incorporates all existing monitoring wells into the remedy monitoring program. Some of the existing wells are located in Bat Cave Wash and the East Ravine.

1. Avoidance of Adverse Impacts to Wetlands and Non-Wetland Waters of the U.S.

In order to achieve the goal of no-net loss of jurisdictional waters of the U.S., including wetlands, avoidance and minimization measures (AMMs) will be implemented. PG&E prepared a Final Wetlands and Waters of the U.S. Delineation Report (CH2M HILL 2014c), delineating jurisdictional waters of the U.S., that was submitted to DTSC and DOI in April 2014, and has taken the location of jurisdictional waters of the U.S. into consideration in the design of the groundwater remedy in order to avoid impacts to jurisdictional wetlands and waters of the U.S. to the extent practicable.

During the remainder of the design phase, PG&E's design team will consult the Wetlands and Waters of the U.S. Delineation Report while considering the location of remedy infrastructure. PG&E's design team will prioritize avoidance of all wetland and non-wetland waters of the U.S. During the remainder of the remedy design, PG&E will continue to implement avoidance, to the extent practicable, and impacts to jurisdictional waters would occur only when there is no practicable alternative available.

2. Minimization of Adverse Impacts to Wetlands and Non-Wetland Waters of the U.S.

Consistent with 40 CFR 230.10(d) and Subpart H of Part 40 CFR 230 requirements to minimize the adverse effects of the discharge of dredged or fill material associated with the Topock Remediation Project, PG&E will implement AMMs during the design phase and best management practices (BMPs) during construction of the remedy in order to minimize adverse impacts to wetlands and non-wetland waters of the U.S.

Minimization measures will be implemented to minimize impacts to wetland and non-wetland waters of the United States within the Project area. All efforts will be taken to avoid jurisdictional resources to the extent practicable. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands, the California Department of Fish and Wildlife (CDFW) requires compliance with AMMs in lieu of a Lake or Streambed Alteration Agreement pursuant to CERCLA Section 121(e) for all work conducted in CDFW jurisdictional washes (CDFW 2013). The geographic extent of CDFW's jurisdiction under California law is broader than the jurisdictional extent of the USACE under CWA 404 and thus avoidance and mitigation measures applied to CDFW jurisdictional waters would as a geographic consequence also be applied to CWA 404 waters. While Arizona does not have a similar state program, PG&E will also implement the same AMMs in Arizona identified by CDFW for California to ensure appropriate protection to CWA 404 jurisdictional areas in the project limits, including those in Arizona. Thirty-four AMMs are to be implemented by PG&E for CDFW jurisdictional washes. Actions taken by PG&E, including in the design phase, to avoid and minimize impacts to jurisdictional wetlands and waters will be recorded in a table and maintained by PG&E for the Project.

<u>Remedy Construction, Operation, Maintenance, and Decommissioning BMPs</u>. During construction, operation, maintenance, and decommissioning, certain best management practices would be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands and non-wetland waters of the U.S. These techniques include flagging or fencing around jurisdictional resources, reducing soil erosion/runoff, sediment controls, spill controls, and other BMPs as described in Best Management Practices and Wetlands Avoidance Measures (see Attachment 1 on the following page) and the CDFW AMMs.

3. Compensatory Mitigation

Under the *2008 Compensatory Mitigation for Losses of Aquatic Resources, Final Rule*, compensatory mitigation requires actions that offset the unavoidable adverse impacts to wetlands, streams, and other aquatic resources authorized by Department of the Army permits. Compensatory mitigation is only considered when all appropriate and practicable steps have been taken to avoid and minimize adverse impacts to the aquatic ecosystem. Compensatory mitigation can be implemented by restoration, enhancement, establishment, or preservation. Restoration involves restoring a previously-existing wetland or aquatic site, enhancement involves improving or enhancing the functions of an existing aquatic site, establishment is the creation of a new aquatic site, and preservation involves an existing aquatic site. Compensatory mitigation can be provided by three methods: permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation. Further, compensatory mitigation should be commensurate with the amount and type of impact associated with the project.

PG&E will calculate temporary and permanent impacts to jurisdictional waters of the United States resulting from project activities prior to construction and periodically thereafter if additional impacts occur. Temporary impacts to waters of the United States will be restored on site, where possible. Otherwise, impacts will be treated as permanent impacts.

At the Topock Remediation Project, PG&E plans to implement mitigation bank compensatory mitigation for permanent loss of waters of the U.S. at the project site, where reasonably available. Mitigation banks involve off-site compensation under the direction of a third party who ensures that compensation is completed and that no-net loss of wetlands and non-wetland waters is successful. Mitigation bank credits are the preferred option for successfully providing compensatory mitigation under the Final Rule. Restoration is the preferred method of mitigation, and PG&E will attempt to fund a mitigation bank that provides restoration of wetlands at a 1:1 ratio of impact to wetlands, where possible. If a wetland restoration bank is unavailable then an enhancement or preservation bank, or other appropriate option, would be suitable. PG&E will also provide compensatory mitigation for impacts to non-wetland waters of the U.S. at a 1:1 ratio.

ATTACHMENT 1 TO PROTOCOL FOR PG&E COMPLIANCE WITH EIR MMRP MITICATION MEASURE BIO-1 AND ARAR #32 AT THE TOPOCK COMPRESSOR STATION

Best Management Practices and Wetlands Avoidance Measures

The potential impacts to jurisdictional waters associated with implementation of the Final Groundwater Remedy at the Topock Compressor Station may be permanent or temporary. Permanent impacts are those that are associated with the construction of the new remedy facilities themselves, which will remain in place during the operation phase until decommissioning and removal. These facilities include new wells, pipelines, and ancillary facilities (e.g., drainage features, remote monitoring equipment, and security fencing). Temporary impacts are those that are associated with construction activities that may require removal of vegetation or soil disturbance from construction activities (i.e., access roads) but will not result in permanent modifications to the bed, bank or channel of waterways.

The following wetland avoidance measures and Best Management Practices (BMPs) will be employed for the Topock Final Remedy Project:

1. A delineation of wetlands and waters of the United States has been prepared for the proposed project area, and submitted to DTSC (CH2M HILL 2014c). This delineation has informed the remedial design and was used to avoid or minimize impacts to sensitive resources. In addition to the mapping of federal jurisdictional wetlands and waters of the U.S., there was also a determination of the areas that are jurisdictional by CDFW under Section 1600. The CERCLA Section 121(e) exemption for the Topock Program obviates the need to secure permits from the U.S. Army Corps of Engineers or from CDFW, however, the substantive requirements of applicable state and federal laws are satisfied. A March 6, 2013 letter from CDFW confirming application of the CERCLA Section 121(e) exemption to the Topock Final Remedy Project and stating that PG&E need not obtain a Lake or Streambed Alteration Agreement, was accompanied by a list of Avoidance and Minimization Measures for the Project.

2. When planned work activities occur near or within jurisdictional wetland and waters, a biological monitor will provide a worker environmental awareness training to construction crews. The training will include information on sensitive biological resources that may occur in construction areas and the requirements to protect those resources. The training will also include information about BMPs to avoid potential indirect impacts to water quality at the project location or in downstream areas as described in the CDFW AMMs. PG&E's construction foreman will be responsible for verifying that all construction workers completed the training prior to beginning work at the project site.

3. Where boundaries of jurisdictional wetlands or waters are found in close proximity to planned construction activities, these features will be clearly demarcated in the field using flagging or brightly colored mesh fencing in order to ensure that they are not inadvertently impacted. The demarcation will be conducted under the supervision of a qualified biologist. The biologist will also survey any vegetation areas prior to clearing or cutting to ensure that there are no sensitive biological resources (such as active bird nests) that might be affected. The pre-construction survey will also include photographic documentation of pre-project conditions.

4. Access routes that pass through jurisdictional wetlands and waters, if needed, will be identified in order to minimize the impacts to perennial vegetation (e.g., trees and shrubs). Where impacts cannot be avoided to arrowweed stands within the historical floodplain, the stems of these plants will be cut to approximately 1 to 1 ½ feet above the ground surface. Then plastic sheeting or a tarp will be placed over the cut stems prior to crossing the area with construction vehicles. This approach will favor ready re-growth of the cut plants after the completion of construction activities. Any protected perennial trees or shrubs that are removed as a result of this project will be mitigated as part of the revegetation planning process.

5. Pre-construction surveys for listed species or actively nesting birds will be conducted immediately prior to the start of construction and after demarcation. Should any listed individuals or active nests be identified, the PG&E biologist will contact the United States Fish and Wildlife Service (USFWS) to determine an appropriate response. Only a biologist with an active Section 10(a) permit will be authorized to remove any individuals from the construction areas to a USFWS-approved release location.

6. The boundaries of the construction work zones and staging (supporting) areas including access routes will follow existing routes as much as possible. All construction work zones will be shown on detail site maps and demarcated in the field. No construction activities, vehicular access, equipment storage, stockpiling, or significant human intrusion will be allowed outside of the designated construction work zone and staging areas.

7. Equipment will not be operated in areas of ponded or flowing water, and no wet excavations will be performed during construction. Construction vehicles and equipment will be checked periodically to ensure that they are in proper working condition and that there are no apparent oil or fuel leaks. Onsite refueling or lubrication of vehicles and cleaning of equipment, or other activities that involve the use of fuels, lubricants, or solvents, will occur only in locations that are away from jurisdictional wetlands and waters.

8. Compliance with the above AMMs within jurisdictional waters will be tracked and reported to DTSC in the quarterly EIR mitigation measures compliance reports.

9. At project completion, the designated biological monitor will return to the site to document the post-construction conditions at the site. Information on the pre-and post-construction conditions will be documented in the Remedial Action Construction Completion Report. Post-construction conditions will be documented with photographs.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status) Pre-Final (90%) Design
1	Section 2.1	CUL-1a-8a: Protocols for Continuation of Tribal Communications This protocol requires that communication be consistent with past practices and communication processes previously entered into by PG&E with Interested Tribes, and that PG&E would continue to communicate with Interested Tribes during the design, construction, operation, and decommissioning of the project. Prior to implementation of construction. For examples of communication procedures consistent with past practices, see 2.1. 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.	PG&E has communicated with the Interested Tribes and will continue to communicate with them during all phases of the Project from design and construction through operation and maintenance as well as decommissioning. Tribes are currently invited to attend monthly meetings to review pieces of the design as they are prepared and to receive updates on the progress of the project. PG&E has also held field meetings with Tribes (e.g., meetings to site well locations, etc. May also see CUL-1a-8d, CUL-1a-8j, and CUL-1a-9) to assist in Tribal understanding of the remedy design. During construction, PG&E will continue to communicate regularly and will also provide updates on field activities so that Tribal monitors may also participate. Outreach efforts are communicated to DTSC on a quarterly basis during design, and will continue to occur quarterly during construction. 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.
2	Section 2.2	CUL-1a-8b: Protocols for Appropriate Treatment of Archaeological Materials These protocols include the following components: • Protocols for the appropriate treatment of archaeological materials that may be disturbed or discovered during implementation of the final remedy – Avoidance is preferred (by PG&E and Tribes) means of treatment in a discovery situation. If PG&E recommends that avoidance is not feasible and the Agencies make a determination that it is not feasible, then the protocols of Discovery Plan of the CHPMP will be followed for appropriate treatment of discoveries. • Protocols for the repatriation of significant items of cultural patrimony that may be recovered during the project • Protocols for the curation of cultural materials recovered during the project. • Treatment of archaeological sites, if data recovery is proposed	During design and construction, if discoveries are made, avoidance is the preferred method of treatment of discoveries. If, however, Agencies make a determination that avoidance is not feasible, PG&E will provide treatment of archaeological materials as outlined in Appendix C (Discovery Plan) of the CHPMP. As described in the protocol, during design and construction, Native American human remains and/or archaeological materials from Federal or Tribal land that are funerary objects, or ceremonial objects, or objects of cultural patrimony will be treated as prescribed in the Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulations (43 Code of Federal Regulations [CFR] 10), and as discussed in Section 8.2 (Treatment of Any Human Remains, Funerary Objections, Ceremonial Objects and Items of Cultural Patrimony) and Appendix D (Plan of Action) of the CHPMP (BLM 2012). If data recovery is proposed for treatment of an archaeological site, PG&E will follow the steps outlined in Section 2.2.3 of the CIMP.
3	Section 2.3	CUL-1a-8c: Protocols for the Review of Cultural Resource-Related Documents These protocols apply to the extent that the BLM has not consulted with Tribes under the consultation process in the Programmatic Agreement and referenced in the CHPMP, and include the following: • Review of cultural resource related documents, including timelines and procedures are specified in detail at Section 2.3.2. • PG&E will afford the Tribes an opportunity to review and comment on Project cultural resource-related documents • Standards as stipulated in the Programmatic Agreement Section XI will be implemented. (Section 2.3.4)	To date, the review of cultural resource related documents has occurred under the procedures identified by the Programmatic Agreement and referenced in the CHPMP. Certain EIR-required cultural resource related documents have also been sent to DTSC for review.
4	Section 2.4	CUL-1a-8d: Protocols for the Review of Project Design Documents These protocols provide for the review of the Topock Compressor Station Groundwater Remediation Project (Project) Design Documents at the Preliminary, Intermediate, and Pre-final phases. In general, at the preliminary phase of each design, PG&E will submit the design document to DTSC/DOI who will then submit to reviewers and invite their initial comments. See CIMP Figure 2-1 for a complete overview of the review process during design.	PG&E has followed the protocols outlined in Figure 2-1 of the CIMP regarding the review of design documents at the 30% and 60% design phases. PG&E will continue to follow the protocol for review of the 90% design.
5	Section 2.5	CUL-1a-8e: Protocols for Restoring the Environment to Its Preconstruction Conditions Upon Decommissioning The protocol presents the general approach for restoration of the areas affected by the groundwater remediation facilities. Restoration activities include grading, contouring, and revegetating the site. The restoration approach will be informed by documentation of the pre-construction condition (e.g., ground photographic records, topographic/aerial maps, disturbed area map, archaeological surveys, historical resource surveys, biological surveys). PG&E will seek ways to restore the affected areas to the conditions prior to construction, as closely as possible. Discussions will take place with the Tribes to develop an understanding of the different restoration techniques and expectations for different environments. For additional details, see Sections 2.5.3 (Restoration Guidelines) and 2.5.4 (Habitat Restoration and Revegetation).	A Plan for Decommissioning of Remedy Facilities and Restoration will be completed within 120 days of DOI's certification of completion of the remediation and a determination by DOI that removal of such facilities is protective of human health and the environment. This Restoration Plan will be developed in consultation with the land owners and managers, including FMIT, U.S. Bureau of Reclamation (USBR), and BLM. The BLM will consult with Signatories, Tribes, and Invited Signatories to the PA on the Restoration Plan. PG&E will implement the Plan to restore the site to conditions existing prior to the construction of the groundwater remediation facilities to the maximum extent practicable.
6	Section 2.6	CUL-1a-8f: IM-3 Decommissioning Plan	The IM-3 Decommissioning, Removal, and Restoration Work Plan is included as Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status) Pre-Final (90%) Design
7	Section 2.7	CUL-1a-8g: Protocols for Repatriation of Clean Soils During Construction Specifically, the management protocol for Handling and Disposition of Displaced Site Material requires work plans that involve activities that displace site material (and that are finalized subsequent to the development of the protocol) to include the following information: • The process for soliciting and considering the inputs of Tribe(s) regarding the management of the material that is displaced as a result of the work. • Details on material handling and short-term/long-term storage (including an inventory of materials displaced by the work). • Process for assessing contamination assessment. • Final disposition alternatives for displaced material.	The Soil Management Plan (SMP) (Volume 4 of the O&M Manual) contains procedures and protocols for the management and disposal of displaced soil including potentially contaminated soil, during drilling, construction, operation, and maintenance of the remedy as well as decommissioning of IM-3 facilities. The procedures and protocols included soil and waste characterization, screening and classification of soils, handling and short-term storage of soils, long-term storage of soils, transportation and disposal of hazardous wastes, and record keeping. Additional procedures and protocols for handling, management, and disposal of other waste streams that could be generated from remedy construction and start-up are included in the Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan.
8	Section 2.8	CUL-1a-8h: Noise Protocols <u>Pre-Construction (Section 2.8.3)</u> a) Establish a disturbance coordinator, who will coordinate both noise and vibration concerns that may arise during construction. b) Identify and coordinate activities where Noise-2 requires noise monitoring. Noise-2 states that noise monitoring will be conducted when construction activities are conducted within 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. c) If noise monitoring during construction is required, noise monitoring locations will be selected in coordination with the Tribes. The EIR MMRP requires that noise measurements be conducted at the nearest noise-sensitive land use relative to the construction activities. d) Examples of noise barriers that could be used during construction to mitigate noise concerns (e.g., berms, stockpiles, dumpsters, bins, and engineered acoustical barriers), and approaches for implementation, will be included in the Construction/Remedial Action Work Plan for review and comment by Tribes and agencies. In the unlikely event that engineered acoustical barriers are required during construction, they will comply with requirements of the EIR. <u>Construction (Section 2.8.3)</u> e) If noise monitoring finds that the relevant noise thresholds are exceeded, temporary noise barriers will be erected. f) Maintain all construction equipment according to manufacturer guidelines. Equipment will be fitted with the best available noise suppression devices. All impact tools will be shrouded or shielded, and all intake or exhaust ports on power equipment will be muffled or shielded. g) Construction equipment will not be allowed to idle for extended periods of time (more than 15 minutes) when not being used for construction. h) Should a concern about the actual noise generated by remedy construction arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant (INCE Board Certified or Professional Engineer in Acoustics) will evaluate all reoccurring disturbances for compliance with applicable standards. Noise measurements will be in accordance with the Topock Sound Measurement Protocol in the Basis of Design Report and the forthcoming Remedial Action Work Plan. All noise complaints and its resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports. <u>Operation and Maintenance (Section 2.8.3)</u> i) Should a concern about the actual noise generated by remedy operation arise, PG&E disturbance coordinator will thoroughly investigate and resolve the issue appropriately. A qualified acoustical consultant will evaluate all reoccurring disturbances for compliance with applicable standards. Noise measurements will be in accordance with the Topock Project Sound Measurement Protocol. All noise complaints and their resolutions will be recorded, tracked, and reported to DTSC in the quarterly compliance reports. j) If a new well needs to be installed or an existing well has to rebuilt during the operation phase, these activities are considered short-term construction activities and all noise protocols for pre-construction and construction phases will apply. <u>Decommissioning (Section 2.8.3)</u> k) Decommissioning are considered short-term construction activities. All noise protocols for pre-construction and construction phases will also apply to the decommissioning phase. <u>Communication (Section 2.8.4)</u> -All Project construction activities shall be communicated to nearby noise-sensitive receptors and Interested Tribes. Elements of this communication include: • A detailed project schedule is established and published for all stakeholders. • Monthly notification to agencies and Tribes of scheduled field activities. During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. • After issuing these notifications, notify the nearby noise-sensitive receptors and Tribes of any schedule changes. • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. • The contact information for the disturbance coordinator will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. In addition to the communication methods described above, PG&E will also consider posting construction schedule information at the information kiosk (CUL-1a-3c). PG&E may also decide to use other communication processes, including a Project website (a Project website could list Project activity schedules and other Project related information) that	<u>Pre-Construction</u> a) PG&E disturbance coordinators, Curt Russell and Chris Smith, will coordinate both noise and vibration concerns that may arise during construction. b) Noise monitoring locations will be the boundary of noise receptors as defined by EIR MMRP NOISE-2 facing the project-related construction activities. The precise monitoring locations will be determined in the field by a qualified acoustical consultant in coordination with the Tribes. c) Section 4 of the Construction/Remedial Action Work Plan contains examples of noise barriers that could be used during construction to mitigate noise concerns. Protocols during construction, operation and maintenance, and decommissioning will be adhered to during implementation of each phase. Compliance actions will be documented and reported to DTSC in the quarterly compliance reports. <u>Communication (Section 2.8.4)</u> • A detailed construction schedule is established and included in the Construction/Remedial Action Work Plan for review by agencies, stakeholders, and Tribes. • Monthly notification to agencies and Tribes of scheduled field activities has been and will continue to be sent by PG&E (Curt Russell or his designee). During periods of extensive construction activity, these notifications will be issued more frequently – weekly and/or daily, as appropriate. This element has been incorporated into the overall communication framework for construction and start-up (see Table 2.3-1 of the Construction/Remedial Action Work Plan). • After issuing these notifications, PG&E will notify the nearby noise-sensitive receptors and Tribes of any schedule changes. Nearby noise-sensitive receptors are residents of the mobile home park at Moabi Regional Park and the Topock Marina, as well as private residents in Topock Marina area. When construction activities occurred within 1850 feet of noise-sensitive receptors to the east, PG&E will post contact information in a conspicuous location near construction areas so that it is clearly visible to nearby sensitive receptors. In addition, mailing of the same information will be sent to those receptors and all Tribes (see Table 2.3-1 of the Construction/Remedial Action Work Plan). • Provide an open-communication process for Tribal representatives to seek more information about Project noise-generating activities. PG&E welcomes Tribal input on timing of Project noise-generating activities and on potential noise-reducing methods. Per CUL-1a-8k, if ceremonies are requested by any Tribe during construction, then PG&E will follow the protocol to accommodate any requests for Tribal ceremonies, which could include monitoring to ensure that construction noise does not exceed the normally acceptable exterior noise level standard in San Bernardino County for places of worship. • The contact information for the Project disturbance coordinators (Curt Russell and Chris Smith) will be posted in a conspicuous location near the construction areas. This information will also be mailed to all nearby noise-sensitive receptors and Interested Tribes. Nearby noise-sensitive receptors include residents at Moabi Regional Park and the Topock Marina area.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status) Pre-Final (90%) Design
		could be accessed by computer or smartphone and/or other simple push applications that apply to mobile devices.	
9	Section 2.9	CUL-1a-8i: Protocols for the Appropriate Methods, consistent with Mitigation Measures, AES-1 and AES-2, to Reduce Visual Intrusion <u>Additional Design Protocols that PG&E May Employ to Reduce Visual Intrusions (Section 2.9.2)</u> In addition to the specific requirements identified in AES-1 and AES-2, PG&E may employ various feasible design concepts identified by PG&E, Tribes, or other interested parties prior to implementation of a Project activity to reduce visual intrusions of the Project design. Potential design concepts include: • Construction of aboveground facilities within existing facilities, when appropriate. • Building designs that are harmonious with existing buildings and nearby landforms, including low profiles when available. • Flush-mount or below-ground installations whenever feasible. • Construction within existing transportation corridors. • Working only within previously-disturbed sites, whenever possible. • Placing aboveground facilities away from traffic, where feasible (i.e., areas where the introduction of the facilities would not create safety issues or visual impacts), to reduce the need for traffic barricades. • Design the lighting associated with above ground facilities to minimize glare and to focus lighting within a facility (e.g., using shields on lighting to reflect light downward and focused within a facility). <u>Opportunity for Agency, Tribal, and Other Stakeholder Input on the Visual Nature of Project Design (Section 2.9.3)</u> Within the design packages, PG&E will include visualizations of various design features described within the text and drawings in the package. Although the visualizations will not be comprehensive of the entire project, they will include many of the aboveground facilities that may be visible to stakeholders after construction. <u>Potential Temporary Visual Intrusions Identified During Remedy Implementation (Section 2.9.4)</u> During the course of remedy implementation, if agencies, Tribes, or other stakeholders identify temporary visual intrusions that should be addressed by PG&E, they should notify the Project Disturbance Coordinator(s), who will be responsible for resolving the issue or coordinating resolution of the issue with the Tribes, DTSC, other agencies, and/or stakeholders.	See response to EIR mitigation measures AES-1 and AES-2 in Table 6.1-1 for compliance actions. <u>Examples of where the additional protocols were employed during the design to reduce visual intrusions:</u> Building designs that are harmonious with existing buildings and nearby landforms, including low profiles when available. For example, the remedy building inside the compressor station and the TW Bench are designed to be compatible with existing buildings and/or the environment. Flush-mount or below-ground installations whenever feasible. For example, most well head completion is flush-mount and most piping installations are below ground. Construction within existing transportation corridors. For example, the majority of piping corridors are within existing roads. Working only within previously-disturbed sites, whenever possible. For example, all proposed construction staging areas and yard are located in previously-disturbed areas. Design the lighting associated with above ground facilities to minimize glare and to focus lighting within a facility (e.g., using shields on lighting to reflect light downward and focused within a facility). This design concept is followed in all building design for the project. <u>Opportunity for Agency, Tribal, and Other Stakeholder Input on the Visual Nature of Project Design (Section 2.9.3)</u> As was done at the 60% design stage, visualizations of various design components are provided in the 90% BOD Report to facilitate review. In addition, photos of typical construction equipment are provided in the Construction/Remedial Action Work Plan to facilitate review of the document. <u>Potential Temporary Visual Intrusions Identified During Remedy Implementation (Section 2.9.4)</u> During the course of remedy implementation, if agencies, Tribes, or other stakeholders identify temporary visual intrusions that should be addressed by PG&E, they should notify Curt Russell and Chris Smith, the Project Disturbance Coordinator(s), who will be responsible for resolving the issue or coordinating resolution of the issue with the Tribes, DTSC, other agencies, and/or stakeholders.
10	Section 2.10	CUL-1a-8j: Protocols for Tribal Notification in advance of Project-Related Activities 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 - PG&E will take care in these advance notifications to identify the field activities that have the potential to be ground disturbing. Examples of field activities which may include potentially ground-disturbing aspects include grading, trenching, boring, drilling, or other excavation for new injection, extraction or monitoring wells. In addition, construction of new pipelines, new treatment facilities, new access roads, new staging areas, other new transportation facilities, or other new Project components may include ground-disturbing aspects. PG&E will use communication methods specified in Section 2.10, and will provide two weeks advance notice of covered activities when possible.	PG&E has provided advance notice of ground-disturbing activities to Tribes during pre-construction phases such as the Freshwater Implementation Plan and Utility Potholing. PG&E also sends monthly emails to Tribes and Agencies that outline the field activities occurring at the Topock Compressor Station for the month. PG&E provides a two week advance notice where possible. PG&E will continue to provide advance notice to Tribes during any other ground-disturbing activities that may occur pre-construction. PG&E will also continue to follow this protocol during construction of the remedy and during operation, maintenance, and decommissioning.
11	Section 2.11	CUL-1a-8k: Protocols to Accommodate Tribal Ceremonies or Activities involving the Topock Cultural Area Protocols to be followed by project personnel to accommodate, if feasible as determined by DTSC, key Tribal ceremonies that involve the Topock Cultural Area. Under the protocol, any Tribe(s) wishing to perform such a ceremony may contact PG&E's Site Manager at the Topock Compressor Station by telephone, email, or in writing to discuss the specific request. PG&E will communicate directly with the requester (by telephone or in person) as soon as the request has been evaluated. PG&E will indicate if all of the requests can be accommodated and, if not, suggest alternatives that PG&E can accommodate. The requestor and PG&E will also discuss the details of other services that PG&E may agree to provide for the benefit of the ceremonial activity, including, power, water, parking, signage, or other support. PG&E will also identify any reasonable and necessary stipulations regarding health and safety, logistical, communication, or site access procedures to be followed in the Topock Compressor Station Groundwater Remediation Project (Project) Area. One stipulation will clearly state that the Topock Compressor Station is excluded, and that access to it cannot be provided.	No requests to conduct Tribal ceremonies have been submitted. If ceremonies are requested during design, construction, operation and maintenance, then PG&E will follow the protocol to accommodate any requests for Tribal ceremonies.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status)
			Pre-Final (90%) Design
12	Section 2.12	CUL-1a-8l: Protocols for Tribal Monitors to Observe Ground Disturbance Activities 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 the IM-3 Facility and subsurface pipeline, or other construction-related activities. Pacific Gas and Electric Company (PG&E) will notify the Interested Tribes (Tribes) as defined by the Environmental Impact Report (EIR) of planned ground-disturbing activities and other scientific surveying that is conducted in anticipation of construction activities. This provides the opportunity for Tribes to send Tribal monitors to the site to observe these activities, if they wish. While on site, Tribal monitors will have the opportunity to discuss their concerns directly with the PG&E project team while the activities are proceeding, as well as reporting their observations and any issues of concern directly to the Tribe(s) that they represent. Sufficient time (a minimum of 1 week notice) will be allowed between the notification and the beginning of the field activity that the Tribe(s) will be able to prepare adequately without undue haste and arrange for one or more monitors.	PG&E has provided notification to Tribes in advance of ground-disturbing activities during the design phase, including during the Alternative Freshwater Evaluation and Utility potholing activities. PG&E will continue to notify Tribes in accordance with the protocol throughout the remainder of the design, construction, operation and maintenance, and decommissioning.
13	Section 2.13	CUL-1a-8m: Provision of Reasonable Compensation for Tribal Monitors Provisions of reasonable compensation for Tribal monitors consistent with historic rates. PG&E will provide reasonable compensation for Tribal monitors who work on the Project. PG&E will negotiate with Tribes, taking into account the requirements of any pertinent MOUs or other legal agreements, to establish pay rates for monitors consistent with historic rates. The negotiated compensation rates will then be formalized in a separate MOU, or in amendments to an existing MOU, with each Tribe that will be supplying the services of one or more monitors.	PG&E has been operating under MOUs and has provided compensation for Tribal monitors currently and will continue to provide compensation during construction, operation and maintenance, and decommissioning phases.
14	Section 2.14	CUL-1a-8n: Protocols for Protective Measures for Archaeological/Historical Sites During Construction Locations requiring specific protective devices, such as temporary fencing, flagging, or other type of demarcation during construction. 2.14.1 Pre-Construction Measures to Identify Sites Requiring Protection. Pre-construction planning efforts will: (1) identify the location and boundaries of any archaeological, historical, and other cultural sites requiring protective measures during construction; and (2) establish zones within which construction may proceed. PG&E and BLM will consult with the Tribes during this process. 2.14.2 Identification of Protective Measures Prior to Construction. Avoidance will be implemented. Avoidance of known cultural sites/sensitive areas may be accomplished by using existing or approved routes of travel, and by carefully avoiding archaeological and historical sites when selecting laydown, access, and temporary work areas appurtenant to construction activities. 2.14.3 Measures to Identify New Sites Requiring Protection during Construction. PG&E's qualified archaeologist would inspect and evaluate any previously unidentified or suspected archaeological or historical resources found during construction, operation, or decommissioning. If resources are discovered, earth-disturbing activities will be temporarily suspended at the location of the find. The find will then be treated by modifying the extent of the construction zone to avoid and protect the resource(s). Thereafter, earth-moving activities may resume within the modified construction zone. Tribal notification will occur under requirements of the CHPMP and PA. 2.14.4 Implementation of Protective Measures. If warranted, protective measures may be employed on or around the archaeological or historical site to protect the resource from disturbance. These measures may include, but are not limited to, protective coverings of soil or riprap, onsite personnel to prevent access to sensitive areas, use of flagging, blaze orange mesh fencing secured to steel posts, bollards, natural barriers of rocks or piled brush, cables suspended between secure posts, and/or signage (e.g., "This Area Closed" or "Exclusion Zone: Keep Out"). Any such measures will be temporary (only as needed during construction), and will, to the extent practicable, not call undue attention to the nature of the resource being protected. Ongoing work within the established construction zone may continue. PG&E, in consultation with DTSC and BLM (if Federal and/or Tribal land is involved) and the Tribes, will determine the appropriate protective measures on a case-by- case basis, and may increase or reduce the size of the Environmentally Sensitive Area (ESA) or Exclusion Zone (EZ) if agreed to by representatives of these parties in the field. The protective measures set forth in this section will be thoroughly covered in the Worker Education Program. 2.14.5 Installation and Inspection of Protective Measures during Construction. PG&E's qualified archaeologists will monitor the installation of all protective measures and their removal after construction. Similarly, Tribal Monitors will be notified and invited to monitor the installation of all protective measures and their removal. PG&E construction inspectors will conduct and document systematic inspections of the integrity of protective measures during the entire period of construction activity. 2.14.6 Protection of New Sites Discovered during Construction. PG&E's qualified archaeologist will inspect and evaluate any new sites that may be discovered during construction and will notify Tribal Monitors of the discovery. Tribal Monitors will then inspect and evaluate the new site(s). Every effort will be made to avoid adverse effects on the discovered site(s) to the maximum extent practicable. Details on the initial inspection procedures are provided in Section 2.14.6. 2.14.7 Restoration After Removal of Protective Measures. After removal of protective measures (e.g., fencing, poles), the areas will be restored to pre-construction conditions. For details on documentation of pre-construction condition and post-construction condition, see Section 2.14.7.	PG&E will implement the protocols for protective measures for archaeological/historical sites during the construction of the remedy. As stated in the protocol, avoidance is the preferred protective measure and will be implemented where any identified archaeological, historical, or other cultural sites require protective measures during construction. If protective measures are used, the measures identified in Section 2.14.4 would be implemented. PG&E's archaeologist would monitor the installation and removal of all protective measures, and Tribal monitors would also be invited to monitor installation and removal. After removal, restoration would occur to pre-construction conditions.

TABLE 6.1-2
Summary of Compliance with Cultural Impact Mitigation Program (CIMP) Protocols
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CIMP Document	Protocols/Relevant Excerpts from Document	Action (Compliance Status) Pre-Final (90%) Design
15	Section 2.15	CUL-1a-8o: Protocols for Reporting Discoveries of Cultural Importance Protocols for the reporting of discoveries of cultural importance consistent with existing statutes and regulations. In the event that any previously unidentified or suspected historic or archeological resource, such as human remains and/or associated funerary objects or graves, is discovered during construction, PG&E will immediately notify the DTSC, BLM, and Tribal representatives if the resource is Native American, consistent with the CHPMP and the EIR Chapter 5.1.1. Human remains, items of cultural patrimony, or funerary objects that may be found shall be handled with utmost cultural and religious sensitivity. As specified in Section 2.2.1, avoidance of cultural resources is preferred over excavation, removal, or further disturbance, particularly in discoveries involving human remains, items of cultural patrimony, or funerary objects. Where human remains and funerary objects, ceremonial items, and items of cultural patrimony are discovered, PG&E will implement the reporting protocols provided in Appendix D (Plan of Action [POA]) of the CHPMP and consistent with Mitigation Measure CUL-4 in EIR Chapter 5.1.1. During initial inspection, PG&E's qualified Cultural Resources Consultant (as specified in CUL-1a-3(a)) will document the discovery. Tribal monitors will be invited to assist in the preparation of the documentation and identification of Tribal cultural values. Discoveries identified as having cultural importance will be documented in a culturally sensitive manner acceptable to the Interested Tribe(s). PG&E will consult with the BLM, and BLM will consult with the Tribal representatives if the resource is Native American in nature, to define the nature and extent of any further studies that may be required.	PG&E will follow the protocol for reporting discoveries, in addition to complying with the CHPMP and PA.
16	Section 2.16	CUL-1a-8p: Protocols for Inspecting Remediation Facilities and/or Staging Areas During Construction Protocols for the inspection of remediation facilities and/or staging areas throughout the construction phase. The locations of remediation facilities and staging areas will be examined for cultural resources throughout the construction phase. This process will include advance notification of interested parties, including Interested Tribes, implementation of procedures for the review of Project design documents, selecting previously impacted land wherever feasible for re-use as staging areas and/or for the siting of remediation facilities, and avoiding direct physical impacts to the Topock Maze as it is manifested archaeologically. PG&E's qualified archaeologist, in coordination with the Tribes, will perform background research and field verification to identify and evaluate any cultural, historical, or archaeological resources within the location of remediation facilities and/or staging areas. Any resources present will be avoided to the extent feasible during construction and use of staging areas and/or remediation facilities pursuant to CUL-1b/c and CUL-2. Further, construction monitoring and treatment of any unanticipated discoveries will be as specified in CUL-1b/c-4 and CUL- 1a-8o. Accordingly, archaeological and Native American monitors will be invited to observe all earth-disturbing activities at remediation facilities and/or staging areas during construction. These monitors will at all times comply with Project-wide and job site-specific safety requirements.	PG&E has included Tribes in review of Project design documents at the 30% and 60% phases, and PG&E has selected previously disturbed land for staging areas and siting of remediation facilities wherever feasible. PG&E's remedial design avoids direct impact to the Topock Maze as it is manifested archaeologically. During construction, PG&E will implement the procedures of the protocol to identify and evaluate any cultural, historical, or archaeological resources within the vicinity of staging areas and remediation facilities. Avoidance will then be implemented for any identified resources, and monitoring and treatment in the case of unanticipated discoveries. PG&E will invite Tribal monitors to observe all earth-disturbing activities.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	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 goal (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 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 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
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
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	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	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 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.	Compliance with this requirement will be achieved by reducing the concentration of Cr(T) in the affected aquifer below the federal 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. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. 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	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	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.	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, including federal, California, and Arizona standards.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	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.	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. The State MCL for Cr(VI) is 10 µg/L. 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. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. 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
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	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.	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.
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	Quarterly progress reports during remedy O&M Other data/reports requested by agencies	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.	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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
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.	Injection wells are classified as Class V injection wells and will be registered with USEPA prior to installation. 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 U.S. (see Figure 2-16 of the 30% BOD Report). 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 U.S. (see Figure 2.4-5 in the 60% BOD Report document). 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 is to be revised in April 2013; results will be summarized in a forthcoming report for DTSC review.	A report titled "*Wetlands and Waters of the United States Final Delineation Report for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California"* (CH2M HILL 2014c) was prepared to summarize results of efforts to delineate jurisdictional areas in the project area, and was submitted to DTSC and DOI on April 18, 2014. The report is also included in Appendix A3 of the 90% BOD Report. On July 10, 2013, the USACE confirmed that CERCLA 121(e)(1) permit exemption applies to the Topock remediation project, and therefore, PG&E is not required to comply with the administrative and procedural elements of Section 404 of the Clean Water Act, however PG&E is obligated to comply with the substantive elements of Section 404 of the Clean Water Act. The locations of jurisdictional wetlands and waters have been incorporated into the design. At the 90% design stage, the final remedy avoids almost all permanent impacts within USACE jurisdictional areas with the following exceptions. There is one well, IRL-4 and one or two associated arsenic monitoring wells that will occur within a jurisdictional waters of the US. There is also a freshwater pipeline that will be installed within an existing unpaved access road within the 100-year of the Colorado River. However, complete avoidance of other

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
										jurisdictional non-wetland waters is not feasible. It has been determined that in order to meet the goals of protection of human health and the environment, to meet the RAOs for the remedy, to monitor remedy performance, to gather data for demonstration of compliance, as well as in response to resolution of design comments with the Tribes, infrastructure (remediation, monitoring wells, and associated piping/conduits) must be installed in certain washes. There are no practicable alternatives to locating certain infrastructure within waters of the United States. Figure 2.4-5 in the 90% BOD Report shows the unavoidable overlaps between planned remedy infrastructure and the USACE jurisdictional waters. In such cases where complete avoidance is not feasible, certain best management practices (BMPs) will be implemented to avoid and minimize temporary and permanent impacts for activities occurring within jurisdictional wetlands (if any) and non-wetland waters of the U.S. Although the USACE did not provide a list of measures that may be taken to reduce impacts to jurisdictional waters and wetlands, the California Department of Fish and Wildlife (CDFW) requires compliance with avoidance and mitigation measures (AMMs) for all work conducted in CDFW jurisdictional washes. The geographic extent of CDFW's jurisdiction is broader than the jurisdictional extent of the USACE under CWA 404 and thus, avoidance and mitigation measures applied to CDFW jurisdictional waters would as a geographic consequence also be applied to CWA 404 waters. While Arizona does not have a similar state program, PG&E will also implement the same AMMs in Arizona identified by CDFW for California as well to ensure appropriate protection to CWA 404 jurisdictional areas in the project area, including those in Arizona. In addition to the CDFW AMMs, PG&E has identified additional BMPs for implementation during remedy construction, operation and maintenance, as well as decommissioning. The additional BMPs are described in the *Protocol for Compliance with EIR Mitigation and Monitoring*

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
										Reporting Program BIO-1 and Applicable or Relevant and Appropriate Requirement (ARAR) #32 at the Topock Compressor Station (see **Exhibit 6.1-1** at the end of Table 6.1-1). A Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) was also prepared and submitted as an appendix of the Construction/Remedial Action Work Plan.
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.	No further action required. The remedy as presented in the 90% design does not result in point source discharges to waters of the United States that will require an NPDES permit.
34	Federal Action-Specific	Federal Water Pollution Control Act (Clean Water Act) -40 CFR 122.26	ARAR Applicable	These regulations define the necessary requirements with respect to the discharge of storm water under the NPDES program. These regulations will apply if proposed remedial actions result in storm water runoff which comes in contact with any construction activity from the site remediation.	Ground disturbance as a result of construction is > 1 acre	PG&E	SWPPP, BMP Plans and Monitoring & Reporting, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 and Site Restoration, Decommissioning Plan for Remedy Facilities and Restoration	PG&E will prepare 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.	A BMP Plan for construction activities was prepared and is included as an appendix in the Construction/Remedial Action Work Plan and the IM-3 Decommissioning Work Plan. In addition, an industrial SWPPP was also prepared and included in Appendix E of the O&M Plan (Volume 1). The SWPPP includes BMPs for O&M activities and a storm water monitoring program in compliance with the General Permit.
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.	No further action required. The remedy, as presented in the 90% design, will not affect navigable waters.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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.	No further action required. The remedy, as presented in the 90% design does not include activities subject to NESHAPs.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
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 2011) 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, subsequently 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 the IM-3 facility; and a Decommissioning Plan for Remedy Facilities and Restoration.	The remedy, as presented in the 90% design, does not substantially burden a person's exercise of religion. Additionally, in compliance with the PA, a Tribal Access Plan (BLM 2011) 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. On October 21, 2013, PG&E provided the Tribes a draft of the Access Plan for lands not under federal management for review and comment. Tribal comments were received on November 22, 2013. PG&E has updated and discussed the plan at the July 24, 2014 TMU. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan. 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, subsequently 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 be prepared and submitted to DTSC shortly after submission of the 90% design.. The 90% design was submitted on September 8, 2014. A Construction/Remedial Action Work Plan and a plan for decommissioning, removal, and restoration of the IM-3 facility were submitted concurrently with the 90% design. In compliance with the CD (Appendix C Scope of Work, Item 9), a Decommissioning Plan for Remedy Facilities will be submitted within 120 days of receipt of DOI's certification of completion of the RA and a determination by DOI that removal of such facilities is protective of human health and the environment.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
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.	Extension of existing PBA through December 31, 2017 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, Plan for Decommissioning of Remedy Facilities and Restoration.	PG&E, USFWS, and DOI are coordinating on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. Goal is to complete the PBA in time for the completion of ESA Section 7 consultation prior to the approval of the Construction/Remedial Action Work Plan.	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.	The Final Groundwater Remedy PBA was prepared to support informal consultations for actions to be conducted under the remedial action, including activities located on BLM and U.S. Fish and Wildlife Service administered lands. Coordination with USFWS, BLM, and DOI on the PBA had occurred. This ESA Section 7 consultation was concluded with receipt of USFWS concurrency letter on July 7, 2014 which preceded the approval of the Construction/ Remedial Action Work Plan.
41	Federal Action-Specific	Migratory Bird Treaty Act - 16 USC 703-712	ARAR Applicable	This Act makes it unlawful to "take, capture, kill," or otherwise impact a migratory bird or any nest or egg of a migratory bird. The Havasu National Wildlife Refuge, which is part of the Topock site, was created as a refuge and breeding ground for migratory birds and other wildlife, therefore, there is potential for contact with migratory birds during proposed remediation activities. Any remedial action selected for the Topock site will be designed and implemented so as to not take, capture, kill, or otherwise impact a migratory bird, nest, or egg.	Remedial action for Topock site	PG&E	Construction/ Remedial Action Work Plan, Plan for decommissioning, removal, and restoration of IM-3 facility, Plan for Decommissioning of 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.	PG&E submitted the Final Bird Impact Avoidance and Minimization Plan (CH2M HILL, 2014d) on April 30, 2014. The plan is also included as an appendix of the Construction/Remedial Action Work Plan, and Appendix I of the IM-3 Decommissioning Work Plan. Regarding decommissioning activities, the Avoidance and Minimization Plan will be based on surveys conducted prior to decommissioning, and during the breeding season; therefore this Plan will be prepared in the future, prior to decommissioning.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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 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. 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.	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. If additional wells in Arizona are required, 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.	No further action is required. The 90% 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.	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. 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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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).	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. 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).	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. 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).	While the 90% design includes freshwater supply from existing wells in Arizona, these supply wells are part of the alternative freshwater source evaluation (also known as the Fresh Water Implementation Plan [FWIP]). Compliance with ARARs, including the Arizona Well Standards, for the supply wells are included in the FWIP. 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).

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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.	No further action is required. The pre-final (90%) design does not involve treatment of groundwater in Arizona.
74	California Action-Specific	Hazardous Waste Control Act (HWCA) - Standards applicable to generators of hazardous waste Title 22, CCR, Div 4.5, Ch 12, Article 1, §66262.11	ARAR Applicable	Owners or operators who generate waste shall determine whether waste is a hazardous waste. Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities are hazardous shall be made when the wastes are generated.	Activity that generates waste that could potentially be hazardous	PG&E	O&M Plan, Construction/ Remedial Action Work Plan, Plan for Decommissioning and Removal of IM-3 Facility and Site Restoration; Plan for Decommissioning of 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 Plan (Volume 1), which is included in this BOD 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.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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.	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; Plan for Decommissioning of 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).	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 are addressed in documents such as the O&M Plan, the Soil Management Plan prepared under EIR mitigation measure HAZ-2c, the Construction/Remedial Work Plan (including the Construction Quality Assurance Project Plan), and the Security Plan prepared under EIR mitigation measure CUL-1a-3b. Waste management, including waste analysis, is described in: a) Section 6 of the O&M Plan, which is included in the BOD Report for the 90% design as Volume 1 of the O&M Manual (Appendix L), b) The Soil Management Plan, which is included in Volume 4 of the O&M Manual (Appendix L), c) The Waste Management Plan, which is included as an appendix of the Construction/ Remedial Action Work Plan, and d) Section 5 of the IM-3 Decommissioning, Removal, and Restoration Work Plan (appendix to the CIMP and to the Construction/Remedial Action Work Plan).

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status) Preliminary (30%) Design	Action (Compliance Status) Intermediate (60%) Design	Action (Compliance Status) Pre-Final (90%) Design
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; Plan for Decommissioning of 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.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual) includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities. Hazardous waste manifests will be prepared for each off-site shipment of hazardous waste.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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; Plan for Decommissioning of 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.	Waste management procedures are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status) Preliminary (30%) Design	Action (Compliance Status) Intermediate (60%) Design	Action (Compliance Status) Pre-Final (90%) Design
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; Plan for Decommissioning of 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.	Waste management procedures (including accumulation requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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; Plan for Decommissioning of 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.	Waste management procedures (including record keeping requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.
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, Construction/ 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.	The O&M Manual, which is included in the BOD Report for the 90% 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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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, Construction/ 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.	The O&M Manual, which is included in the BOD Report for the 90% 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, Plan for Decommissioning of Remedy Facilities and 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.	The IM-3 Decommissioning, Removal, and Restoration Work Plan was prepared and is included in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. Achievement of RAOs will be considered clean closure and that will remove any post-closure care obligations. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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; Construction/ Remedial Action 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 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. Containers used to transfer, store or treat hazardous waste will comply with requirements in 22 CCR §66262.171-§66262.179.	Waste management procedures (including containers requirements) are described in the following documents: 1) O&M Plan (Volume 1 of O&M Manual), Section 6, Waste Management Plan and Recoverable Materials, describes procedures for the collection, characterization, storage, transportation, and disposal of waste generated during operation and maintenance of the remedy. 2) Soil Management Plan (Volume 4 of O&M Manual), includes procedures and protocols for the management and disposal of potentially contaminated or contaminated soils displaced during drilling, construction, operation and maintenance of the remedy, and decommissioning and removal of IM-3 facilities. 3) The Waste Management Plan in an appendix of the Construction/Remedial Action Work Plan includes procedures for the management of wastes (other than soil) generated during construction and startup of the remedy. 4) IM-3 Decommissioning, Removal, and Restoration Work Plan, Section 5, Waste Management Plan and Recoverable Materials includes procedures for collection, characterization, storage, transportation, and disposal of wastes (other than soil) generated during the decommissioning and removal of IM-3 facilities.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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;	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.	At the 90% design stage, there are two design elements that could trigger compliance with this ARAR: **Sampling Purge Water Holding Tank in MW-20 Bench Carbon Amendment Building** If the purge water or decon pad water accumulated in this tank exhibits hazardous waste characteristics, the water tank and any ancillary equipment handling hazardous waste will comply with the requirements for hazardous waste tank systems. It will be labeled as a hazardous waste tank, be equipped with secondary containment and overfill prevention controls, daily inspections will be performed and documented, and an engineer's assessment of the tank system's integrity will be performed. **Portable Treatment Unit for Well Rehabilitation at Well Head** Treatment of well rehabilitation water with a pH below 2.0 at the well head may be performed in a portable treatment unit that is subject to the requirements for a fixed treatment unit (FTU) operating under the Conditional Authorization permit tier if it operates entirely onsite, or to the requirements for a transportable treatment unit (TTU) operating under the Permit By Rule permit tier if it operates at multiple sites. If the treatment unit includes tanks that accumulate or treat waste with hazardous characteristics, the tanks and any ancillary equipment that handles hazardous waste will comply with the requirements for hazardous waste tank systems, including labeling, having secondary containment and overfill prevention controls, being subject to documented daily inspections, and having an engineer's assessment of the tank system's integrity performed. If the treatment unit operates as a TTU, compliance will be the obligation of the TTU owner.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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 (Volume 4 of O&M Manual)	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.	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.	No further action is required. The 90% design does not include construction of a landfill.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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; Construction/ 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.	No further action is required. The 90% 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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
89	California Action-Specific	<u>Land Disposal Restrictions (LDR) for RCRA wastes and non-RCRA wastes</u> -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; Plan for Decommissioning of 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.	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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
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.	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. Section 5 of the Construction/Remedial Action Work Plan includes contingency planning for failure modes during construction (including large releases), assess and mitigate risks, and prioritize risk management in order to prevent problems before they arise. The project-specific HMBP (Appendix F of the O&M Plan) also addresses procedures for emergencies. Communication protocols including contacts and notification in emergency conditions are presented in Exhibit L2.2-1 of the O&M Manual, Table 2.3-1 of the Construction/Remedial Action Work Plan, and the HMBP.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (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.	Although the 90% design does not include regulated units, the following 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: 1) Appendix E of the O&M Plan (Volume 1 of the O&M Manual) includes an industrial SWPPP that involves BMPs designed to reduce pollutants in discharges that may affect receiving water quality during operations and maintenance of the remedy. 2) Volume 2 of the O&M Manual includes a sampling and monitoring plan for groundwater and surface water. 3) The Construction/Remedial Action Work Plan includes a BMP Plan for construction activities that involves visual inspections and monitoring and sampling for purposes of ensuring the protection of receiving water quality. 4) The project-specific HMBP addresses procedures for emergencies.
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.	The O&M Manual, which includes a sampling and monitoring plan for groundwater and surface water, is included as Appendix L in the BOD Report for the 90% design. PG&E will prepare quarterly Progress Reports that presents the results and analysis of monitoring data.
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.	Although the 90% design does not include regulated units, the programs described in the sampling and monitoring plan for groundwater and surface water (Volume 2 of the O&M Manual) and future quarterly progress reports provide a level of protection equivalent to a detection monitoring program that will provide reliable indication of a release.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	Although the 90% design does not include regulated units, the programs described in the sampling and monitoring plan for groundwater and surface water (Volume 2 of the O&M Manual) and future quarterly progress reports 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.	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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	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.
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	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 of the 60% BOD Report.	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 of the 90% BOD Report.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
							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.			
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, Plan for Decommissioning of Remedy Facilities and 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.	The remedy includes water and monitoring wells, and will adhere to the standards specified in this ARAR. An approach for well decommissioning has been developed by a subgroup that includes PG&E, DTSC, DOI, and Interested Tribes. Protocols for well decommissioning developed based on this approach, are presented in the O&M Plan (Volume 1 of the O&M Manual). Well construction and decommissioning procedures are also described in the Construction/Remedial Action Work Plan.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	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. The state MCL for Cr(VI) is 10 µg/L. 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 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. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions, and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. 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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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	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). Surface water data in the Colorado River show concentrations of TDS less than the Surface Water Objectives for the Colorado River of 723 mg/L. Calculations show that remedy operations have insignificant impact on TDS in the river. 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**.** Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection are localized, will attenuate under site conditions and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status): Preliminary (30%) Design	Action (Compliance Status): Intermediate (60%) Design	Action (Compliance Status): Pre-Final (90%) Design
									Measure/Remedial Action Completion Report.	Modeling also indicates that manganese generated from in-situ remediation does not exceed the upper tolerance level of background manganese concentration at the site.
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 the 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.	The O&M Manual is Appendix L of the BOD Report for the 90% 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. Modeling indicates that arsenic concentrations that may temporarily be elevated by the generation from in-situ remediation and freshwater injection will attenuate under site conditions, are localized, and will return to pre-remedy baseline levels after the end of active remediation and the cessation of freshwater injection, respectively. 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.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	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.
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, Plan for Decommissioning of Remedy Facilities and Restoration	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.	The 90% design was submitted to DOI on September 8, 2014, and includes proposed facilities on BLM land. Engineering drawings are included as Appendix D to the 90% design report and an O&M Manual is included as Appendix L. The Construction/Remedial Action Work Plan was also submitted concurrently with the 90% design as part of the 90% design. Progress reports will be submitted during the construction and operation and maintenance of the remedy. PG&E understands that DOI will coordinate its review of these submittals with BLM. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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, Plan for Decommissioning of Remedy Facilities and Restoration	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.	See **Table 6.2-1A (Supplemental Information for ARAR #7_AUA_CD).**

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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 in the 60% BOD Report document 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.	Figure 2.4-5 in the 90% BOD Report document 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 90% 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 also comply with avoidance, minimization and mitigation measures specified in the Section 404 protocol (see Exhibit 6.1-1 at the end of Table 6.1-1) and the requirements of the Programmatic Biological Assessment. USFWS will be consulted on the 90% BOD Report.
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	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, Plan for Decommissioning of 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	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).	Documents led by BLM include the PA, the CHPMP, the Brochure, the Annual Report, and the Tribal Access Plan. The PA is 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 also 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 be prepared and submitted to DTSC shortly after the submission of the 90% design. The Tribal Access Plan for lands under federal management was completed on November 26, 2011. On October 21, 2013, PG&E provided the Tribes a draft of the Access Plan for lands not under federal management for review and

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
				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.				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.	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.	comment. Tribal comments were received on November 22, 2013. PG&E has updated the plan and included the plan in an appendix of the Construction/Remedial Action Work Plan. (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 Third Annual Report was provided by BLM to the Signatories, Tribes, and Invited Signatories for comment on June 18, 2014. 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 90% design, the Construction/ Remedial Action Work Plan, and the IM-3 decommissioning, removal, and restoration work plan were submitted on September 8, 2014. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a site-specific Plan for Decommissioning and Restoration of remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status) Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. 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 90% design, the Construction/ Remedial Action Work Plan, and the IM-3 decommissioning, removal, and restoration work plan were submitted on September 8, 2014. In compliance with the CD (Appendix C Scope of Work, Article 9), PG&E will prepare a Plan for Decommissioning and Restoration of the remedy facilities within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status) Preliminary (30%) Design	Action (Compliance Status) Intermediate (60%) Design	Action (Compliance Status) Pre-Final (90%) Design
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.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. The 90% design and the Construction/Remedial Action Work Plan were submitted on September 8, 2014.
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.	There are no historic landmarks in the APE. No further action is required.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP.
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.	BLM led the preparation of the Tribal Access Plan for lands under federal management, and the Plan was completed on November 26, 2011. The EIR-required Access Plan was prepared and is included in an appendix of the Construction/ Remedial Action Work Plan.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	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 90% 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 the 90% design, certain infrastructure (piping) cannot be located outside of 100-year floodplain as defined by the above baseline flood elevation. PG&E has worked with Mohave County Flood Administrator to ensure compliance with the county requirements for construction in the floodplain.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP. The Construction/Remedial Action Work Plan was prepared and submitted concurrently with the 90% design on September 8, 2014.
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.	Requirements in the PA and the CHPMP will be adhered to. These requirements include implementation of mitigation measures identified in the PA and the CHPMP and through ongoing consultation activities with the Tribes that will avoid, mitigate, or otherwise minimize adverse effects from the undertaking. Tables 6.2-2 and 6.2-3 summarize actions by PG&E to implement the applicable provisions under the PA and the CHPMP.

TABLE 6.2-1
Summary of Compliance with Identified ARARs
Groundwater Remedy Basis of Design Report/Pre-Final (90%) 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?[4]	Action (Compliance Status)		
								Preliminary (30%) Design	Intermediate (60%) Design	Pre-Final (90%) Design
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.	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 90% 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 the 90% design, certain infrastructure (piping) cannot be located outside of 100-year floodplain as defined by the above baseline flood elevation. PG&E has worked with 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.
[4] The intent of this column is to identify what current or future document(s) are intended to satisfy this measure and be transparent on future forthcoming documentation. This column is not intended to document compliance with the ARARs.

TABLE 6.2-1A
Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD)
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Items listed in DOI's October 23, 2008 letter *"PG&E Topock Compressor Station Remediation Site – Evaluation of Attainment of Fish and Wildlife Service Location-Specific ARARs for the Proposed Remedial Alternatives"*	**Action (90% Design Compliance Status)**
What the proposed actions/facilities are – including specifics (such as how many wells, the spacing of wells, detailed sizes/lengths of facilities, etc.)	The 90% design was submitted to DOI on September 8, 2014. Section ES. 3 and Table ES-1 (Summary of Engineering Design Parameters and Key features) of the 90% BOD report provide an executive summary and high level description of the remedy features (wells, pipelines, supporting systems and utilities, structures/buildings, access roads, etc.) including references to specific report figures that show the locations of these features. Detailed descriptions of the remedy features are provided throughout the BOD report, specifically: • Section 3.2 describes the in-situ remediation system and its configuration including the IRZ wells, the River Bank Extraction Wells, the Inner Recirculation Loop wells, the TCS Recirculation Loop wells, the Freshwater Injection Wells, and the associated pipeline alignment. • Section 3.3 describes the source of freshwater, the contingent arsenic treatment system, and freshwater piping conveyance including storage. • Section 3.4 describes the remedy-produced water management system. • Section 3.5 describes the utilities and other supporting facilities including power supply, SCADA, and structures/buildings to support the remedy. • Section 3.6 describes the monitoring network/wells. • Section 5 describes the ICs which are also required components of the remedy.
Where the use would be conducted – including specific areas of use, habitat types and acres, key wildlife species that occur there, proportion of refuge or habitat type involved, and other areas affected incidental to use – provide in site maps	Section 2.4 (Other Site Conditions Affecting Design) of the 90% BOD report describes the baseline site conditions that affect remedy design. Among the documented conditions related to ecological resources at the site are surface water quality, USACE/CDFW jurisdictional waters and wetlands, vegetation communities, special status plants, and special status wildlife, avian, and aquatic species. Select maps were provided in Section 2.4 that overlays the remedy features on surveyed ecological resources.
When the use would be conducted—including time of day and year; duration of use; and a timeline of implementing, performing/maintaining, and closing out the actions/facilities	An estimated project schedule is included in Exhibit 7.5-1 in Section 7.5. Exhibit 7.5-1 provides an estimated timeline for implementing the remedial action through remedy start-up and start of full remedy operations (anticipated June 2019). Consistent with the CMS/FS and Agencies Decision Documents (ROD, Statement of Basis), it is anticipated that this remedy could require 30 years of operations on refuge lands. Per the November 20, 2013 State Water Resources Control Board letter, monitoring on refuge land will be required in order to demonstrate that the water quality objective for arsenic in the receiving groundwater is met "within the earlier of (i) 20 years after achieving the remedial action objective for chromium or (ii) 20 years after ceasing injection of the water containing naturally occurring arsenic at concentrations above the water quality objective." After the remedial action is complete, the remedy facilities will be decommissioned. An updated project schedule will be included in the 90% design and the future Remedial Action Work Plan.
How the use would be conducted—including techniques and equipment used, the number of people involved, routine operation and maintenance procedures	O&M procedures are described in Volume 1 of the Draft O&M Manual (Appendix L of the 90% BOD Report). Details related to construction of the remedy are included in the Construction/Remedial Action Work Plan, submitted concurrently with the 90% design.
What would be the anticipated impacts—identifying and describing the impacts; citing available sources of information (plans, environmental assessments, narratives, research, state plans, field experience, consultation with others); distinguishing between long-term and short-term impacts; documenting direct, indirect, and cumulative impacts on refuge resources	Section 2.4 (Other Site Conditions Affecting Design) of the 90% BOD report describes the baseline site conditions that affect remedy design. Among the documented conditions related to ecological resources at the site are surface water and wetlands, vegetation communities, special status plants, and special status wildlife, avian, and aquatic species. PG&E, USFWS, and DOI coordinated on the Programmatic Biological Assessment (PBA) for the final groundwater remedy. The Final Groundwater Remedy PBA (CH2M HILL 2014k) was prepared to support informal consultations for actions to be conducted under the remedial action, including activities located on BLM and U.S. Fish and Wildlife Service administered lands. This ESA Section 7 consultation was concluded with receipt of USFWS concurrency letter on July 7, 2014 which preceded the approval of the Construction/Remedial Action Work Plan. Measures outlined in the PBA and associated USFWS determination will be implemented before and during construction activities. Biological completion reports will be submitted to USFWS documenting areas of impacts and monitoring of construction activities. Impact analyses for proposed construction and operation activities are described in the Final Groundwater Remedy PBA (CH2M HILL 2014k) for the action area, and also in the Habitat Restoration Plans for the HNWR lands (CH2M HILL 2014n) and for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o) (these plans are included as appendices to the Construction/Remedial Action Work Plan). Impacts analysis are also described in the EIR Section 4.3.3.3 and include: BIO-1 – Potential Fill of Wetlands and Other Waters of the U.S. or removal of Riparian Habitat; BIO-2 – Direct Disturbance of and Loss of Habitat for Special-Status Birds and Desert Tortoise; and BIO-3 Fish Mortality, Interference with Spawning Habitat, and Other Adverse Effects. Of these, only BIO-1 and BIO-2 are related to the proposed activities. The certified EIR summarizes results from site-specific surveys that were conducted for Southwestern willow flycatcher, Mojave desert tortoise, Yuma clapper rail, and other avian species which were also identified during these surveys. Implementation of the EIR mitigation measures would reduce all of these impacts to a less-than-significant level. Subsequent studies have been conducted to document the type and extent of jurisdictional wetlands and waters of the U.S. (Wetland Delineation Report, Aug 2013); as well as the type and location of rare and protected plants (Floristic Survey Report, Aug 2013) and culturally significant plants (Ethnobotany Survey Report, Aug 2013). Additional survey for lycium and arrowweed was conducted in response to comment #311 DOI-140. Potential impacts to sensitive resources during remedy implementation will be documented as required by the EIR. Additionally, applicable cultural resource mitigation measures included in the Programmatic Agreement (PA) (BLM 2010), Cultural and Historic Properties Management Plan (CHPMP), Cultural Impact Mitigation Program (CIMP), and the EIR Section 4.4 are being and will continue to be implemented to avoid, minimize, or mitigate adverse effects to cultural and historic properties on refuge land.
What mitigation is planned for loss of functional value of refuge while use is in operation	The Construction/Remedial Action Work Plan includes a Habitat Restoration Plan in compliance with the CD, Appendix C (Scope of Work), Article 3. This plan has been prepared to provide information requested by the HNWR for its Appropriate Use Analysis and Compatibility Determination (AUA/CD) regarding planned mitigation for potential loss of functional value of refuge while use is in operation.

TABLE 6.2-1A

Information for the Havasu National Wildlife Refuge's Appropriate Use Analysis and Compatibility Determination (AUA/CD)

Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Items listed in DOI's October 23, 2008 letter *"PG&E Topock Compressor Station Remediation Site – Evaluation of Attainment of Fish and Wildlife Service Location-Specific ARARs for the Proposed Remedial Alternatives"*	**Action (90% Design Compliance Status)**
How and when the actions/facilities would be closed out—including restoration plans	In addition to the Habitat Restoration Plan described above, a Plan for Decommissioning of Remedy Facilities and Restoration will include procedures for the removal and decommissioning of the groundwater remedy. The Plan will also incorporate planning/approaches for post-remedy restoration (including, but not limited, to a series of photo points). This future Plan will be submitted to DOI within 120 days of DOI's certification of completion of the remedial action and a determination by DOI that removal of such facilities is protective of human health and the environment. In addition to the plans mentioned above, three other restoration plans also pertain to HNWR lands including the Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats (CH2M HILL 2014o), the Aesthetics and Visual Resources Protection and Revegetation Plan (CH2M HILL 2014l), and the Mitigation and Monitoring Plan for Culturally Significant Plants (CH2M HILL 2014p).
What contingency plans will be in place—identifying actions that will be taken should an accident, unintended discharge, etc. occur.	Contingency Plans are described in Volume 3 of the O&M Manual of the 90% BOD report. Additional details on Contingency Plans for the Remedy Construction are included in the Construction/Remedial Action Work Plan.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

				Action (Compliance Status)	
Item No.	**Reference Location in PA Document**	**Relevant Excerpt from Document**	**Triggering Event**	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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.	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.	PG&E Cultural Resources Expert (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 7-10, 2014. 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).	The Tribal Access Plan for lands under federal management was completed on November 26, 2011. PG&E has prepared an Access Plan in coordination with Tribes, for the lands not under federal management, taking into consideration the information in the BLM Access Plan. The Access Plan is included in an appendix of the Construction/Remedial Action Work Plan and submitted on September 8, 2014.
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.	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration was prepared and submitted as Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. Section 8 of the Plan includes restoration guidelines (steps to be followed during restoration), elements of the restoration of habitat and revegetation and demobilization, and a draft annotated outline of a future more detailed, site specific IM-3 Restoration Plan. In coordination with the FMIT and other Tribes, PG&E has developed a schedule for developing the more detailed Restoration Plan. PG&E anticipates that some details of the restoration plan, in particular the amount of earthwork and earth movement involved in the restoration, will be deferred to the completion of decommissioning, so that PG&E and the Tribes can evaluate which approach may minimize further disturbance (and may minimize the amount of earth movement) while achieving the required restoration.
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.	BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA’s Consultation Protocol.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)	
				Intermediate (60%) Design	**Pre-Final (90%) Design**
5	Stipulation II(B)	At each phase (work plan 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 work plan 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.	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 the 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.	In the pre-final (90%) design, existing monitoring wells have been incorporated into the monitoring well network for the remedy, thereby reducing the need for drilling new monitoring wells.
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	The 60% design presented 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.	The 90% design presents planned facilities and activities for the implementation of the groundwater remedy. The Construction/Remedial Action Work Plan includes procedures and protocols to be implemented and contingencies during remedy construction and start-up. The O&M Manual includes procedures for implementation and contingencies during operation and maintenance of the remedy. BLM has consulted and is continuing to consult with the Tribes regarding the design under the PA's Consultation Protocol, and will consult the Tribes on the Construction/Remedial Action Work Plan and O&M Manual.
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 the 60% Basis of Design (BOD) Report. 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 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; an updated version of the map is included in Appendix A2 of the 90% Basis of Design (BOD) Report. 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 pre-final (90%) 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 piping corridor is located almost entirely in existing roadways, right of ways and previously disturbed areas.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

				Action (Compliance Status)	
Item No.	**Reference Location in PA Document**	**Relevant Excerpt from Document**	**Triggering Event**	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
				• 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.	• Most of the existing access roads have been incorporated into the 90% design. • The remedy-produced water conditioning plant and the contingent systems (arsenic treatment and dissolved metals removal) are located entirely within the footprint of the Compressor Station. • The operation building and carbon storage/amendment facilities are located on the existing Transwestern Bench and MW-20 Bench. • All of the proposed soil storage and construction staging areas are located on previously disturbed areas. • The main construction headquarters and staging area is located on previously disturbed areas at Moabi Regional Park.
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.	The planning of field activities is executed under the guidance of PG&E Cultural Resources Expert (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.	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.	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.	PG&E Cultural Resources Expert (Glenn Caruso) participated in field reviews of planned remedial facilities with the design team on April 7-10, 2014. 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 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.	The plan for the decommissioning and removal of the IM-3 Facility and Site Restoration was prepared and submitted in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), 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/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

				Action (Compliance Status)	
Item No.	**Reference Location in PA Document**	**Relevant Excerpt from Document**	**Triggering Event**	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), 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.	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.	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.	This stipulation will be adhered to in planning for the decommissioning of remedy facilities. A site-specific Plan for Decommissioning and Restoration of remedy facilities will be submitted in the future (within 120 days of DOI's certification of remedial action completion and a determination by DOI that removal of such facilities is protective of human health and the environment), 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.	PG&E has developed the plan for the decommissioning and removal of the IM-3 Facility and Site Restoration, in consultation with the Tribes. The Plan is submitted in Appendix B of the CIMP and also as an appendix of the Construction/Remedial Action Work Plan.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

				Action (Compliance Status)	
Item No.	**Reference Location in PA Document**	**Relevant Excerpt from Document**	**Triggering Event**	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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 Construction/Remedial Action 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.	This stipulation will be adhered to during the field implementation of the Construction/Remedial Action Plan and during the operation and maintenance of the remedy. 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/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)	
				Intermediate (60%) Design	**Pre-Final (90%) Design**
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.	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.	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's Site Operations Manager, and PG&E Cultural Resources Expert. PG&E will invite participation from the Tribes, archaeological monitors, and agency staff, as appropriate.
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.	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. In addition, a similar measure under the CIMP (CUL-1a-8I) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.

TABLE 6.2-2
Summary of Compliance with Applicable Programmatic Agreement (PA) Stipulations
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

				Action (Compliance Status)	
Item No.	**Reference Location in PA Document**	**Relevant Excerpt from Document**	**Triggering Event**	**Intermediate (60%) Design**	**Pre-Final (90%) Design**
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.	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. In addition, a similar measure under the CIMP (CUL-1a-8l) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.
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.	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. In addition, a similar measure under the CIMP (CUL-1a-8j) will also be adhered to during field implementation. The CIMP is included in an appendix of the Construction/Remedial Action Work Plan.
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.	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.	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/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in PA Document	Relevant Excerpt from Document	Triggering Event	Action (Compliance Status)	
				Intermediate (60%) Design	**Pre-Final (90%) Design**
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.	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/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	Action (Compliance Status)	
			Intermediate (60%) Design	**Pre-Final (90%) Design**
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 6.2-2.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c), (e) and (f) in Table 6.2-2
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 6.2-2.	See responses to PA Stipulations V(A)-(E) in Table 6.2-2.
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 6.2-2.	See responses to PA Stipulations I(D), III(B)(3)(c), and V(D)-(E) in Table 6.2-2.
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 responses EIR MMRP CUL-1a in Table 6.1-1. 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.	See responses to EIR MMRP CUL-1a in Table 6.1-1. PG&E's steps to prevent and reduce inadvertent damage are outlined in the CIMP Protocol for CUL-1a-8n: Protocols for protective measures for archaeological/historical sites during construction (Section 2.14 of the CIMP). In this protocol, PG&E outlines pre-construction measures to be taken to identify sites requiring protection, pre-construction identification of protective measures, and procedures for installation and removal of the protective measures, and restoration of the area to pre-construction conditions. Further, under the CHPMP requirements at Section 6.6.5 Periodic Site Monitoring, PG&E has proposed a monitoring and condition assessment program in the 2013 monitoring report (AE 2014) and submitted for DTSC review.
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 6.2-2. See also EIR MMRP CUL-1a-8(l).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP 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/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	Action (Compliance Status)	
			Intermediate (60%) Design	Pre-Final (90%) Design
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.	PG&E has proposed a monitoring and condition assessment program in the 2013 monitoring report (AE 2014) and submitted for DTSC review.
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 6.2-2. See also EIR MMRP CUL-1a-8(l).	See responses to PA Appendix C, Monitoring Protocol in Table 6.2-2. See also EIR MMRP CUL-1a-8(l).
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 6.2-2.	See response to PA Stipulation II(B) in Table 6.2-2.
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 6.2-2. See also EIR MMRPs 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.	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 6.2-2. See also EIR MMRPs CUL-1a-8(i), AES-1, and AES-2. Regarding Item 4, PG&E will introduce only native plants grown from local seed sources. These plants will be of the same species as those removed. At this 90% design stage, removal of tamarisk and arrow weed will occur during pipeline construction on the historical floodplain. The remedy design has avoided native trees in this area where they have been observed; however, it is possible that individual palo verde or mesquite trees could occur within the tamarisk thickets that will be affected. Where possible during construction, native trees will be avoided even if this requires additional impacts (i.e., removal or trimming) on tamarisk and arrow weed. There will be locations where impacts to native trees cannot be avoided and those losses will be mitigated according to the nature of the impact and the approaches in the appropriate restoration plan for the HNWR refuge, riparian areas, mature plants, or culturally-significant plants. Mitigation for impacts could include transplantation of likely candidate (younger) trees or replacement planting in a designated restoration area. The northern aerial bridge crossing of Bat Cave Wash is one location where it is currently known that 3 palo verde trees will require removal in order to install the aerial pipe bridge. 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.

TABLE 6.2-3
Summary of Compliance with Applicable Cultural and Historic Property Management Plan (CHPMP) Provisions
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Item No.	Reference Location in CHPMP Document	Relevant Excerpt from Document	Action (Compliance Status)	
			Intermediate (60%) Design	**Pre-Final (90%) Design**
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 EIR MMRP CUL-1a-8k in Table 6.1-1.	See response to EIR MMRP 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 6.2-2.	See responses to PA Stipulations I(B), III(B)(1), III(B)(2)(a)-(c) and (e) in Table 6.2-2.
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 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	PG&E will follow the procedures specified in Appendix C of the CHPMP (Discovery Plan). See also responses to PA Stipulation IX(A)-(D) in Table 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.
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 6.2-2, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	PG&E will follow the procedures specified in Appendix D of the CHPMP (Plan of Action). See also responses to PA Stipulation IX(A)-(D) in Table 6.2-22.7-3, and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-12.7-1.
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 6.2-2. See also EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.	See responses to PA Stipulation IX(A)-(D) in Table 6.2-2 and to EIR MMRP CUL-1a-8(b) and -8(o) in Table 6.1-1.

SECTION 7

Project Delivery Strategy/Updated Schedule

The CD (DOI 2013) requires a discussion of the project delivery strategy at the preliminary (30%) design stage, and this discussion has been carried forward into the pre-final (90%) 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 Construction/Remedial Action Work Plan (provided under separate cover) further details 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 includes:

- Construction health and safety plan
- Schedule for the completion of the remedial action tasks
- Schedule for submitting other remedial action-required plans
- Plan for sampling during construction
- Construction Quality Assurance Project Plan (CQAPP) and Contingency Plan
- Methods for implementing the CQAPP/O&M Plan/Contingency Plan
- Compliance with ARARs and EIR mitigation measures
- Tentative formulation of remedial action team
- Decontamination procedures and disposal of materials

The procedures and criteria for approval of decommissioning of IM-3 are also presented herein (see Section 7.4) in response to a 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 pre-final (90%) 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 pre-final (90%) design includes health and safety design criteria in Appendix C. Health and Safety Plans for future field activities including, but not limited to, construction and O&M of the final groundwater remedy are provided as part of the Construction/Remedial Action Work Plan and O&M Manual, respectively. As implementation of the remedial action progresses, addendums or revisions to the Health and Safety Plans will be prepared, as appropriate. 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 pre-final (90%) and 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 documents for the preliminary (30%), intermediate (60%), pre-final (90%), and final (100%) submittals.

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 an evaluation of alternatives for transition from the IM to the final groundwater remedy, and to present a preferred plan.

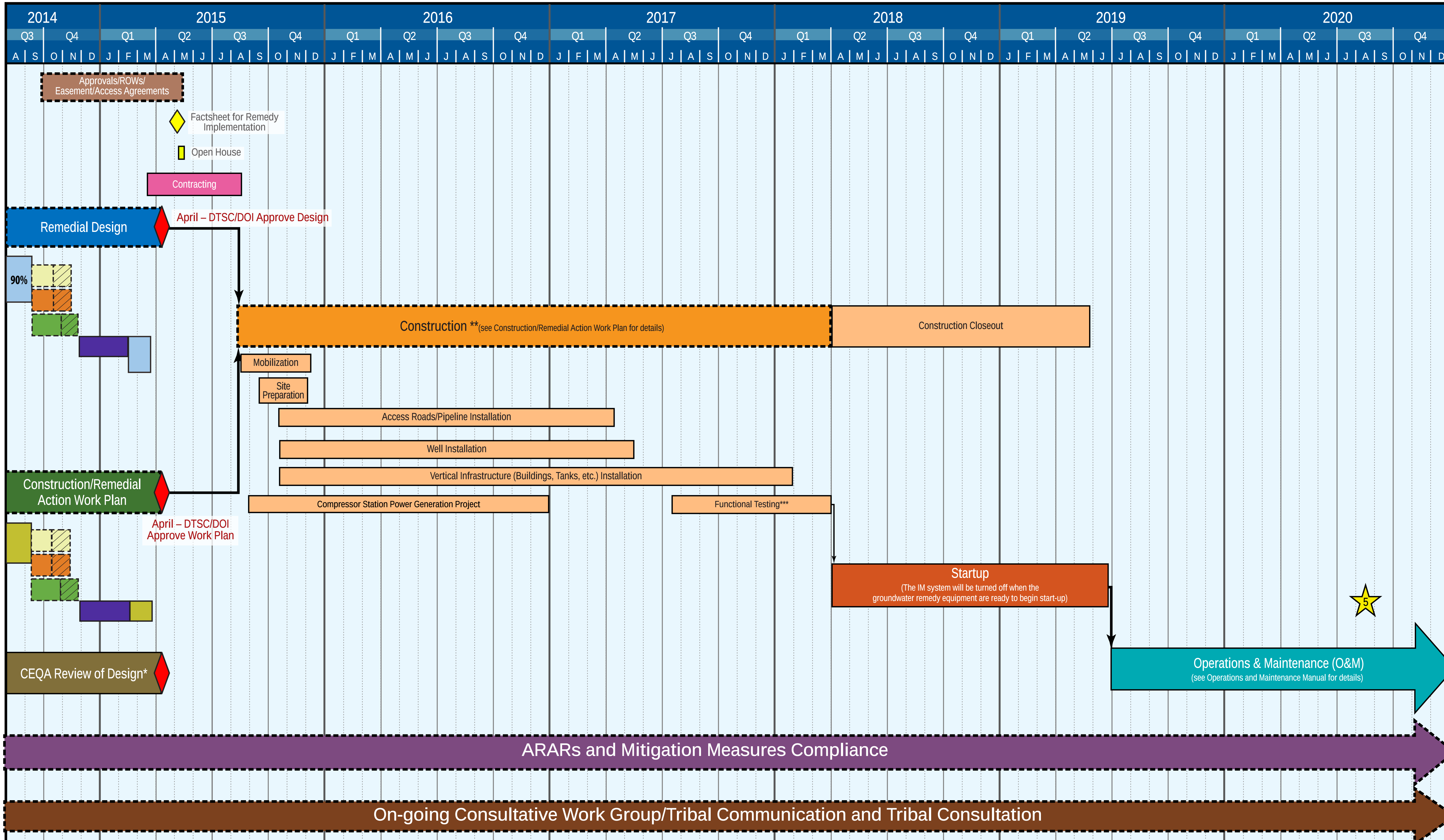
7.3.1 Criteria Used to Evaluate the Transition Alternatives

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, Startup, and Initial O&M Schedule

PG&E Topock Compressor Station | Needles, California
September 2014



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
- Agencies 5-year Review

* Duration of review is dependent on type of CEQA document
** Start of construction depends on completion of CEQA review
*** This period is often referred to as "commissioning" or "shakedown", which is the period when the construction contractors make minor adjustments as necessary to insure the system or components is operating and functioning as designed.

EXHIBIT 7.2-1
GROUNDWATER REMEDY SCHEDULE
GROUNDWATER REMEDY BASIS OF DESIGN REPORT, PRE-FINAL (90%) 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 in-situ barrier (i.e., establish a continuous front of carbon along the NTH IRZ to develop the reducing conditions necessary to actively reduce Cr[VI] in groundwater) 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 offline 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[8] 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[9] 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[9] 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[9] 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). Note that all model layers were simulated in all groundwater flow and solute transport model runs. However, only Model Layers 2 and 4 are presented in an effort to condense the number of figures included. Model Layers 1 and 2 represent the shallower portion of the aquifer and have similar plume footprints; because the simulated results in Model Layers 1 and 2 were similar, Model Layer 2 is presented as representative of the shallower portion of the aquifer. Model Layers 3 and 4 represent the deeper portion of the aquifer and have similar plume footprints; because the simulated results in Model Layers 3 and 4 were similar, Model Layer 4 is presented as representative of the deeper portion of the

[8] The pre-final (90% design) nominal scenario assumes IRL-1 and IRL-2 (northern Inner Recirculation Loop Injection Wells) will receive River Bank Extraction Well water (amended with carbon if hexavalent chromium concentrations in the River Bank Extraction Wells exceed the clean-up goal) to the lower two-thirds of the saturated interval (approximately Model Layers 2 to 4); and IRL-3 and IRL-4 (southern Inner Recirculation Loop Injection Wells) will receive fresh water. Thus, the startup scenarios include IRL-3, IRL-4, FW-1, and FW-2 with the Freshwater Injection ON; and Inner Recirculation Loop ON includes only IRL-1 and IRL-2. FW-1 (not depicted in the figures) is located west of the area shown.

aquifer. 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.

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 Section 7.4 of 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:

- The IM system will be turned off when the groundwater remedy equipment and systems are in place and ready to begin start-up. The remedy equipment and facilities may include some or all of the following: NTH IRZ wells, the River Bank Extraction Wells, the Freshwater Injection Wells, the monitoring wells, the East Ravine/TCS wells, the pipelines, and/or other systems (e.g., controls, electrical) needed to operate these wells.
- 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[9] 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

[9] See footnote 9

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.

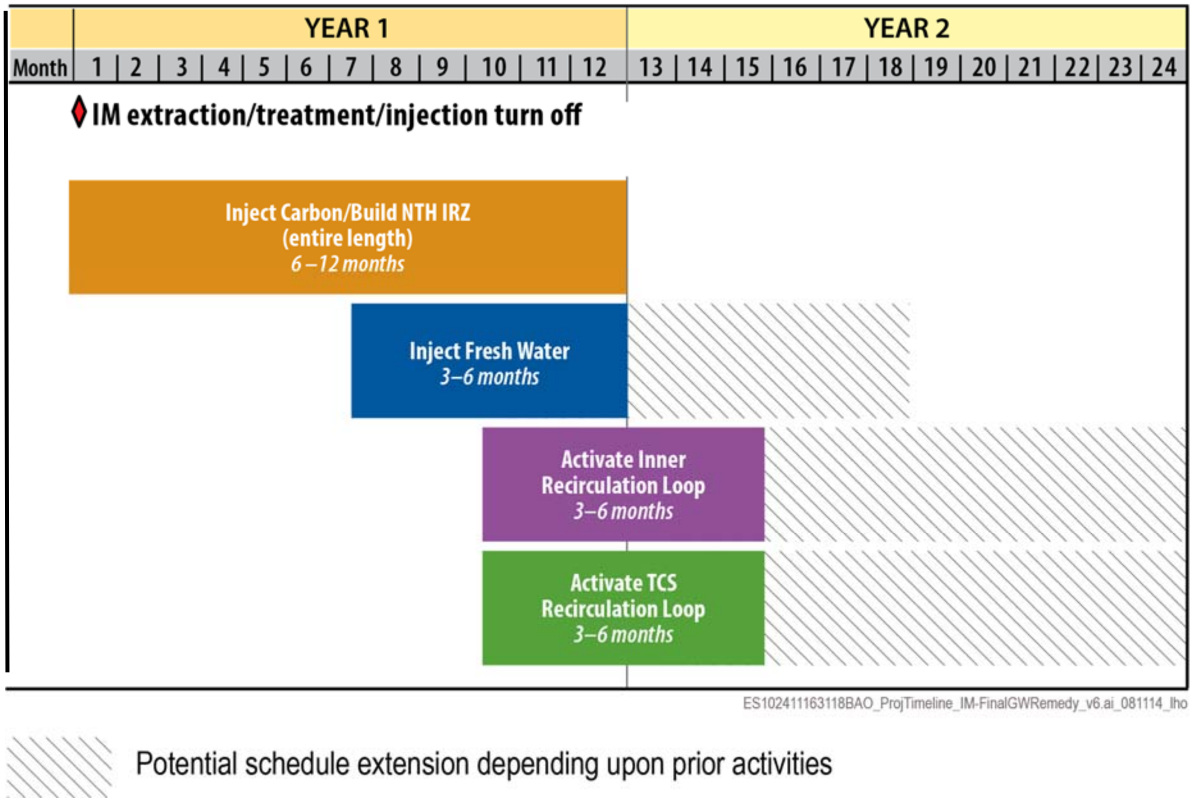


EXHIBIT 7.3-1
PROJECTED TIMELINE FOR IMPLEMENTATION OF PROPOSED TRANSITION PLAN
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

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

In a worst-case scenario, operation of the IM pumping could interfere with the remedy start-up and lead to a process failure over portions of the NTH IRZ line (incomplete distribution of carbon substrate and gaps in the NTH IRZ barrier). The downside of complete shutdown of the IM system upon final groundwater remedy start-up is that the hydraulic control exerted by the IM pumping would end. From a hydrogeologic perspective, this is not a significant concern due to the slow migration rate and the presence of the reducing rind. As demonstrated by the modeling effort described in Section 7.3.2, the proposed plan is protective of water quality in the Colorado River. The proposed plan is also consistent with the requirements regarding IM-3 shutdown and remedy startup steps set forth in the 2012 Settlement Agreement between the FMIT and DTSC (DTSC 2012b).

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 and DOI'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 and DOI as part of the Construction/Remedial Action Work Plan. These procedures and criteria are set forth in the 2012 Settlement Agreement between the FMIT and DTSC (DTSC 2012b).

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.

Additionally, with respect to step (b) above, DOI must concurrently determine the remedy to be functioning properly and performing as designed for DOI to consider the remedy "operational and functional" (OF) in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan Section 300.435(f)(2). Note that the regulation also states that the groundwater remedy becomes OF either one year after construction is complete, or when the remedy is determined by both DTSC and DOI to be functioning properly and performing as designed, whichever is earlier. DOI may grant extensions to the one-year period, as appropriate. As directed in the April 4, 2014 letter (DTSC and DOI 2014), PG&E is developing, in coordination with DTSC and DOI, measurable and quantifiable short-term goals (OF/OPS) to facilitate the remedy performance assessment.

PG&E will 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

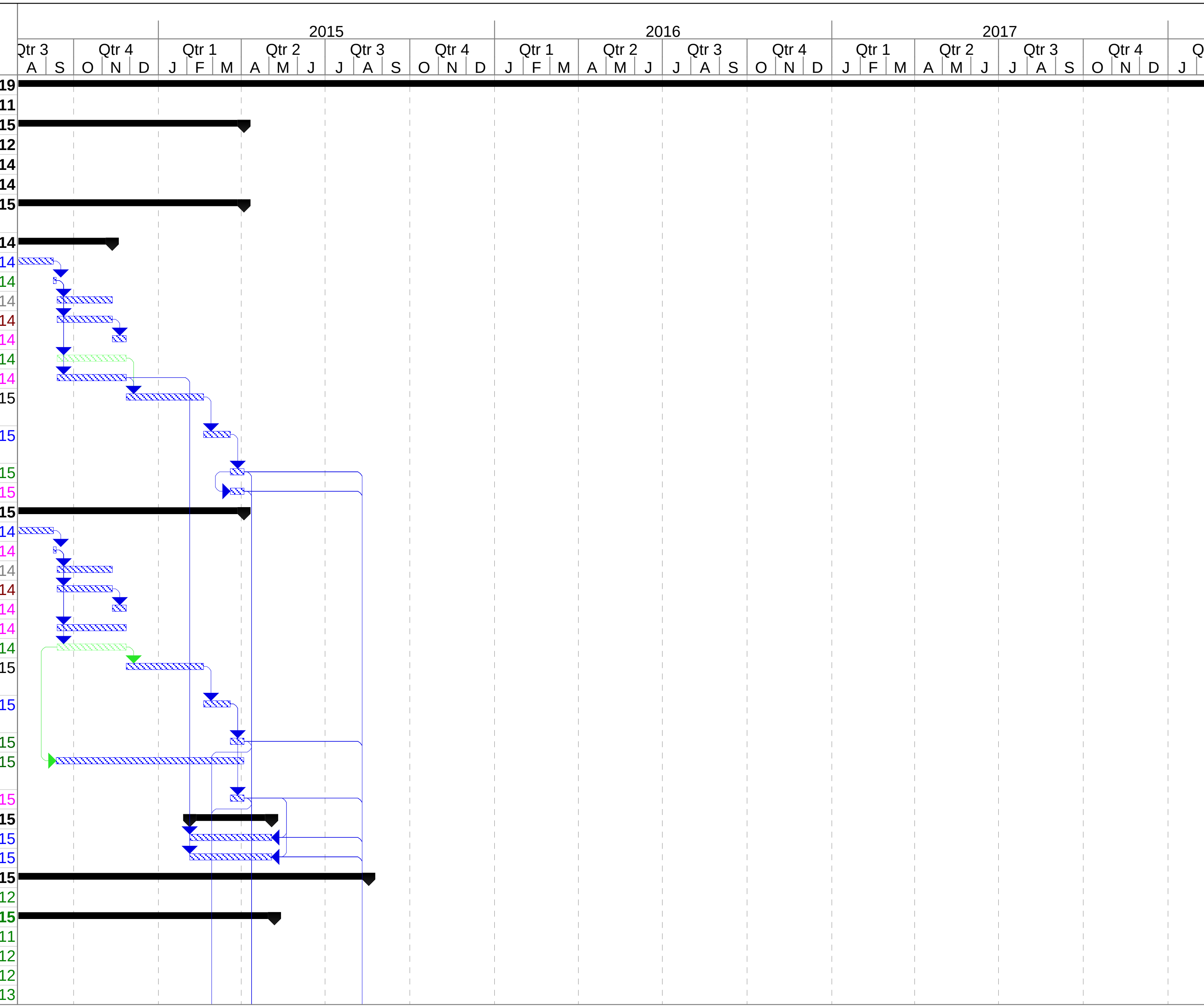
For this project, PG&E plans to use pre-qualified contractors, where appropriate and available, including those who have prior experience working at Topock, to save time on procurement, to reduce time spent on the learning curve, and to reduce the potential for delays/conflicts during implementation. PG&E has established a Chromium Project Management Office (PMO) to contract and implement PG&E's chromium remediation program, including construction of the Topock groundwater remedy. All contracting will follow procurement requirements established by PG&E and the PMO including PG&E's Supplier Diversity Program. At this pre-final (90%) design stage, PG&E has not identified any labor, contractor, or equipment availability concerns. Labor, contractor, and/or equipment constraints, if any, will become apparent as PG&E initiates the contracting and procurement process.

The updated project schedule is presented in Exhibit 7.5-1. A summary of the schedule updates at this pre-final (90%) design stage is listed below (note that for brevity and focus, the project schedule included in this 90% BOD was simplified to focus on the remedial design, construction, startup, and O&M activities):

- Pre-Final/Final Remedial Design and Construction/Remedial Action Work Plan (Lines 119 through 142) – This schedule shows the 90% and 100% design submittals on September 8, 2014 and in March 2015, respectively. Agencies' approvals of the final design and the Construction/Remedial Action Work Plan are anticipated in April 2015.
- ROWs/Easements/Landowner Agreements/Approvals (Lines 143-145) – PG&E is in the process of obtaining access agreements, easements, and other permits and approvals. Target completion in May 2015.
- Community Outreach (Lines 153 through 156) – DTSC and DOI plan to issue Factsheets to provide updates on the remedy design and approval, as well as the upcoming construction of the remedy. DOI also plans open houses in multiple locations in the area prior to the start of remedy construction. This schedule shows the target timeframe for the Factsheets and the open houses in May 2015.
- Contracting (Line 157) – This schedule shows a 5-month construction contracting and procurement period prior to the start of construction.
- Construction (Lines 158-174) – A preliminary construction schedule (including work breakdown structure [WBS]) was developed and included in Section 3.2 of the Construction/Remedial Action Work Plan. A high level summary is presented herein. Using construction durations and sequencing logic that are typical and feasible for similar projects constructed in similar site conditions, the overall construction schedule for the groundwater remedy is estimated to be 15-16 quarters (including 4-5 quarters for construction closeout). It is important to note that the exact durations and logic that will actually be used for planning and executing field activities will be based on the structure of construction contracts selected by PG&E and contractors to provide the safest and most efficient operation that meets project requirements. A more detailed construction schedule will be prepared following construction contractor selection and procurement. The schedule will be continually updated during project implementation..
- Start-up (Transition from IM to final groundwater remedy) (Lines 175 -181) – The timeline for implementation of the proposed IM to final groundwater remedy transition presented in Section 7.3.3 is shown here. There is no change to the steps and associated duration since 60% design.
- Operation and Maintenance (Line 182) – This schedule shows the target start of full remedy operation in June 2019.

EXHIBIT 7.5-1 -- GROUNDWATER REMEDY DESIGN, CONSTRUCTION, STARTUP, AND INITIAL OPERATION SCHEDULE

ID	Task Name	Duration	Forecasted Start	Forecasted Finish
1	**DESIGN, PERMITTING, AND CONSTRUCTION OF GROUNDWATER REMEDY**	**2186.75 days**	**Mon 1/31/11**	**Mon 6/17/19**
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)**	**925 days**	**Tue 9/20/11**	**Fri 4/3/15**
17	**Preliminary Design**	**174 days**	**Tue 9/20/11**	**Thu 5/17/12**
29	**Intermediate Design**	**501 days**	**Fri 5/18/12**	**Fri 4/18/14**
58	**Implementation Plan for Evaluation of Alternative Freshwater Sources**	**422 days**	**Fri 11/16/12**	**Mon 6/30/14**
97	**Pre-Final/Final Design (include plan for decommissioning, removal, and restoration of IM3 facility)**	**260 days**	**Mon 4/7/14**	**Fri 4/3/15**
98	**Documents submitted in advance of 90%**	**140 days**	**Wed 4/30/14**	**Tue 11/11/14**
119	Prepare/submit Pre-Final Design Package	5.29 mons	Mon 4/7/14	Mon 9/8/14
120	DTSC forward to CWG/TWG	3 days	Tue 9/9/14	Thu 9/11/14
121	CWG/TWG review/comment on Final Design Package	60 edays	Fri 9/12/14	Tue 11/11/14
122	Tribal Consultation	60 edays	Fri 9/12/14	Tue 11/11/14
123	BLM process after close of comment period	15 edays	Tue 11/11/14	Wed 11/26/14
124	DTSC review/comment on Final Design Package	75 edays	Fri 9/12/14	Wed 11/26/14
125	DOI review/comment on Final Design Package	75 edays	Fri 9/12/14	Wed 11/26/14
126	Comments resolution (duration depends on quantity and nature of comment. Duration to be confirmed after discussion of RTC process with stakeholders)	12 wks	Thu 11/27/14	Wed 2/18/15
127	Prepare/submit Final Design Package (duration to be confirmed after receipt of comments and RTCs)	1 mon	Thu 2/19/15	Thu 3/19/15
128	DTSC approves design	2.2 wks	Fri 3/20/15	Fri 4/3/15
129	DOI approves design	2.2 wks	Fri 3/20/15	Fri 4/3/15
130	**Construction/Remedial Action Work Plan**	**260 days**	**Mon 4/7/14**	**Fri 4/3/15**
131	Prepare/submit Draft Work Plan	5.29 mons	Mon 4/7/14	Mon 9/8/14
132	DOI forward to DTSC/CWG/TWG	3 days	Tue 9/9/14	Thu 9/11/14
133	CWG/TWG review/comment on Draft Work Plan	60 edays	Fri 9/12/14	Tue 11/11/14
134	Tribal Consultation on Draft Work Plan	60 edays	Fri 9/12/14	Tue 11/11/14
135	BLM process after close of comment period	15 edays	Tue 11/11/14	Wed 11/26/14
136	DOI review/comment on Draft Work Plan	75 edays	Fri 9/12/14	Wed 11/26/14
137	DTSC review/comment on Draft Work Plan	75 edays	Fri 9/12/14	Wed 11/26/14
138	Comments resolution (duration depends on quantity and nature of comment. Duration to be confirmed after discussion of RTC process with stakeholders)	12 wks	Thu 11/27/14	Wed 2/18/15
139	Prepare/submit Final Work Plan (duration to be confirmed after receipt of comments and RTCs)	1 mon	Thu 2/19/15	Thu 3/19/15
140	DTSC approves Final Work Plan	2.2 wks	Fri 3/20/15	Fri 4/3/15
141	CEQA Evaluation of Work Plan (depending on CEQA documentation. To be determined after initiate checklist)	6.95 mons	Fri 9/12/14	Fri 4/3/15
142	DOI approves Final Work Plan	2.2 wks	Fri 3/20/15	Fri 4/3/15
143	**ROWs/Easements/Landowner Agreements/Approvals/Compliance**	**63 days**	**Wed 2/4/15**	**Sun 5/3/15**
144	Other Approvals and Compliance	3 mons	Wed 2/4/15	Sun 5/3/15
145	Landowner Agreements/Leasing/ROW Agreements	3 mons	Wed 2/4/15	Sun 5/3/15
146	**Community Outreach**	**1007.25 days**	**Fri 10/7/11**	**Mon 8/17/15**
147	Prepare/Issue Project Update Factsheet	4 mons	Fri 10/7/11	Tue 1/31/12
148	**Community Outreach Activities (State)**	**935 days**	**Fri 10/7/11**	**Wed 5/6/15**
149	Update mailing list	2.95 mons	Fri 10/7/11	Fri 12/30/11
150	Conduct Community Survey	1.62 mons	Tue 1/31/12	Fri 3/16/12
151	Conduct Community Interview	2 mons	Wed 4/25/12	Thu 6/21/12
152	Prepare/Issue Community Outreach Plan	7.1 mons	Mon 3/19/12	Wed 1/16/13



Project: PG&E Topock Remediation Project

Tasks Not Started/In Progess — Tasks Finished — Baseline Schedule — Milestone — Overall Task Duration — Inactive Task — Inactive Milestone — Inactive Summary — Manual Task — Duration-only — Manual Summary Rollup — Manual Summary — Start-only — Finish-only

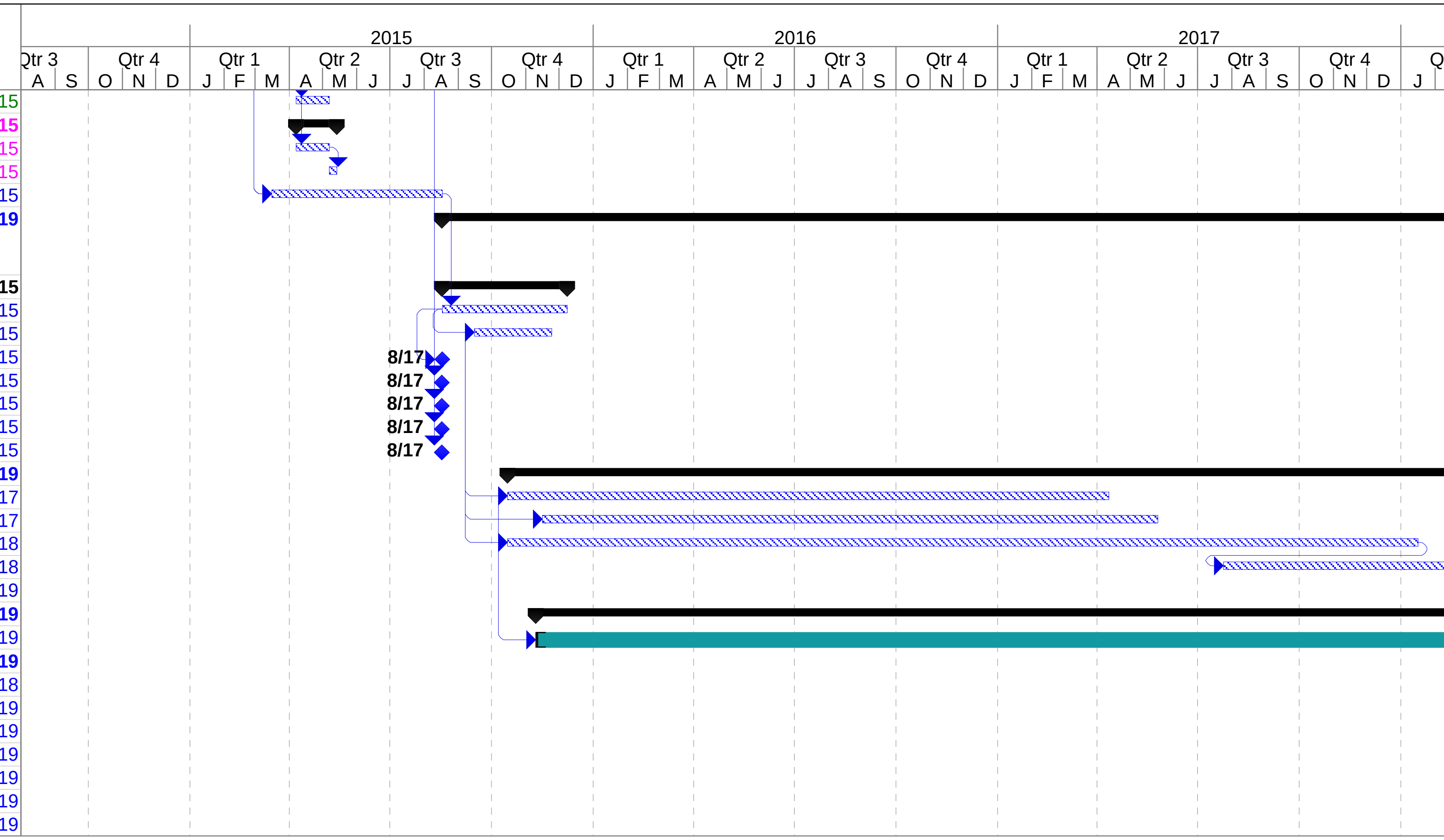
edays = calendar days; days = work days
Baseline Schedule is the 8/15/07 CWG Schedule (rev 1, 12/12/07).
*Timeframes shown are for planning purpose. Actual timeframes may vary.

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

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

EXHIBIT 7.5-1 -- GROUNDWATER REMEDY DESIGN, CONSTRUCTION, STARTUP, AND INITIAL OPERATION SCHEDULE

ID	Task Name	Duration	Forecasted Start	Forecasted Finish
153	Prepare/Issue factsheet for Corrective Measures Implementation	30 edays	Mon 4/6/15	Wed 5/6/15
154	**Outreach/Public Participation Activities (Federal)**	**27 days**	**Mon 4/6/15**	**Wed 5/13/15**
155	Prepare/issue factsheet for Remedy Implementation	30 edays	Mon 4/6/15	Wed 5/6/15
156	Open house (Multiple Locations)	1 wk	Thu 5/7/15	Wed 5/13/15
157	Contracting	5.25 mons	Mon 3/16/15	Mon 8/17/15
158	**Construction (this is a preliminary construction schedule for planning purposes only. See Section 3, Construction Approaches and Sequencing, of the Construction/Remedial Action Work Plan for details)**	**995.5 days**	**Mon 8/17/15**	**Mon 6/10/19**
159	**Pre-Construction**	**81.25 days**	**Mon 8/17/15**	**Tue 12/8/15**
160	Mobilization	113 edays	Mon 8/17/15	Tue 12/8/15
161	Site Preparation	70 edays	Tue 9/15/15	Tue 11/24/15
162	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 8/17/15	Mon 8/17/15
163	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 8/17/15	Mon 8/17/15
164	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 8/17/15	Mon 8/17/15
165	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 8/17/15	Mon 8/17/15
166	Stakeholder Attending Kick-Off Meeting at Site	0 days	Mon 8/17/15	Mon 8/17/15
167	**Construction Activities**	**941.8 days**	**Thu 10/15/15**	**Mon 5/27/19**
168	Pipelines/Access Pathways Installation	18.5 mons	Thu 10/15/15	Tue 4/11/17
169	Remediation and Monitoring Wells Installation	19 mons	Mon 11/16/15	Thu 5/25/17
170	Vertical Structures Installation	28 mons	Thu 10/15/15	Tue 1/16/18
171	Commissioning	8.5 mons	Mon 7/24/17	Thu 3/29/18
172	Construction Closeout	14.3 mons	Fri 3/30/18	Mon 5/27/19
173	**Reporting**	**934.5 days**	**Tue 11/10/15**	**Mon 6/10/19**
174	Prepare/submit monthly construction progress reports	44.5 mons	Tue 11/10/15	Mon 6/10/19
175	**Startup**	**316 days**	**Fri 3/30/18**	**Mon 6/17/19**
176	Shutdown IM extraction/treatment/injection	1 day	Fri 3/30/18	Mon 4/2/18
177	Inject carbon/build NTH IRZ (6-12mons)	12 mons	Mon 4/2/18	Wed 3/20/19
178	Inject freshwater(3-6mons)	6 mons	Tue 9/25/18	Wed 3/20/19
179	Activate Inner recirculation loop (3-6mons)	6 mons	Fri 12/21/18	Mon 6/17/19
180	Activate TCS recirculation loop (3-6mons)	6 mons	Fri 12/21/18	Mon 6/17/19
181	Startup complete/start full remedy operations	0 days	Mon 6/17/19	Mon 6/17/19
182	Start Operation and Maintenance	0 days	Mon 6/17/19	Mon 6/17/19



Project: PG&E Topock Remediation Project

Tasks Not Started/In Progess	Overall Task Duration	Manual Task	Start-only
Tasks Finished	Inactive Task	Duration-only	Finish-only
Baseline Schedule	Inactive Milestone	Manual Summary Rollup	
Milestone	Inactive Summary	Manual Summary	

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 Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which 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 (30%), Intermediate (60%), Pre-Final (90%), and Final (100%) Design Submittals	Preliminary Design submitted on November 18, 2011 Intermediate – April 5, 2013 Pre-Final – September 2014 Final – March 2015
	• Waste management practices	Operation and Maintenance (O&M) Plan, Construction/Remedial Action Work Plan	See submittal schedules below for O&M Plan, Construction/Remedial Action Work Plan
	• Site safety and security provisions	Intermediate and Final Design Submittals	Intermediate – April 5, 2013 Pre-Final – September 2014

TABLE 7.2-1
Cross Reference of 1996 CACA Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which 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
	• 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	Pre-Final – September 2014 Final – March 2015
Operation 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	O&M Manual	Draft O&M Manual submitted with Intermediate design on April 5, 2013 Pre-Final – September 2014 Final – March 2015

TABLE 7.2-1
Cross Reference of 1996 CACA Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which 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 – September 2014 Final – March 2015
	• Project schedule • Cost estimates	Preliminary, Intermediate, Pre-Final, and Final Design Submittals, and Construction/Remedial Action Work Plan	The project schedule and cost estimate are included in the corresponding documents.
Health and Safety Plan	• See Attachment 2 of CACA	Health and Safety Plan for O&M Health and Safety Plan for Construction	The Health and Safety Plans are included in Volume 5 of the O&M Manual and an appendix of the 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 monthly progress reports to be prepared and submitted during remedy construction.

TABLE 7.2-1
Cross Reference of 1996 CACA Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

CACA-required Documents	CACA Requirements	Which 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 quarterly progress reports to be prepared and submitted during remedy operation and maintenance.

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Documents will Contain or Satisfy this Requirement	Target Submittal Schedule
Remedial Design Work Plan	• Plans and schedules for implementation of all remedial design and pre-design tasks identified in the Statement of Work, 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, an 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 – September 2014 Final – March 2015
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 Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Documents will Contain or Satisfy this Requirement	Target Submittal Schedule
Intermediate Design (60%)	• Basis of Design (design assumptions, permit plans, prelim easements/access requirements, P&IDs) • Drawings/specs (incl. operation and maintenance [O&M] requirements) • Remedial Action (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
Pre-Final (90%) and Final Design (100%)	• Final Basis of Design • Final plans and specifications • Operation and Maintenance Plan • Contractor Construction Quality Assurance Project Plan (CQAPP) • Field Sampling Plan • Contingency Plan • IM-3 Decommissioning Plan[1] • 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	Pre-Final/Final Design Submittals (see Table 7.2-3 for content)	Pre-Final – September 2014 Final – March 2015
Operation and Maintenance Plan	• See CD, Appendix C (Scope of Work)	O&M Plan (Volume 1 of O&M Manual; see Table 7.2-3 for content)	Draft O&M Manual submitted on April 5, 2013 Pre-Final – September 2014 Final – March 2015

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Documents will Contain or Satisfy this Requirement	Target Submittal Schedule
Field Sampling Plan	• See CD, Appendix C (Scope of Work)	O&M Plan, Construction/ Remedial Action Work Plan	The Sampling and Monitoring Plan is included in Volume 2 of the O&M Manual. Sampling requirements during construction are included in the Construction/ Remedial Action Work Plan.
Contingency Plan	• See CD, Appendix C (Scope of Work)	O&M Plan, Construction/ Remedial Action Work Plan	The O&M Contingency Plan is included in Volume 3 of the O&M Manual. The Construction Contingency Plan is included in Section 5 of the Construction/Remedial Action Work Plan.
Health and Safety Plan	• See CD, Appendix C (Scope of Work)	Health and Safety Plan for O&M Health and Safety Plan for Construction	The Health and Safety Plans are included in Volume 5 of the O&M Manual and an appendix of the Construction/Remedial Action Work Plan.
Construction Quality Assurance Project Plan (CQAPP)	• See CD, Appendix C (Scope of Work)	Construction/Remedial Action Work Plan	Draft – September 2014 Final – March 2015
Remedial Action Work Plan	• Revised Health and Safety Plan • 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 CQAPP/O&M Plan/Construction Contingency Plan • Protocols for documenting ARARs compliance Identification of the remedial action team • CQAPP • Disposal of materials • Requirements for project closeout • Site Management Plan • IM-3 Decommissioning Plan[1] • Project Management Plan • Habitat Restoration Plan • Decontamination Plan • Data management	Construction/Remedial Action Work Plan (including Health and Safety Plan)	Draft – September 2014 Final – March 2015

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Documents will Contain or Satisfy this Requirement	Target Submittal Schedule
	• Collection and maintenance of information In addition, the following item may be required: • Communication procedures and protocols		
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	Monthly during construction, quarterly during operation and maintenance

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Documents will Contain or Satisfy this Requirement	Target Submittal Schedule
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 monthly progress reports to be prepared and submitted during remedy construction.
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	Per CD, Appendix C, Item 7, an RA Completion Report will be prepared once cleanup goals and RAOs are achieved and/or the agencies issue a decision that Monitored Natural Attenuation is appropriate to address residual Cr(IV) in portions of the plume. Submittal schedule will be established in the quarterly progress reports to be prepared and submitted during remedy operation and maintenance.

TABLE 7.2-2
Cross Reference of Consent Decree Requirements and Corresponding Documents
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

Consent Decree-required Documents	Consent Decree Requirements	Which Documents will Contain or Satisfy this Requirement	Target Submittal Schedule
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	Per CD, Appendix C, Item 8, this certification will be requested by PG&E from DOI. Submittal schedule will be established in the quarterly progress reports to be prepared and submitted during remedy operation and maintenance.
Remedy Decommissioning Plan	• Procedures for the removal and decommissioning of the groundwater remedy system and associated infrastructure • Post-remedy restoration	Remedy Decommissioning Plan	Per CD, Appendix C, Item 9, the Plan will be submitted within 120 days of DOI's Certification of Completion of the RA and a determination by DOI that removal of such facilities is protective of human health and the environment. Submittal schedule will be established in the quarterly progress reports to be prepared and submitted during remedy operation and maintenance.

Note:
CD = Remedial Action/Remedial Design Consent Decree between PG&E and the United States (DOI 2013).

[1] Section 8 of the IM-3 Decommissioning Plan (presented as an appendix to the Construction/Remedial Action Work Plan) includes restoration guidelines (steps to be followed during restoration), elements of the restoration of habitat and revegetation and demobilization, and a draft annotated outline of a future, more detailed site-specific IM-3 Restoration Plan. In response to the Tribes' comments on the 60% design and the draft IM-3 Decommissioning Plan, PG&E has proposed a schedule to develop a more detailed Site-Specific IM3 Restoration Plan. The proposed schedule was tailored to provide timely details on the restoration process, and to avoid delay so that restoration will commence shortly after decommissioning is completed. As stated in the responses to comments on the 60% Design (RTC #277 in Appendix I), PG&E anticipates that some details of the more detailed Site-Specific Restoration Plan, in particular the amount of earthwork and earth movement involved in the restoration, will be deferred to the completion of decommissioning, so that PG&E and the Tribes can evaluate which approach may minimize further disturbance (and may minimize the amount of earth movement) while achieving the required restoration. PG&E believes that specific determination can best be made when the condition of the ground surface is known, following the removal of the IM-3 facilities.

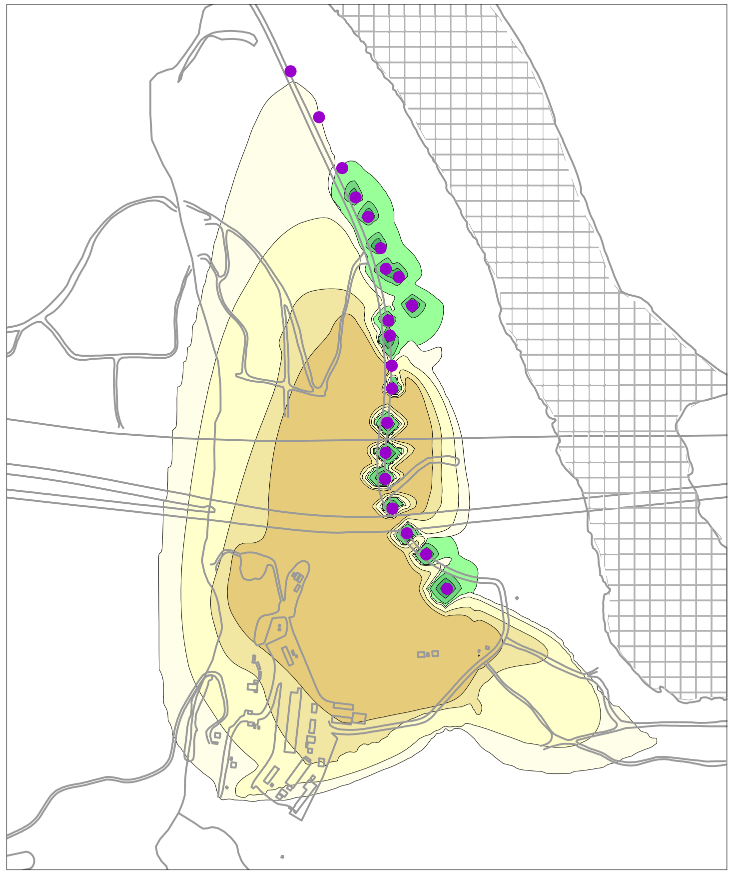
TABLE 7.2-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

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 (30%) Design Package	**Intermediate (60%) Design Package**	**Pre-Final (90%)/Final (100%) Design Package**
• **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
Draft O&M Plan	**Final O&M Plan**	**Draft/Final Construction/Remedial Action Work Plan**
• 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) • Health and Safety Plan for O&M	• 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 Construction • Documents required to establish institutional control(s)[1]

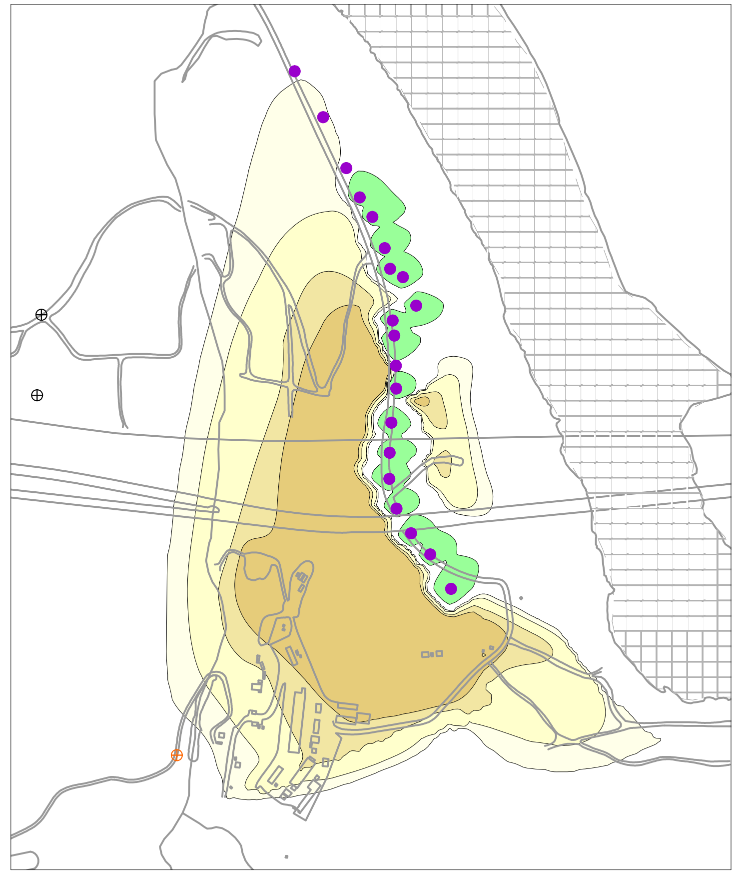
TABLE 7.2-3
Packaging and Content of Selected Key Technical Documents During Design
Groundwater Remedy Basis of Design Report/Pre-Final (90%) Design
PG&E Topock Compressor Station, Needles, California

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**
None	• Soil Management Plan (ARAR #86)	• Updated Soil Management Plan (ARAR #86) • Plan for decommissioning and removal of IM-3 facility and site restoration (ARAR #14) • Industrial Storm Water Pollution Prevention Plan (SWPPP)/BMP plans and Monitoring & Reporting Program (ARAR #34) <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) • Protocol for compliance with <u>Section 404 of the Clean Water Act (</u>ARAR #32)
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)	• Updates of items previously submitted with the Intermediate Design deliverables • Health and Safety Plan for Ground-Disturbing Activity (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) • Industrial Storm Water Pollution Prevention Plan (SWPPP)/BMP plans and Monitoring & Reporting Program (HYDRO-1) • Contingency Plan for Onsite Fueling Areas (HAZ-1b-b) • Project-specific hazardous materials business plan (HAZ-1a-c) • Paleontological Resources Management Plan (CUL-3) • Avoidance and minimization plan for special status birds (BIO-2a) (Agreed upon by DTSC) • Habitat restoration plan for riparian vegetation and other sensitive habitats (BIO-1) • Aesthetics and Visual Resources Protection and Revegetation Plan (AES-1b/1e, AES-2c/2f) • 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) (for DTSC review/evaluation) • Cultural resources treatment plan (CUL-1b/c-3) (for DTSC Approval) • CIMP (include plan for decommissioning and removal of IM-3 facility and site restoration, plant transplantation/monitoring plan (if needed)) (CUL-1a-8) (for DTSC Approval) • Protocols for compliance with applicable mitigation requirements related to CWA Section 404 (BIO-1) • Avoidance and Minimization Measures for work conducted in CDFW Jurisdictional Washes (BIO-1)

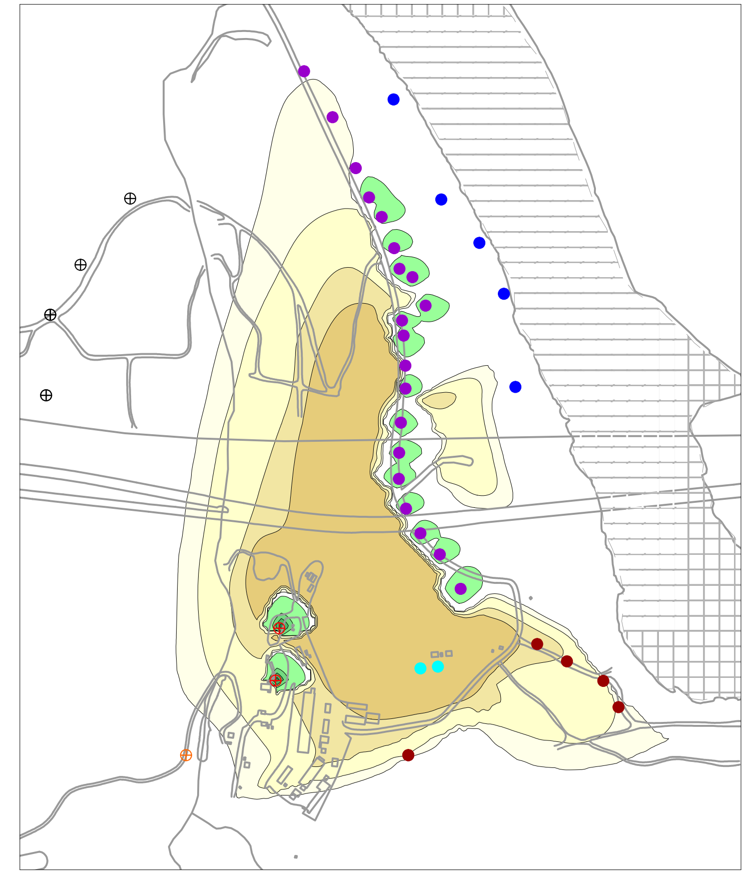
Note:
[1] For definition of Institutional Controls, see Section 5 of this Basis of Design Report.



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

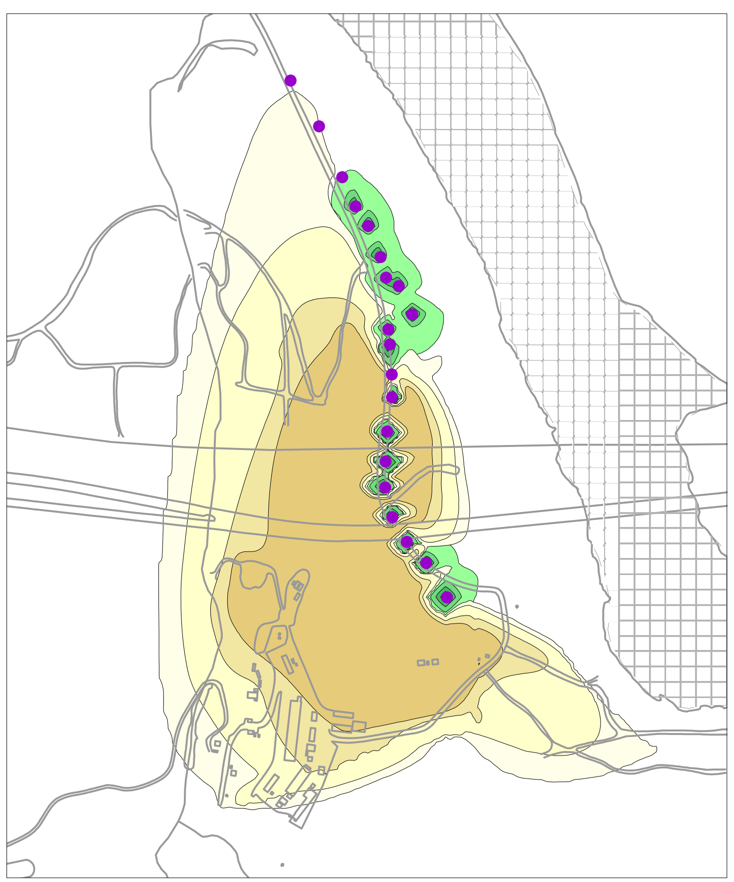
N

*Note: The pre-final (90%) nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive River Bank extracted groundwater (carbon-amended if hexavalent chromium concentrations in the River Bank extracted groundwater exceed the clean-up goal) to the lower two-thirds of the saturated interval (approximately layers 2 to 4); and IRL-3 and IRL-4 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. FW-1 (not shown) is located west of the area shown.

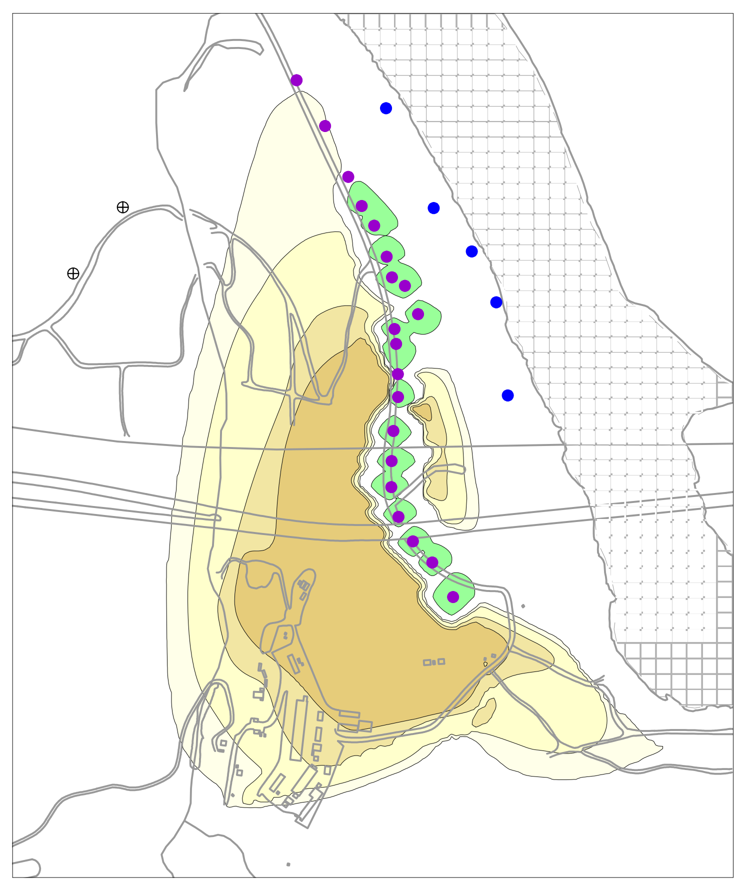
SCALE IN FEET
0 1,000 2,000

SCENARIO 1A START UP SCHEDULE

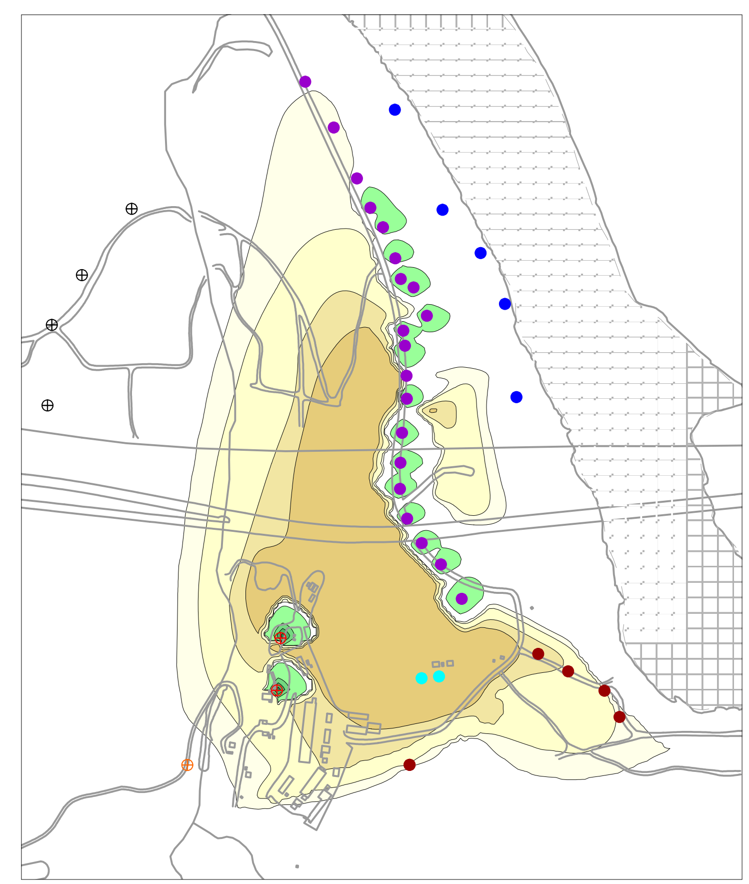
Months 0-6: NTH IRZ ON
Months 6-9: NTH IRZ OFF and FW ON
Months 9-12: NTH IRZ OFF and FW,
TCS Recirculation Loop, & IRL ON



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

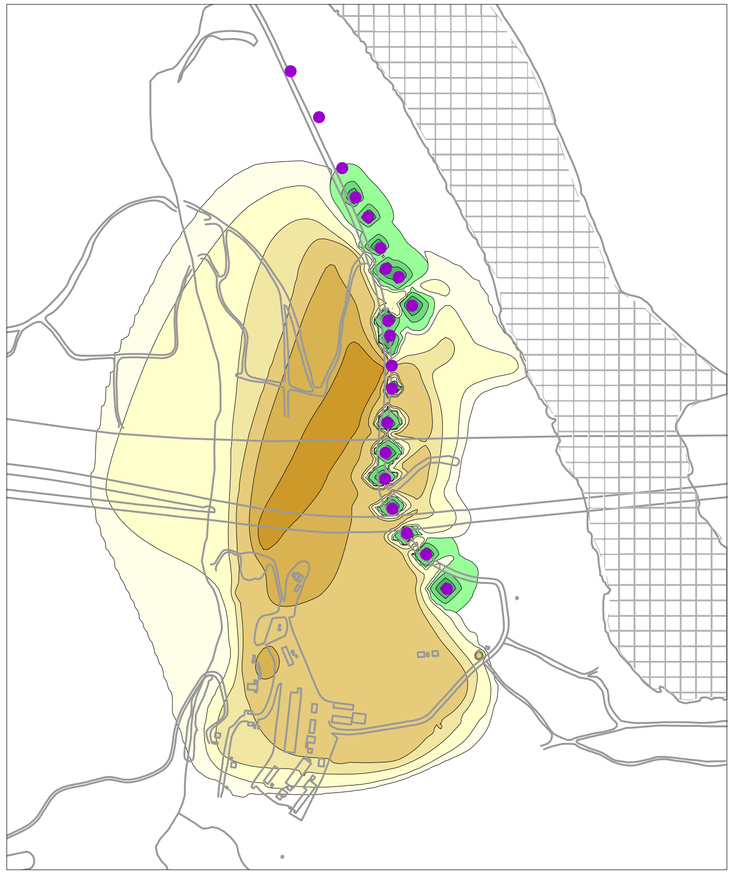
GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

SIMULATED HEXAVALENT CHROMIUM TRANSPORT IN MODEL LAYER 2 FOR 1 YEAR START UP SCENARIOS

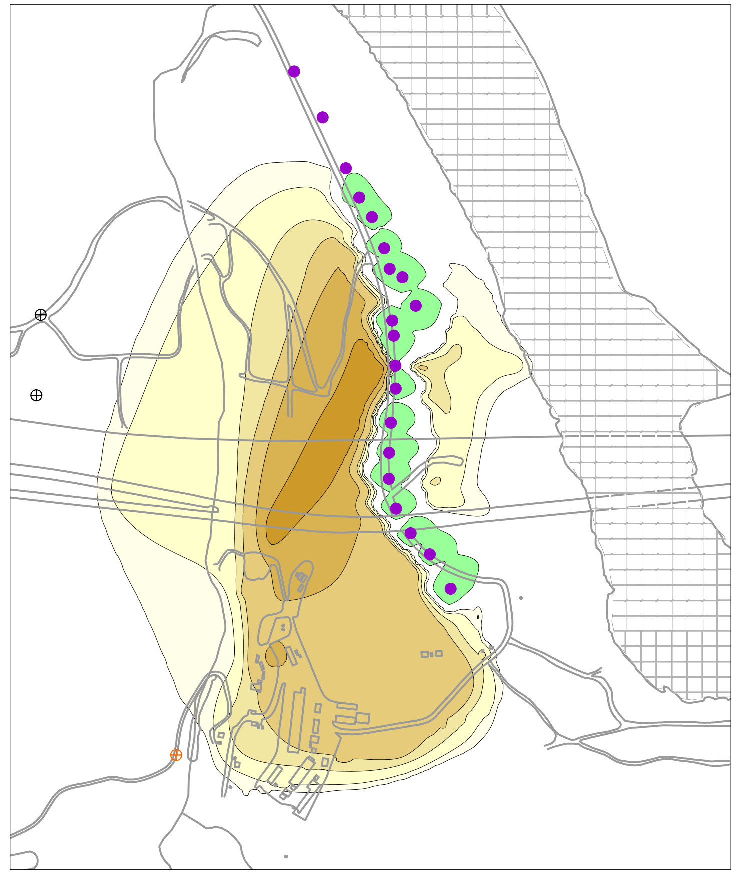
ARCADIS

FIGURE
7.3-1

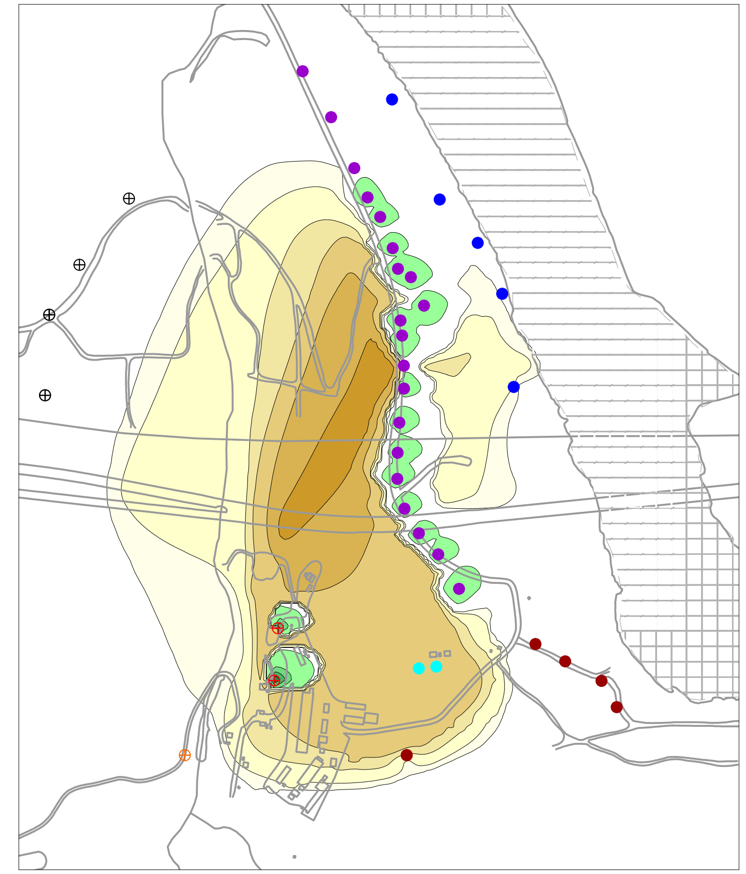
1A



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 pre-final (90%) nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive River Bank extracted groundwater (carbon-amended if hexavalent chromium concentrations in the River Bank extracted groundwater exceed the clean-up goal) to the lower two-thirds of the saturated interval (approximately layers 2 to 4); and IRL-3 and IRL-4 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. FW-1 (not shown) is located west of the area shown.

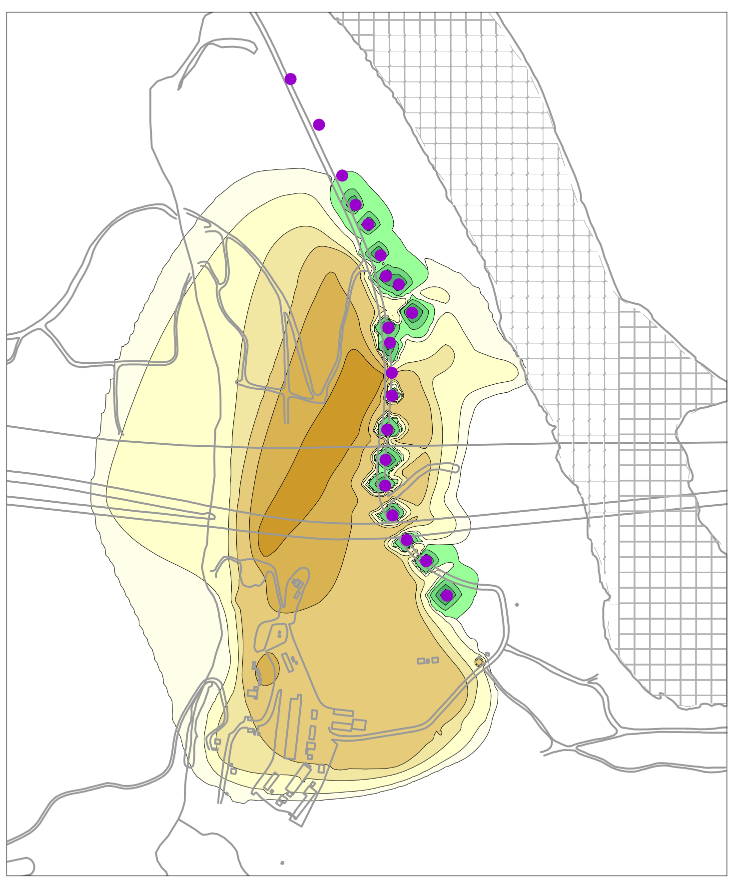
SCALE IN FEET

0 1,000 2,000

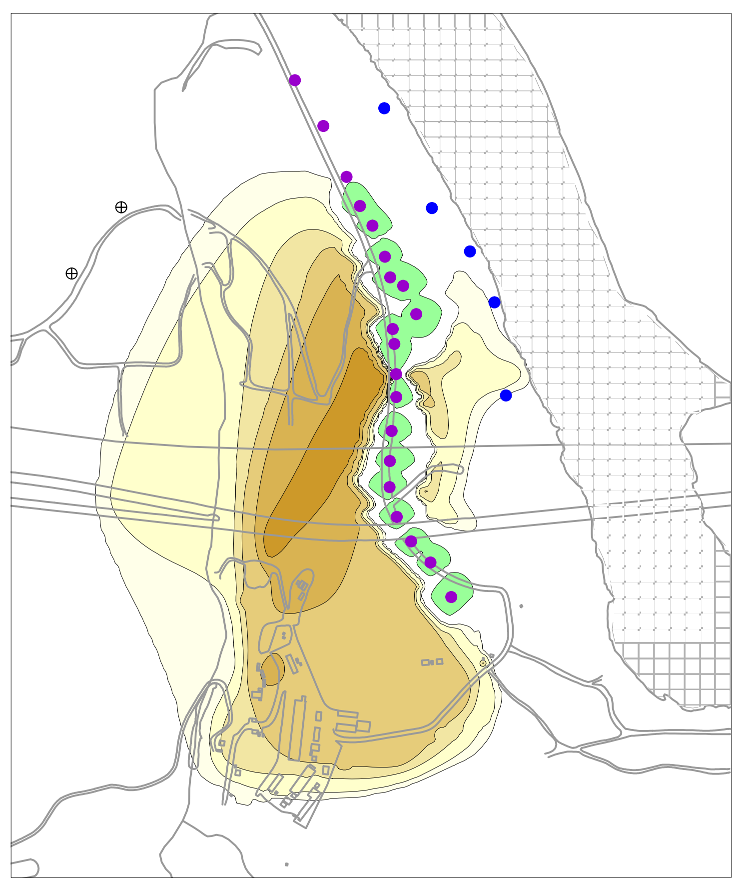
SCENARIO 1A START UP SCHEDULE

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

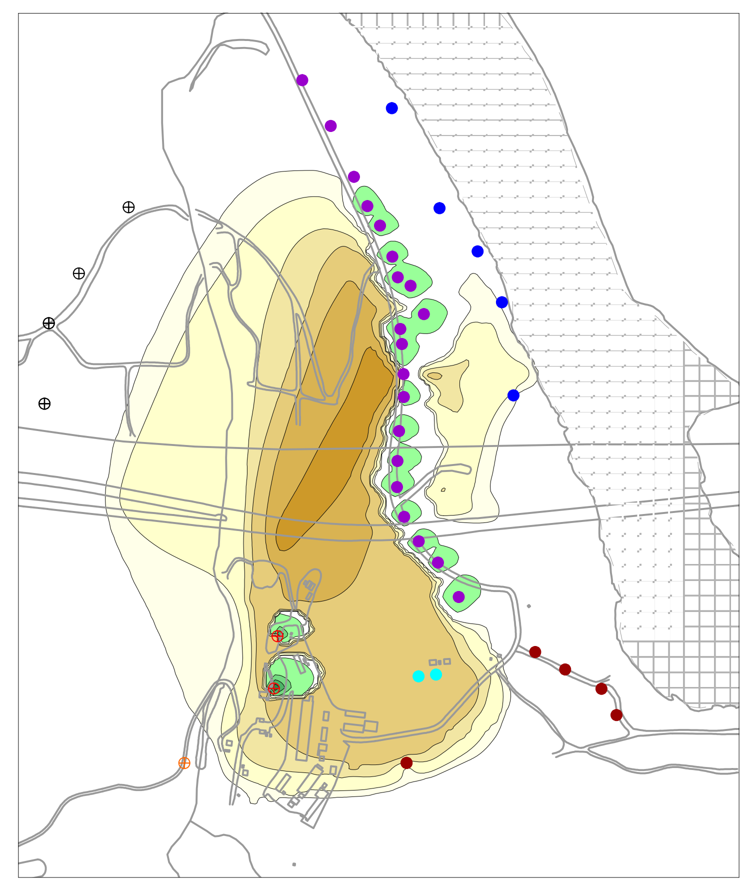
2A



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)

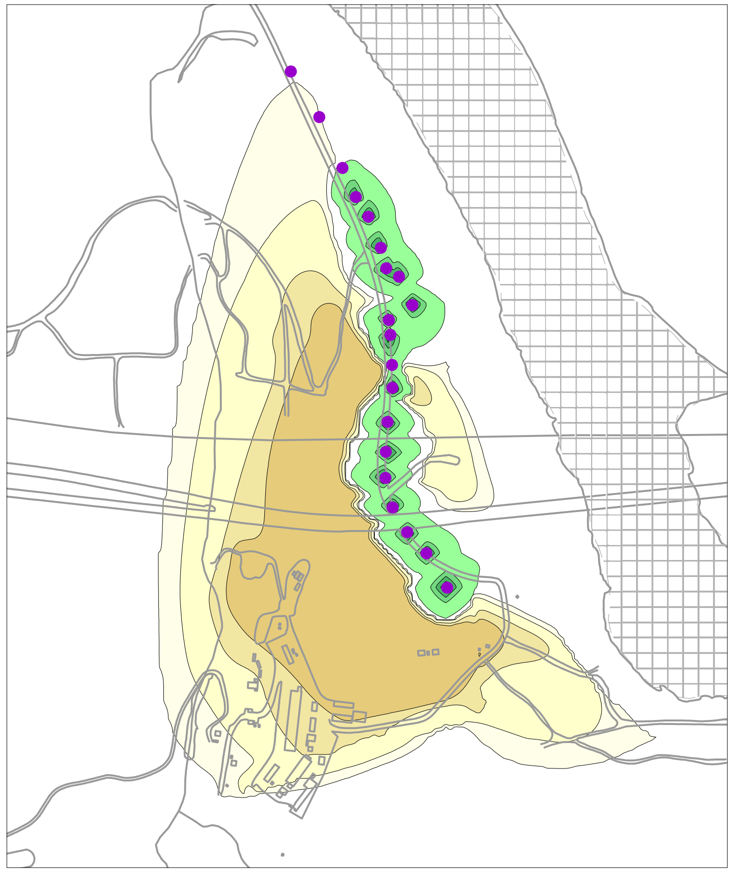
1 25 50 75 100

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

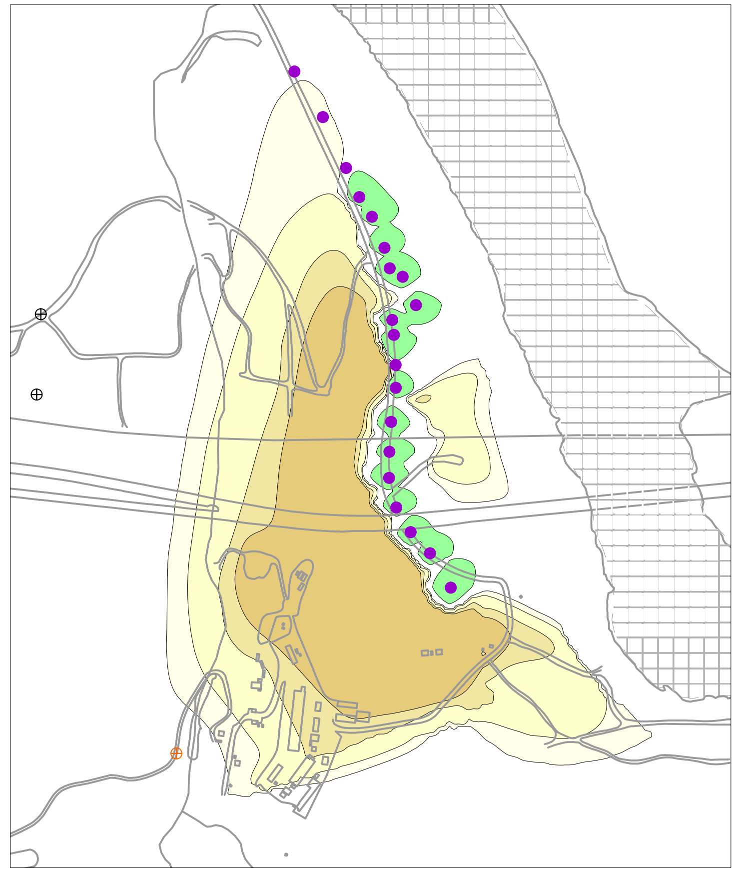
SIMULATED HEXAVALENT CHROMIUM TRANSPORT IN MODEL LAYER 4 FOR 1 YEAR START UP SCENARIOS

ARCADIS

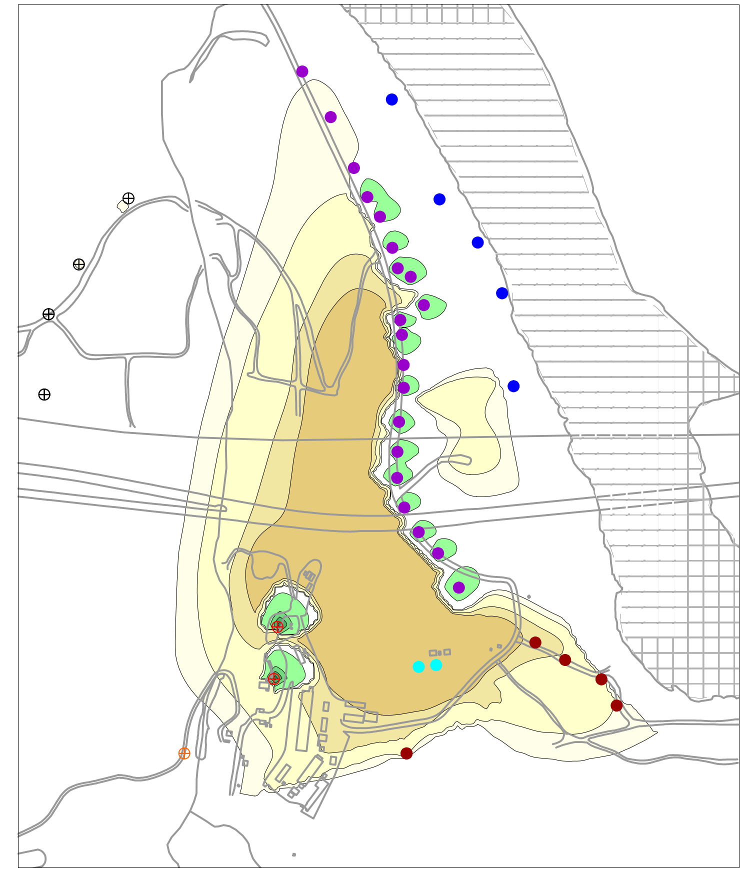
FIGURE
7.3-2



Transition Month 12
NTH IRZ ON



Transition Month 18
FW ON



Transition Month 24
FW, TCS Recirculation Loop, & IRL ON

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

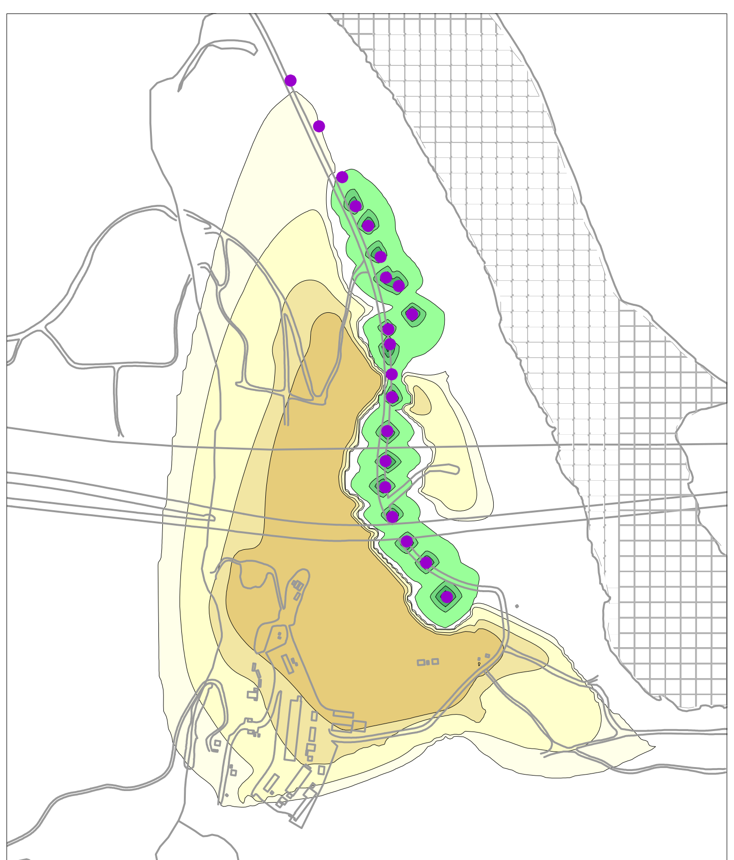
N

*Note: The pre-final (90%) nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive River Bank extracted groundwater (carbon-amended if hexavalent chromium concentrations in the River Bank extracted groundwater exceed the clean-up goal) to the lower two-thirds of the saturated interval (approximately layers 2 to 4); and IRL-3 and IRL-4 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. FW-1 (not shown) is located west of the area shown.

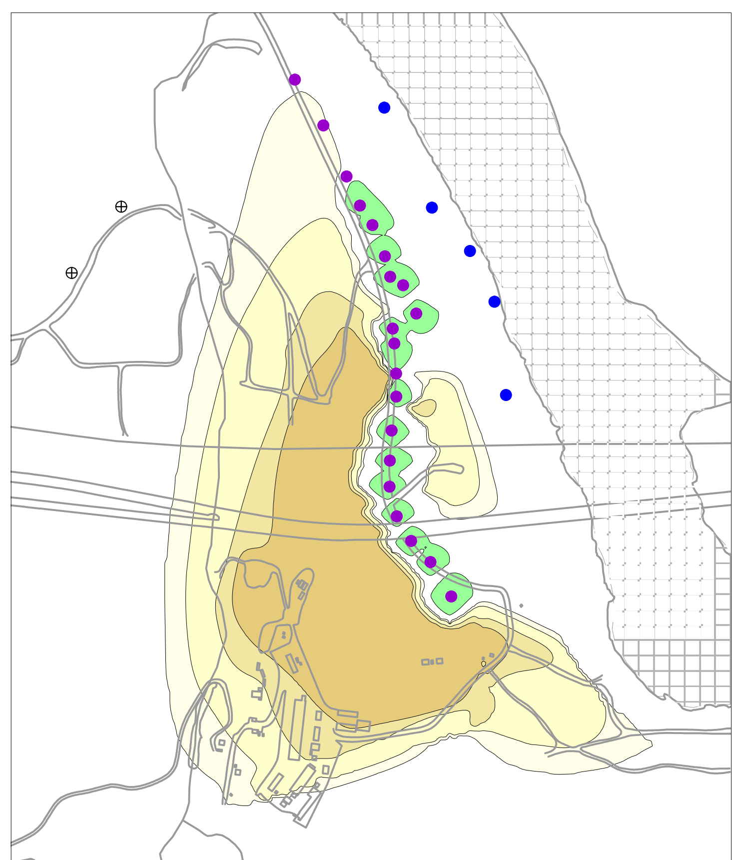
SCALE IN FEET
0 1,000 2,000

SCENARIO 1B START UP SCHEDULE

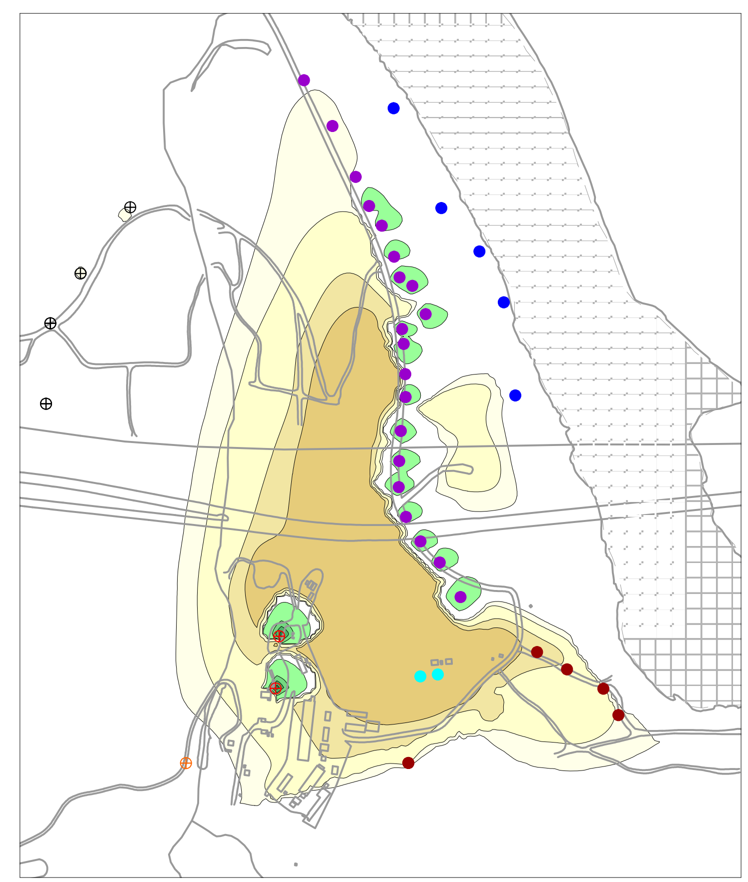
Months 0-12: NTH IRZ ON
Months 12-18: NTH IRZ OFF and FW ON
Months 18-24: NTH IRZ OFF and FW, TCS Recirculation Loop, & IRL ON



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)

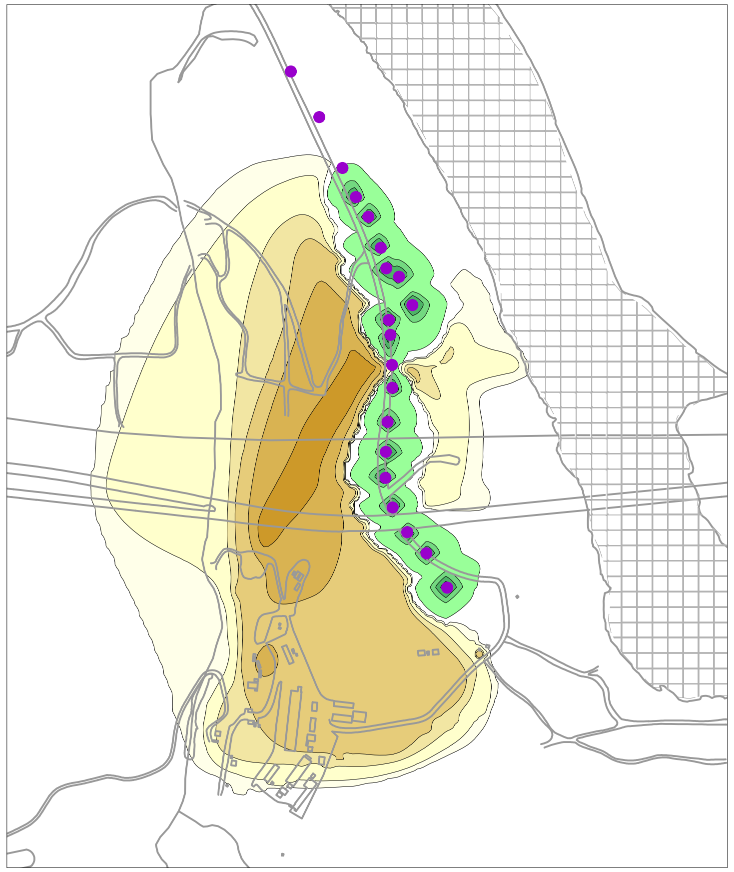
1 25 50 75 100

GROUNDWATER REMEDY BASIS OF DESIGN REPORT
PRE-FINAL (90%) DESIGN
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

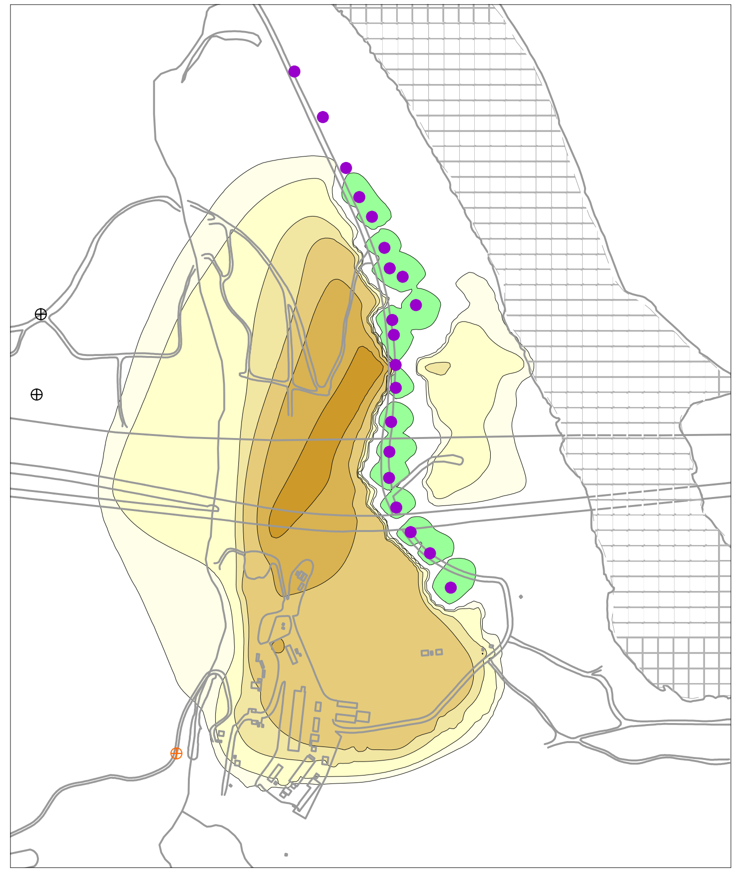
SIMULATED HEXAVALENT CHROMIUM TRANSPORT IN MODEL LAYER 2 FOR 2 YEAR START UP SCENARIOS

ARCADIS

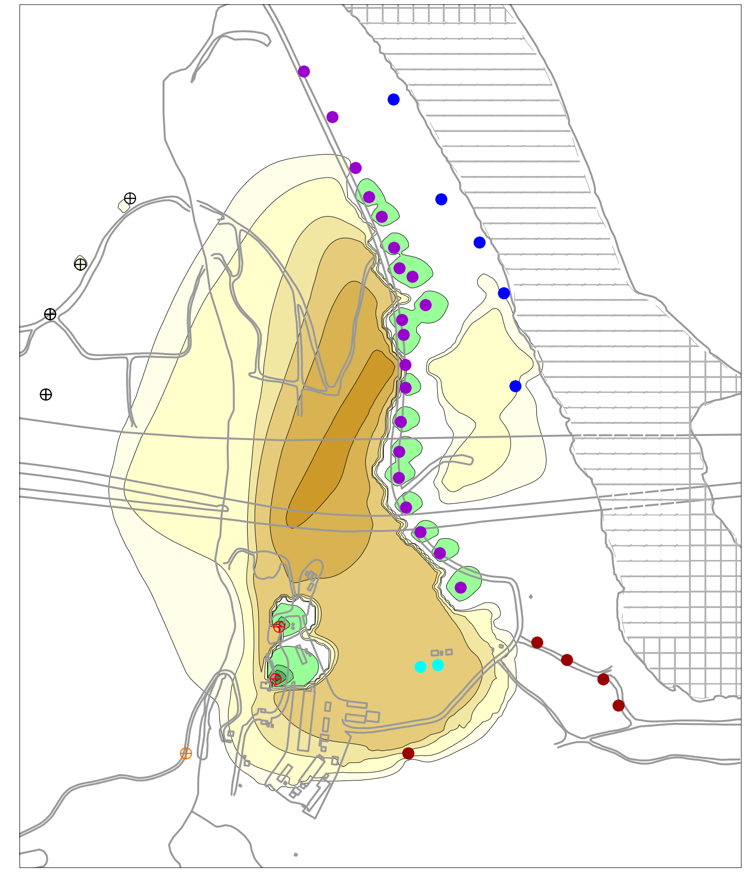
FIGURE
7.3-3



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

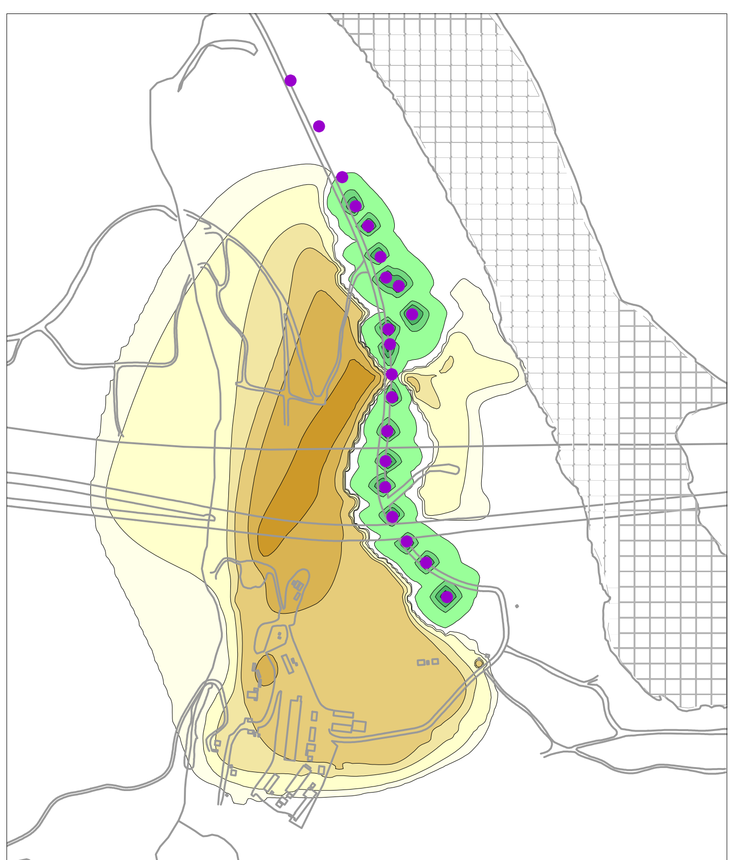
N

*Note: The pre-final (90%) nominal scenario assumes IRL-1 and IRL-2 (northern wells) will receive River Bank extracted groundwater (carbon-amended if hexavalent chromium concentrations in the River Bank extracted groundwater exceed the clean-up goal) to the lower two-thirds of the saturated interval (approximately layers 2 to 4); and IRL-3 and IRL-4 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. FW-1 (not shown) is located west of the area shown.

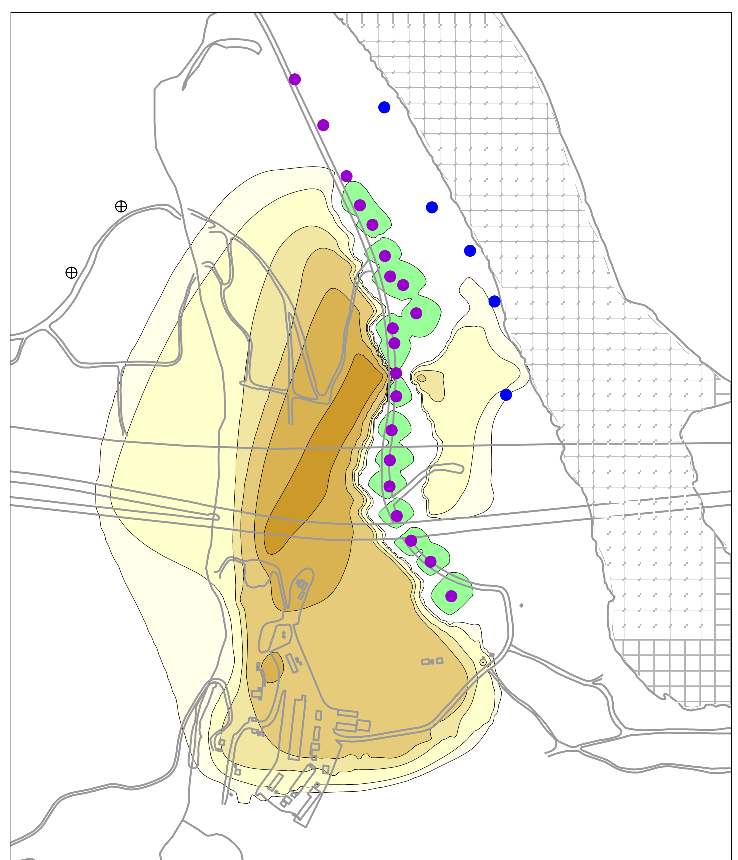
SCALE IN FEET
0 1,000 2,000

SCENARIO 1B START UP SCHEDULE

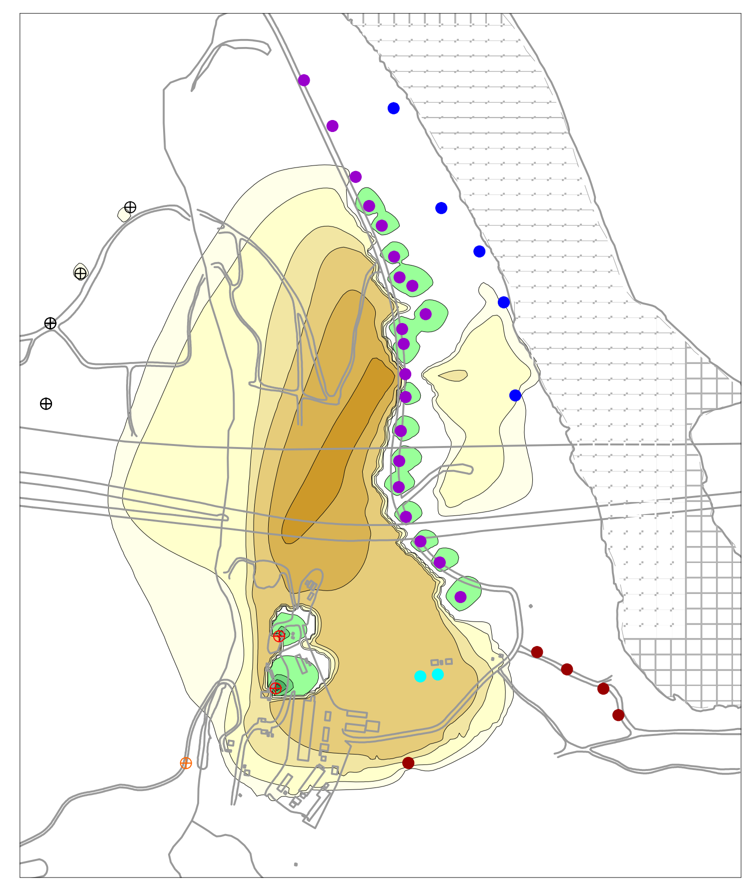
Months 0-12: NTH IRZ ON
Months 12-18: NTH IRZ OFF and FW ON
Months 18-24: NTH IRZ OFF and FW, TCS Recirculation Loop, & IRL ON



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
PRE-FINAL (90%) 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

SECTION 8

Updated Cost Estimate

This section will not be completed in time for the publication of the 90% BOD Report on September 8, 2014. It will be completed on September 15, 2014 and at that time will be sent to all recipients of the 90% BOD Report hardcopies for insertion into their binders. Other readers will be able to download a PDF of Section 8 from the project SharePoint site.

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.

Applied Earthworks, Inc. (AE). 2014. *Topock Compressor Station Groundwater Remediation Project: Condition Assessments at Sixty-Nine Archaeological and Historical Sites.*

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.

_______. 2001. *Ambient Groundwater Quality of the Sacramento Valley Basis: A 1999 Baseline Study*.

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.

Brady and Associates Geological Services (BAGS) and Applied Earthworks (AE). 2014. *Geoarchaeological Assessment for the Topock Remediation Project, Mohave County, AZ, and San Bernardino County, CA*. February 28.

California Department of Fish and Wildlife (CDFW) (formerly the California Department of Fish and Game [CDFG]). 2008. California Natural Diversity Database (CNDDB). Results of electronic record search. Wildlife and Habitat Data Analysis Branch. Sacramento, CA. December 1.

_______. 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.

_______. 2011a. California Natural Diversity Database (CNDDB). 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.

_______. 2013. 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/DTSC 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 to Attachment B, Statement of Decision and Resolution of Approval, of the January 31, 2011 DTSC Memorandum (Subject: Certification of the PG&E Topock Compressor Station Groundwater Remediation Project Final Environmental Impact Report [FEIR]) from Aaron Yue to Karen Baker.

_______. 2011d. *Final Environmental Impact Report for the Topock Compressor Station Groundwater Remediation Project*. January 31.

_______. 2012a. 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.

_______. 2012b. Settlement Agreement between the Fort Mojave Indian Tribe and DTSC, dated December 19, 2012.

California Department of Toxic Substances Control (DTSC) and U.S. Department of the Interior (DOI). 2014. Joint letter to Yvonne Meeks/PG&E. Subject: Directives on Outstanding Issues of the Response to Basis of Design Report/Intermediate (60%) Comments for PG&E Topock Compressor Remediation Site. April 4, 2014.

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 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.

_______. 2006a. *Draft RCRA Facility Investigation/Remedial Investigation Soil Investigation Work Plan Part A, PG&E Topock Compressor Station, Needles, California*. November.

_______. 2006b. *Information Review of Groundwater Conditions in Bedrock Formations at PG&E's Topock Compressor Station, Needles, California.* March 15.

_______. 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.

_______. 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.

_______. 2009e. *Summary of Findings Associated with the East Ravine Groundwater Investigation Report*. December 16. (Appendix A to the *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.*)

_______. 2009f. *Groundwater Background Study, Steps 3 and 4: Revised Final Report of Results, PG&E Topock Compressor Station, Needles, California*. November 6.

_______. 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.

_______. 2011l. *Draft Basis of Design Report/Preliminary (30%) Design Submittal for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California*. 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. *Freshwater 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.

_______. 2013h. *Topock Groundwater Remediation Project Revised Floristic Survey Report.* December 30.

_______. 2013i. *Revised Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation, PG&E Topock Compressor Station, Needles, California*. June 18.

_______. 2013j. *Final Implementation Plan for Evaluation of Alternative Freshwater Sources in the Topock Project Remediation Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California*. August 2.

_______. 2013k. *Basis of Design Report/Intermediate (60%) Design Submittal for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California*. April.

_______. 2014a. *Addendum to the RCRA Facility Investigation/Remedial Investigation Report, Volume I, PG&E Topock Compressor Station, Needles, California.* May 30.

_______. 2014b. *Summary of Findings Associated with the Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California.* April 2.

_______. 2014c. *Wetlands and Waters of the United States, Final Delineation for the Topock Compressor Station Groundwater Remediation Project.* April 18.

_______. 2014d. *Final Bird Impact Avoidance and Minimization Plan, Topock Groundwater Remediation Project*. April 30.

_______. 2014e. *Topock Groundwater Remediation Project Revised Ethnobotany Survey Report*. January 15.

_______. 2014f. *Supplemental Ethnobotanical Plant Surveys for the PG&E Topock Compressor Station*. February 28.

_______. 2014g. *Combined Fourth Quarter 2013 Monitoring, Semiannual July - December 2013 and Annual January - December 2013 Operation and Maintenance Report, Interim Measure No. 3 Groundwater Treatment System, PG&E Topock Compressor Station, Needles, California*. January 15.

_______. 2014h. *Fourth Quarter 2013 and Annual Interim Measures Performance and Site-Wide Groundwater and Surface Water Monitoring Report, PG&E Topock Compressor Station, Needles, California*. March 14.

_______. 2014i. *Riparian Vegetation and California Department Fish and Wildlife Jurisdiction for the Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California. May 9.*

_______. 2014j. *Addendum to Topock Compressor Station Groundwater Remediation Project Mature Plants Survey Report. May 19.*

_______. 2014k. *Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Final Groundwater Remedy*. April 28.

_______. 2014l. *Topock Compressor Station Groundwater Remediation Project Aesthetics and Visual Resources Protection and Revegetation Plan*. September 8.

_______. 2014m. *Construction/Remedial Action Work Plan for the Final Groundwater Remedy, PG&E Topock Compressor Station, Needles, California.* September 8.

_______. 2014n. *Topock Compressor Station Groundwater Remediation Project, Havasu National Wildlife Refuge Habitat Restoration Plan.* September 8.

_______. 2014o. *Topock Compressor Station Groundwater Remediation Project Habitat Restoration Plan for Riparian Vegetation and Other Sensitive Habitats.* September 8.

_______. 2014p. *Topock Groundwater Remediation Project Mitigation and Monitoring Plan for Culturally Significant Plants*. May 1.

_______. 2014q. *Final Addendum to the Summary of Findings Associated with the East Ravine Groundwater Investigation, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California*. September 8.

_______. 2014r. *Addendum to Summary of Findings Associated with the Evaluation of Alternative Freshwater Sources in the Topock Remediation Project Area, Pacific Gas and Electric Company, Topock Compressor Station, Needles, California*. September 8.

Dzombak, D.A. and Morel, F.M.M. 1990. *Surface Complexation Modeling: Hydrous Ferric Oxide*. Wiley-Interscience, New York, 393 pp.

Ela, Wendell P. and A. E. Saez. 2006. *Innovative Technologies for Arsenic Residuals Stabilization*. AWWA Research Foundation.

Green, R.L. 2005. *Trends in Golf Course Water Use and Regulation in California*. UC Riverside Turfgrass Research Facility. Online: http://ucrturf.ucr.edu/

HDR, Inc. 2013. *Annual Report Technical Review Committee Activities, Topock Compressor Station Groundwater Remediation Project, San Bernardino County, California.* November 26.

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.

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). 2009. *Upland Reductive Zone In-Situ Pilot Test Final Completion Report*. Prepared by ARCADIS for PG&E. March 3.

_______. 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.

_______. 2011. *Programmatic Sustainable Remediation Guidance*. Prepared by Haley & Aldrich, Inc. and Endpoint Consulting, Inc. for PG&E, San Ramon, CA. July.

_______. 2012a. *Programmatic Sustainable Remediation Guidance (Revision 1)*. Prepared by Haley & Aldrich, Inc. and Endpoint Consulting, Inc. for PG&E, San Ramon, CA. July.

_______. 2012b. *Management Protocol for Handling and Disposition of Displaced Site Material, Topock Remediation Project, Needles, California*. October 3.

_______. 2014. *Cultural Impact Mitigation Program for the Topock Remediation Project, Mohave County, Arizona, and San Bernardino County, California*. May.

Parus Consulting, Inc. (Parus). 2014. *Paleontological Resources Management Plan: MMRP CUL-3*. February 28.

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.

_______. 2013. Letter from John Bishop/SWRCB to Stewart Black/DTSC. Subject: Topock Compressor Station: Remedy Requirements Associated with Groundwater Containing Naturally Occurring Arsenic. November 20.

U.S. Army Corps of Engineers (USACE). 2013a. Re: Topock Remediation Project (File No. SPL-2013-00476). Letter from Geraldo Salas/USACE to Yvonne Meeks/PG&E. July 10, 2013.

_______. 2013b. Email communication from G. Salas/USACE to V. Nez/PG&E. Re: Topock Remediation Project (File No. SPL-2013-00476). July 12, 2013.

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.

_______. 2007. DOI Memo from Melissa Dewart/Office of the Solicitor to Kris Doebbler/Remedial Project Manager, PG&E Topock CERCLA Site. Re: CERCLA Permit Exemption. November 16, 2007.

_______. 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. Subject: "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-BRO-OP, Document 23. Entered November 21.

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.

_______. 2001. National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring; Final Rule Federal Register / Vol. 66, No. 14 / Monday, January 22, 2001 / Rules and Regulations [[Page 6976]] 40 CFR Parts 9, 141 and 142.

_______. 2006. *Federal Leadership in High Performance and Sustainable Building Memorandum of Understanding*. Online: http://www.epa.gov/greeningepa/projects/buildings_mou.htm. January 24.

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.

_______. 2012. Letter from Steve Spangle/USFWS to Field Manager/BLM, Lake Havasu Field Office, Lake Havasu, Arizona. Subject: Extension and Modification to the Programmatic Biological Assessment for Pacific Gas and Electric Topock Compressor Station Remedial and Investigative Action, January 2007. December 27, 2012.

_______. 2014. Letter from Steve Spangle/USFWS to Field Manager/BLM, Lake Havasu Field Office, Lake Havasu, Arizona. Subject: Request for Concurrence on the Pacific Gas and Electric Topock Compressor Station Final Groundwater Remedy, San Bernardino County, California and Mohave County, Arizona. July 7.

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.* USFWS Region 2, Albuquerque, NM. BOR 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.